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Assessment of construction risks in public projects located in the state of Kuwait

Ruqaya Al-Sabah and Omar Refaat

Department of Civil and Environmental Engineering, Kuwait University, P.O. Box: 5969 Safat, 13060 Kuwait
Corresponding Author: ruqaya.alsabah@eng.ku.edu.kw

ABSTRACT

This current study presents the considerable risks confronted by construction firms engaged in public projects located at the State of Kuwait and quantifies their probability of occurrence and severity. The identified risks were categorized into two main categories including country and project risks. The country risks were further subcategorized to five categories comprising stability, economy, regulatory, community, and environmental. On the other hand, project risks were classified into engineering, production, monetary, and administration risks. These risks were then quantified through a survey distributed to private contractors who had experience in Public Project in the State of Kuwait. The overall Importance Indicator (II) was computed for the ten risk groups in terms of their probability of occurrence and severity on project cost and schedule. The association between the (II) of the probability of occurrence and (II) of the severity from two aspects was inspected and classified using the Risk Assessment Tool (RAT). In conclusion, the study shows that all of the ten risk groups were of low level. The intensive evaluation of the study results showed that most significant risks were Price Inflation (E1), Resources Restrictions (E2), Resources Quality (E3), Public Establishments Regulations and Laws (R2), Permits and Licenses (R3), Contract Harsh Clauses (R4) Inclement Weather (N1), Performance of Subcontractors (P6), Performance of Preselected Subcontractors (P7), Insufficient Project Duration (P9), Subcontractors Coordination (A6), Transmittals Process (A8), and Major Changes (M4).

Although this study focused on quantifying risks in the Public Projects in the State of Kuwait, the recognized risks and their importance can direct contractors looking to work in construction projects located in the Middle East and North Africa region, particularly in countries that have abundant of natural resources but experience some to extreme internal instability. These firms can utilize the RAT developed in this research to determine expected risk probability of occurrence and severity on their project performance and develop appropriate mitigation measures.

Keywords: Construction Risks; Kuwait Public Construction Projects; Importance Indicator (II); Risk Assessment Tool (RAT).

OVERVIEW

Construction is a worldwide industry that is extremely growing during the last few decades with a variety of mega projects over the world, ranging from airports, dams, ports, bridges, and many more, which are typically related to the public development of any country. Alongside the vast number of public projects that are commencing internationally many local and international contractors are eager to be part of these projects, as this allows them to expand their risks across different projects and benefit from allocating their risks effect on different projects' parties. Getting involved in several construction projects will also allow the contractor to have to promote cash flow, which is a main objective of any successful company. Nevertheless, construction projects are usually associated with elevated level of difficulties, ambiguity, and risks (Ozorhon et al. 2008; Hastak and Shaked 2000). Based on that, contractors will be open to a collection of risks such as price increase, resources availability, and other risks related to the country stability, community, cultural, and environmental risks confronted in the hosting country (Lee et al. 2011). Consequently, projects performance with respect to cost, time, quality, and safety will be adversely affected; however, this can be minimized by getting familiarized with type of risks involved and countries' characteristics (Andi, 2006).

Notwithstanding that the construction projects are filled with uncertainties, contractors continue to play an essential role in the improvement of public construction projects in the State of Kuwait. In response to this involvement, the government of the State of Kuwait together with Kuwait National Assembly has established a set of laws and provisions that ease and improve the contractor's selection process in public projects, which is managed and controlled by the Central Agency for Public Tenders (CAPT). This construction procurement process law has been completed and sanctioned in line with the grow in the public construction market as tremendous pace over 2014 with contracts awarded to the tune of US$ 27 billion with buildings and infrastructure of the primary focus areas. After the unrestrained period of political instability, bureaucracy slowing down government projects and the adverse impact of the global economic slowdown, the economy of the State of Kuwait is making a steady recovery with projects back on track in 2014. But this does not reduce some of the distinctive risks related to their projects, which should be cautiously considered by any contractors a priori. The present paper summarizes the findings of a broad study that was commenced to distinguish and evaluate the probability of occurrence and severity of unique risks most frequently confronted by contractors engaged with public projects in the State of Kuwait.

LITERATURE REVIEW

Risk exists in any fields, from economics, management, and medicine, to operations research, engineering, construction, and business. Each of these professions deals with unique set of risks and addresses them in ways relevant to their own needs. Therefore, members of each field have their unique perspective on risk and its management (Aubert et al., 2005). In the arena of business management, risks can be understood as the probable occurrence of undesirable events having unfavorable effect on business fortune. Yet, construction risks are generally perceived as events that influence project objectives of cost, time, and quality (Akintoye and MacLeod 1997). Foreign construction market is exposed to variety of risks involving socail, cultural, economic, political, regulatory, contractual, and market exchange (Baloi and Price 2003; Chua et al. 2003; Chan and Tse 2003; Ashley and Bonner 1987). Risks are commonly encountered in Asian construction market in form of bureaucratic government system and long project approval procedures, poor design, inadequate tendering practices, late internal approval processes from the owner, contractor inadequate experience, client's financial failure, subcontractors incompetence, material and labor supply shortage, inadequate communication between parties, insufficient infrastructure, varying technical standards and local preference policies, regulatory restrictions, contractual arrangements, government interference and cross-cultural problems were risks encountered in their construction industry (Sambasivan and Soon 2007; Thuyet et al. 2007; Chua et al. 2003; Fang et al. 2004; Ogunlana and Promkuntong 1996). On the other hand, Zhang (2011) found that social risks including local protectionism, risk of poor social relations between various parties in local region, permits risks, and dispute with local labor are risks experienced by international contractors in China construction market.

From the Middle Eastern projects perspective, number of researches examined risks usually encountered by local construction firms. El-Sayegh (2008), Assaf and Al-Hejji (2006), Koushki et al. (2005), Kartam and Kartam (2001), and others mentioned various significant causes of project's schedule and cost increase in Saudi Arabia, Kuwait, and United Arab Emirates (UAE). The authors determined that severe climate, permits problems, unqualified labor force, project inefficient bidding process, changes, late payment, insufficient design, management problems, material shortage, problem in initial planning, poor owner's decision, government authorities bureaucracy, prices escalation, impracticable time schedule, inappropriate interference, unforeseen conditions, and incapable staff were among the foremost sources of projects' schedule delay and cost overrun.

However, there is a gap in the literature regarding the focus on risks experienced by contractors engaged in public construction projects located at the State of Kuwait specifically. El-Sayegh (2008) for instance studied risks related to international companies working in the UAE construction market and concluded that they do not vary much than those mentioned above. Abdul-Rahman et al. (2012) have also developed a framework to assist international architectural, engineering, and construction (AEC) firms in managing risks when operating in Gulf construction. Given the large

number of construction projects that are executed, being executed, and will be executed in the need future in the State of Kuwait to enhance the quality of life for the people living in the State of Kuwait, it is necessary to perform more studies to examine risks confronted by local or international firms and try to drag their attention to these risks prior to getting involved in public construction projects in the Middle East or specifically in the State of Kuwait.

RESEARCH OBJECTIVES

The foremost objective of the current analysis is to assess the risks confronted by different construction related firms associated with public construction markets in the State of Kuwait. Construction firms are those that provide construction services including client, designers or consultants (A/E), construction managers, contractors, subcontractors, and suppliers. The objective of the paper is to investigate risks encountered during both the design/ procurement phase and the construction phase. Therefore, different project participants' contribution is crucial to the study conclusion and findings. Moreover, the association between the risks probability of occurrence and severity with regard to project's cost and schedule will be analyzed.

CHARACTERISTICS OF THE STATE OF KUWAIT CONSTRUCTION MARKET

Kuwait is a small country, about 17,819 km2, located in the northern edge of Eastern Arabia at the top of the Arabian Gulf; it shares borders with Iraq and Saudi Arabia. The primary natural resource of the country is oil; the country's reserves are almost 95 billion barrels, around 10% of the world's total reserve; it plays an important role in alleviating and developing the country's economy (World Bank 2007). This ranks as third in the world behind Saudi Arabia and Iraq. Another economic source is the country's location; Kuwait bay is a generously sized natural harbor and has always been a leading access point for trade entering and leaving the northeast Arabia and Iraq. The location of Kuwait plays main commercial port, as its economic importance continues.

Since early sixties, Kuwait has taken steps toward transition to more exposed multi-business supported by the oil productions and trade (Sweis et al. 2008). Kuwait's construction industry is set to reach $15.6 billion in 2020 where essential infrastructure, highways, bridges, refineries, and buildings took ultimate importance and recently resulted in a number of mega projects (e.g., Shagaya Renewable Energy Complex, Sabah AlSalem University and Kuwait New Refinery Project) (Ventures on Site 2017). Additionally, healthcare investments are one of the major drivers of the construction industry's growth where the development of new or existing hospitals valued $5.5 billion. Kuwait comes in the third place with a number of projects in infrastructural development in the country that were being urged by high levels of population growth (Arab World Construction, 2009). A robust economy has provided the government with the necessary liquidity to undertake large-scale construction projects. The government is expected to invest $3 billion in the construction industry in the next five years, while private sector investment to the tune of $8 billion is also anticipated (Arab World Construction, 2009). The Public Authority of Housing has taken up a determined project for providing new housing units, while the Ministry of Education has assured to construct more than 300 new schools. Other major projects include al-Zour refinery, Failaka island development, the expansion of Kuwait International Airport (KIA), Jaber Al-Ahmed Al-Sabah causeway, Kuwait Railway, and a major road development program including the construction of an eighth ring road, expected to start soon (Construction Week 2012; MEED 2011; Arab World Construction 2009)

Conversely, the 2011 political unrest associated with pro-democracy movements in some countries (e.g., Egypt, Libya, and Tunisia) unfavorably influenced the regions' short-term economy position resulting in a decrease in construction volume (MEED 2011).

One of the exceptional risks related to Kuwait public construction market that impact construction firms is "Government Uncertainty". The country has experienced disturbance starting with the First Gulf War in 1990. The unrest continued beyond the liberation of the State of Kuwait with the Second Gulf War in 2003. Additionally, in

early 2011 a wave of democracy pursuing actions started in Tunisia and quickly spread to Egypt and other countries, explicitly Bahrain, Libya, Syria, and the Republic of Yemen. These occurrences lead to weakening of the economy and interruption of the progress of current construction projects. Various other projects were suspended across the region with emigrants leaving the countries in obedience with evacuation instructions from their countries (ENR 2011).

Another risk associated with Kuwait construction market is "Deficiency in Resources". This risk is remarkably important to the construction industry as it has and continues to impact in progress projects in the region, for instance, as a result of the recent unrest where a number of projects are at risk of disruption because of the lack of skilled labor and other resources for example, Qatar and Bahrain causeway in Bahrain ($5 billion) and others (ENR 2011 and Vinson and Elkins 2011).

Using "Standardized Forms of Contract" or utilizing specific type of clauses that do not adequately fit within the construction environment in the State of Kuwait represents another risk. It poses emphasis on allocating risks on the contractors and greatly depends on the Federation Internationale des Ingenieurs Conseils (FIDIC) forms (Vinson and Elkins 2011). For instance, in the State of Kuwait it is mandatory to utilize these types of forms in construction projects to regulate relationships between parties and to shift the risks to another party who is not responsible for carrying such risk. But getting familiar with these type of contracts can conclude to a wrong sense of protection and unforeseen risks when used in some jurisdictions due to the possible modifications related to it. Some utilized contracts, for instance, request variety types of warranties such as bid bond, advance payment bond, performance bond, retention warranty, and maintenance bonds that could be liquidated from surety provider with no need for evidence about the contractor's performance (Bunni 2005). The magnitude of this inequity might render contractors to numerous kinds of risks like unfair withdrawal of bonds or warranties, contractors assured with the original cost of the bid bond and extend-or-call threats (Russell 2000). Moreover, these types of standardized contracts are ruled by the country's law where civil codes will be applied and undesirable risks for the unwary could be encountered.

Lastly, the State of Kuwait government impacts public construction projects by generating some development regulations and contractual requirements such as permits and licenses, hygienic and building codes, minimum income amounts, importation of material, and terms and availability of funding for construction (Fawzy 2002). This apparently encompasses a degree of risk.

On the other hand, "Price Escalation" represents another risk that is encountered in construction industry. The substantial number of construction projects, which took place in the region, presents an increase in the demand for the material and resources, affecting the costs of material used in construction such as cement, steel reinforcement, and aluminum (Davis Longdon 2009). Furthermore, construction industry in the state of Kuwait depends extremely on imported material, in which their prices were highly influenced by oil prices, and air or sea shipping rates.

"Scarcity and Quality of Resources" are another risk that is highly experienced in the State of Kuwait mainly from the labor perspective. While workers in construction projects wages are usually low, the obtainability of skillful labor is a foremost concern in the State of Kuwait construction industry. Additionally, workers efficiency is so low, in which most of the times double of the workers are needed to finish the job. Low workers' efficiency is associated with diverse causes, which comprises ambiguity in technical contract documents, delay in variation order implementation, coordination between different projects' parties, absence of supervision, absence of motivations, complicated assessment by the engineer, and many more (Jarkas and Bitar 2012). Moreover, a significant number of the labors are emigrants who have not been through any proper education or professional preparation program primarily due to the lack of controlled labor unions (Yosef 2004). Another major restraint for contractors is that they have to enter into an agreement with the government to control the emigrants worker entry and to confirm that workers have left the country on the completion of work. This will cause fluctuations and discontinuities as well as imperative characteristics that illustrate construction workers request in the country and cause contractors to avoid maintaining permanent managerial staff, expert workers, and a suitable fleet of construction equipment (Jaselskis and Talukhaba 1998).

"Harsh Weather" is one of the major risks associated with the State of Kuwait the, as it is located in the tropics with pleasurable atmosphere from October to the end of April. Nevertheless, the summer months are very hot and humid with temperatures over 40°C, which harshly influences construction projects efficiency and productivity (Jaselekis and Talukhaba 1998). On certain days when temperature reaches a high of 50°C, work needs to be suspended. Some contracts mandate the contractors to follow some rules to protect their workers against these crucial weather situations, such as providing rest periods according to the weather, checking workers health conditions periodically, and shifting working hours to night time to prevent the high heat and sun exposure (Current Standard Contract, 2015).

"Bureaucratic System" is one of the major reasons in delaying construction projects in the State of Kuwait. The decision making in most of the authorities is made by one certain person, which makes it difficult to get things done with a fast track option. Permits, licences, and approvals will be done in a long period of time, which affects the project schedule.

Regarding "Tough Competition", there are a huge number of contractors who compete in public construction projects in the State of Kuwait. Although the process of selecting the contractor is well managed and controlled by a special committee, the competition between contractors is too hard, which makes it impossible for small contractors to win in any of the public projects. The mega projects in the State of Kuwait are limited to certain contractors who are capable of handeling such projects.

Lastly, regarding "Religious Occasions", there are many Islamic holidays such as "Eids, Esraa' and Me'raj and the Prophet's Birthday" that are considered in the State of Kuwait. These holidays can affect the progress in the construction projects and cause delay the schedule. Also, the holy month of Ramadan when Muslims fast from dawn to the evening can affect the project progress and the workers productivity as the working hours will be reduced.

RESEARCH METHODOLOGY

Risk Recognition

The research methodology was performed in consecutive steps, starting with "risk recognition" where the topmost risks experienced in the State of Kuwait construction industry were listed. The recognized risks will then be incorporated in the comprehensive survey that will be used in the data collection stage for further evaluation. Initially, risks factors were recognized throughout a broad evaluation of former studies done in risks related to construction industry. First, the research team targeted the risks recognition by examining risks related to international construction industry (Ozorhon et al. 2008; Ozorhon et al. 2007; Dikmen and Birgonul 2006; Gunhan and Arditi 2005a; Gunhan and Arditi 2005b; Chan and Tse 2003; Baloi and Price 2003; Hastak and Shaked 2000); second the research team have narrowed down the scope of investigations and assess risks related to countries located in Asia (Ling and Poh 2008; Zou et al. 2007; Sambasivan and Soon 2007; Alaghbari et al., 2007; Andi 2006; Chua et al. 2003); lastly the scope of investigation has been restricted on researches done on risks confronted exclusively in the Middle Eastern and Northern African (MENA) construction industry (Tumi et al. 2009; Sweis et al. 2008; El-Razek et al. 2008; El-Sayegh 2008; Elyamany et al. 2007; Assaf and Al-Hejji 2006; Zaneldin 2006; Abdul Rashid and Bakarman 2005; Koushki et al. 2005; Al-Reshaid et al. 2005; Goda 1999; Mezher and Tawil 1998). Because the State of Kuwait construction industry has similar characteristics and conditions as MENA's countries, the research team have stopped the investigation to this level.

Another risk recognition approach the research team have followed is evaluating construction contracts and design-consultation agreements currently used in the State of Kuwait construction industry and other Arabian Gulf countries. Risks found in these contracts were recognized with the assistance of the construction companies currently working in the State of Kuwait (Current Standard Contract 2015).

This initial risk recognition step concluded that a total of forty-three (43) risk causes encountered by contractors working in the State of Kuwait projects were classified into country risks and project risks. The risks classification was

applied to differentiate between risks that are beyond the firms' control and risks that could be managed, transferred, or avoided by the construction firms. Fifteen Country related risks, which are associated with investing in the country, can not be controlled by the construction project parties, and are related to the public market or the government decisions, were classified into (1) stability risks, (2) economy risks, (3) regulatory risks, (4) community risks, and (5) environmental risks. Moreover, twenty-eight project related risks, which occur from the certain aspects of the project and actions, are controllable by the project parties. Project risks are subcategorized into (1) engineering risks, (2) production risks, (3) monetary risks, and (4) administration risks. These nine risk subcategories were implemented in previous studies and were adopted in the present study to cluster risks having similar characteristics and simplify the data analysis stage. Both country and project risks and their associated subgroups are summarized in Table 1. Risks were included to one of the most applicable nine subcategories mentioned above. For example, it was discovered that certain risks may be incorporated into more than one category; nevertheless, the risks were included in the best appropriate category to avoid dual counting.

Table 1. Country and Project Risk Classifications (total number of risks in each class).

Country Risks (15)	**Project Risks (28)**
Stability risks (5): Political Variability (S1), Authority Performance (Override) (S2), Safety and Crimes (S3), Bribe and Corruption (S4), Public Authorities Strikes (S5).	**Engineering risks (3):** Inadequate Contract Documents (G1), Incorrect Supplemental Reports (G2), Inadequate Design Team Decision (During Construction) (G3).
Economy risks (3): Price Inflation (E1), Resources Restrictions (E2), Resources Quality (E3).	**Production risks (11):** Project Location And Accessibility (P1), Long Lead Material or Equipment (P2), Resources Supplied By a Third Party (P3), Testing Performance (P4), Workforce Efficiency and Level of Experience (P5), Performance of Subcontractors (P6), Performance of Preselected Subcontractors (P7), Different Site Conditions (P8), Insufficient Project Duration (P9), Inadequate Project Schedule and Control Tools (P10), Accident/Safety Standards (P11).
Regulatory risks (4): Local Products and Services (R1), Public Authorities Regulation and Requirements (R2), Permits and Licenses (R3), Contract Harsh Clauses (R4).	**Monetary risks (8):** Error in Bids and Quotation (M1), Late or Deficiency in Processing Monthly Payment (For Contractor or Subcontractor) (M2), Variation Orders (M3), Major Changes (M4), Retainage Magnitude (M5), Delay Damages on Contractor (M6).
Community risks (1): Public holidays and Observations (C1).	**Administration risks (8):** Insufficient Scope Definition (A1), Insufficient Contract Type (A2), Insufficient Project Delivery System (A3), Extensive Number of Packages (A4), Projects Administration/Management Team (A5), Subcontractors/Suppliers Coordination (A6), Engineers Harsh Decision (A7), Transmittal Process (A8).
Environmental risks (2): Inclement Weather (N1), Natural Catastrophic Events (N2).	

Data Gathering

The Data Gathering step took place after completing the Risk Recognition step, where a questionnaire was established to rate each risk cause recognized in the previous step from the perception of different companies engaged in public construction projects located in Kuwait. The questionnaire was divided into 3 parts and intended to weigh risks causes for distinct projects. The first part includes questions related to the company and project general information like type of the project, firm's role in the project, contract type, magnitude of change orders in Kuwaiti Dinars and number of days of delays encountered. In the following parts of the questionnaire, the contributors were asked to weigh the 43 recognized risks provided in Table 1, with accordance to their probability of occurrence, together with the severity on cost and schedule of the project as outlined in Table 2. The probability of occurrence can be rated with a scale of never, low, medium, and high (on a four-point scale correspondingly). Likewise, the severity from different perspectives was classified as absent, minimal, moderate, and severe (on a four-point scale correspondingly).

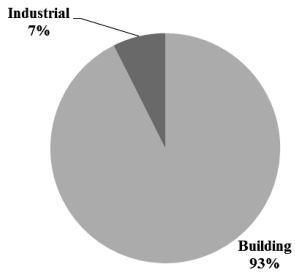
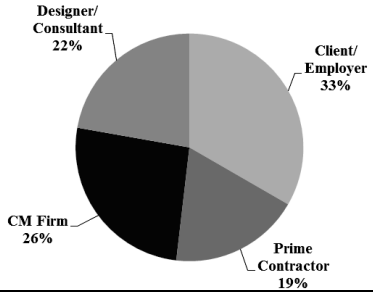
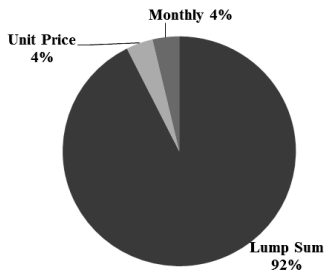
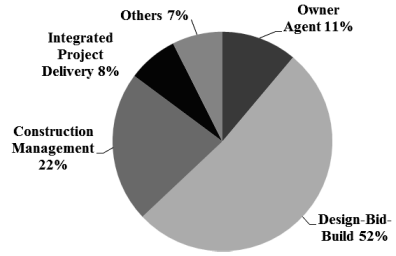
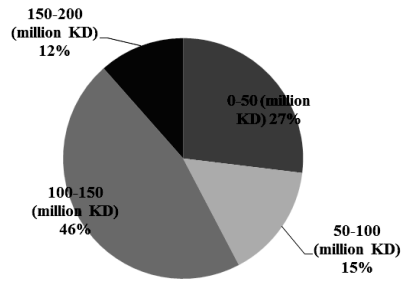
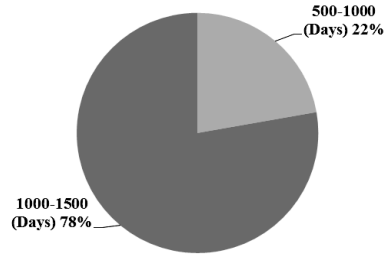
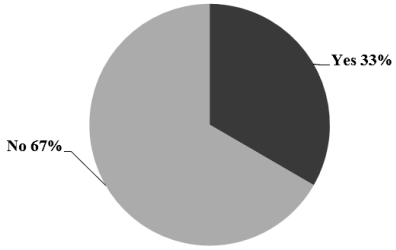
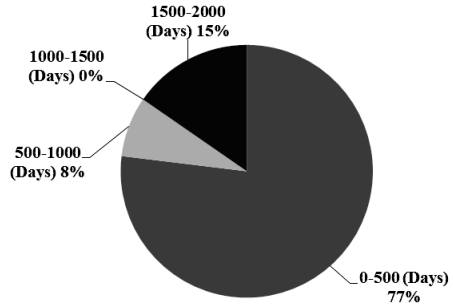
Table 2. Rating Definitions.

Attributes	Definitions
Probability of Occurrence	How often the unfavorable event will occur in a public construction project located in Kuwait.
Severity on Project Cost	The event's qualified influence on public construction project cost or fund located in Kuwait.
Severity on Project Schedule	The event's qualified influence on public construction project schedule located in Kuwait.

Thirty-seven construction related companies engaged with public construction project located in the State of Kuwait were reached and asked to complete the questionnaire through a website or a paper-copy form or by a one-to-one meeting conducted by one of the research members. It was concluded with a 73% reply-rate with 27-filled questionnaires. A listwise exclusion was followed, where an entire record was omitted from the database if any value is missing. Accordingly, 96%, 26 completed questionnaires, were included in the analysis. The characteristics of the construction firms and their related projects who have completed the survey are presented in Table 3. The firms mostly entailed of client/employer (33%) and Construction Management firm (26%). They were primarily engaged in building projects (93%). Most of the projects utilized lump sum type of contract representing (92%) of the database. However, the delivery system that was frequently used was Design Bid Build (DBB) with (52%).

With regard to the project cost, 46% of the research samples have project contract cost of 100 - 150 million Kuwaiti Dinar and 33% have encountered cost overrun. On the other hand, 21 out of 27 projects have project duration of 1000 – 1500 days and 20 out of 27 projects have encountered delay of 0 – 500 days.

Table 3. Characteristics of Questionnaire Respondents

Project Type	Company Role
	
Contract Type	**Type of Project Delivery System**
	
Contract Cost	**Construction Duration**
	
Cost Overrun	**Schedule Overrun**
	

Data Evaluation

The dataset was evaluated by computing the Importance Indicator (II) for every risk causes at both country and project levels. This indicator has been considerably utilized in many construction risk studies to weigh several failure factors during the project lifecycle (El-Sayegh 2008; Sambasivan and Soon 2007; Odeyinka et al. 2006). The II was

implemented in this study to determine the importance of the risk factor with respect to the probability of occurrence, severity on the cost of the project, and severity on the schedule of the project. With the scale of 1 to 4 assumed for the probability of occurrence and severity, the II will range from 1 to 4 where a value around 4 will signify more importance risk cause. The weights appointed by the contributors in the questionnaire were converted to II amount implanting Equation (1).

The Importance Indicator, II = $\sum_{i=1}^{4} WiXi/27$ Equation (1)

The following explains equation (1) in more details:

Wi = The rate appointed to the ith contribution; Wi = 1, 2, 3 or 4. Consequently, $W1 = 1$ was appointed for never occurrence or absent severity scale point, $W2 = 2$ for low occurrence or minimal severity, $W3 = 3$ for medium occurrence or moderate severity, and $W4 = 4$ for high occurrence or severe severity.

Xi = Total number of contributors conforming to rate category Wi for a specific risk cause.

The total number of contributors is 27.

i = Reply category indicator = 1, 2, 3 and 4.

A 43 II for probability occurrence and 2x43 II (i.e., project cost and project schedule) for severity were determined. Then they were exemplified on the Risk Assessment Tool (RAT). RAT offers an illustrative method to assess the association among the II of the probability of occurrence and II of the severity on two properties including project cost and project duration. The RAT is measurable risk evaluation methods utilized in the risk management research to illustrate and categorize the risks' severity (Kerzner 2009; Conrow 2000). The tool transfers the subjective standards of the probability of occurrence and severity into a consequent risk importance to allow ranking of risk events. Accordingly, a 3 X 3 matrix illustration of the II of probability of occurrence versus the II of the severity is utilized to allocate the risk event into three different areas of importance comprising low, moderate, and high, as demonstrated in Figure 1. The probability of occurrence and severity coordinate is portioned to four systematic qualitative classes beginning with never (1) to high (4), and from absent (1) to severe (4) correspondingly. The nine areas of importance comprised in the matrix are shown in Figure 1 with external triangle of moderate to high importance risk events that is not the exact demonstration of the internal triangle used for low importance risk events. This disproportionate matrix permits the logical demonstration of the risks importance, where the external triangle unevenly categorizes risk events with high probability of occurrence and severe severity; however, the internal triangle approximately represents risks with low probability of occurrence and low severity.

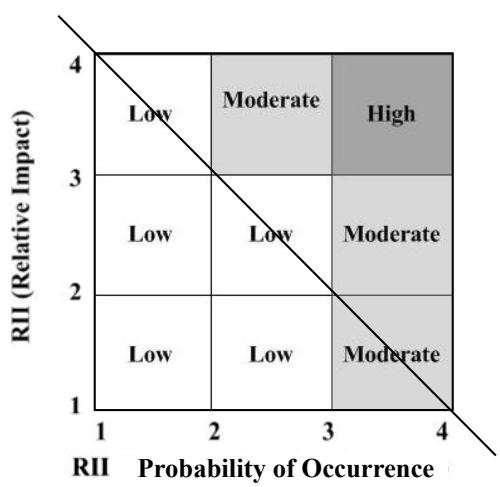


Fig. 1. Risk Mapping Matrix

The average II of probability of occurrence vs. the average II of the severity on project cost and schedule for both country and the project risks categories are presented in two different RAT presented in Figure 2. For instance, the II for the stability risk category under country risks is obtained by averaging the II of the five risks incorporated in this category (See Table 1).

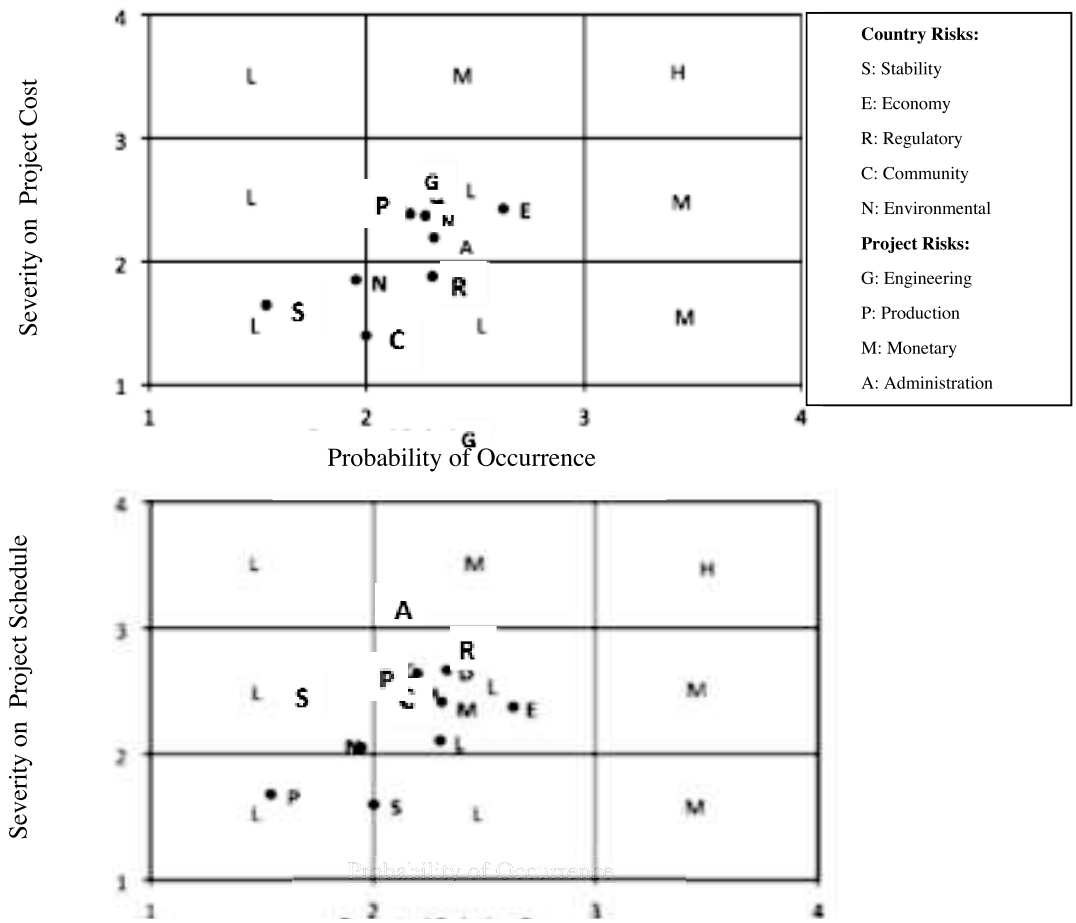


Fig. 2. Country and Project Groups' Matrix Allocation.

Furthermore, The II of the probability of occurrence versus the II of the severity on project cost, schedule for each country, and the project risks are represented in four distinctive RAT shown in Figure 3. This permits for a more precise evaluation of the overall probability of occurrence and severity of each risk category and their level of importance.

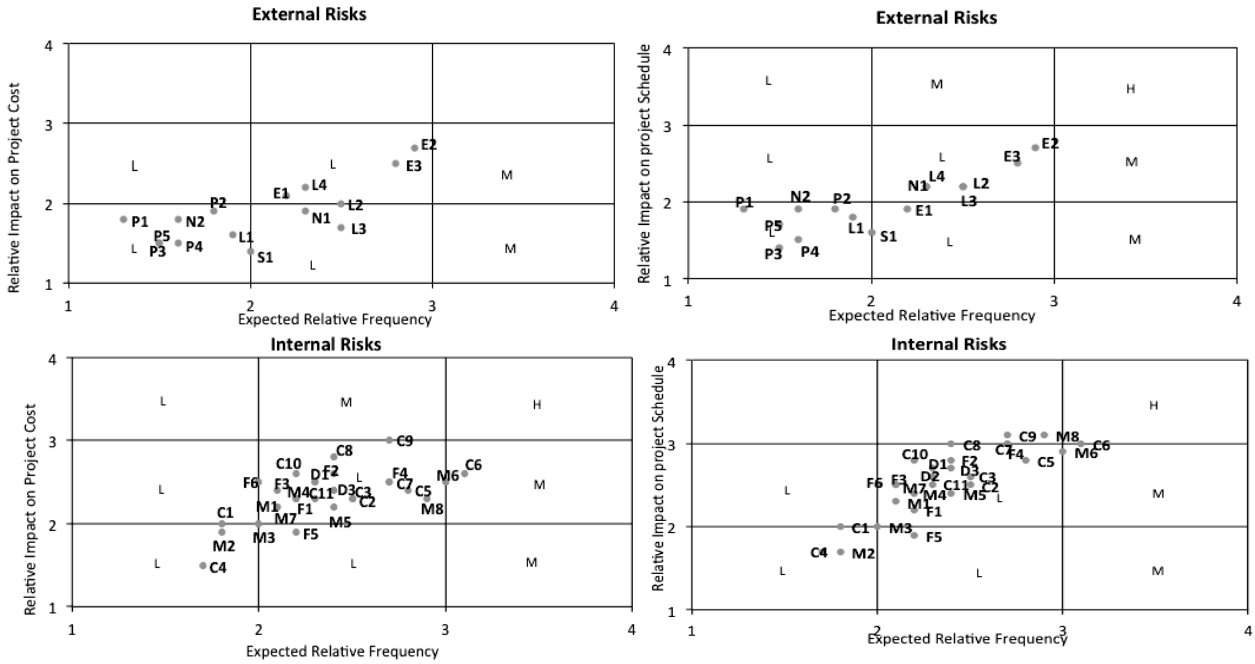


Fig. 3. Country and Project Risks Matrix Representations.

Besides allocating country and project risks on the RAT, the Risk Importance for country and project risks on project cost and project schedule were calculated and ranked to obtain the top five risks on cost and schedule. The calculated risk importance for the top risks is listed in Tables 4 and 5, respectively. Risk Importance (RI) is determined by using Equation (2). Equation 2 was used in previous studies and will be utilized in the present study to sort the risks according to their risk importance score. Although the application of Equation (2) has a diverse implication in the risk management, it ranks risks with regard to their significance in view of both probability of occurrence and severity. For instance, if risk has low probability of occurrence and high severity or vice versa the risk will have a high Risk Importance.

Risk Importance, RI = $II(Probability\ of\ Occurrence)\ x\ II(Severity)$ Equation (2)

Table 4. Risk Importance for Country Risks.

Country Risks			
Risk Importance (Cost)	Risk Type	Risk Importance (Schedule)	Risk Type
7.83	E2	7.83	E2
7	E3	7	E3
5.06	R4	5.5	R2
5	R2	5.5	R3
4.62	E1	5.06	N1
4.37	N1	5.06	R4
4.25	R3	4.18	E1
3.42	S2	3.42	S2
3.04	R1	3.42	R1
2.88	N2	3.2	C1
2.8	C1	3.04	N2
2.4	S4	2.55	S5
2.34	S1	2.47	S1
2.25	S3	2.4	S4
2.25	S5	2.1	S3

Table 5. Risk Importance for Project Risks.

Project Risks			
Risk Importance (Cost)	Risk Type	Risk Importance (Schedule)	Risk Type
8.1	P9	9.3	P6
8.06	P6	8.99	A8
7.5	A6	8.7	A6
6.75	P7	8.37	P9
6.75	M4	8.1	P7
6.72	P5	8.1	M4
6.72	P8	7.84	P5
6.67	A8	7.2	P8
6.24	M2	6.72	M2
5.76	G3	6.5	P3
5.75	G1	6.48	G3
5.75	G2	6.25	P2
5.75	P2	6.21	E1
5.75	P3	6.16	P10
5.72	P10	5.98	G2
5.29	P11	5.76	A5
5.28	A5	5.75	P11
5.06	A4	5.28	A4
5.06	M1	5.25	M3
5.04	M3	5.25	A7
5	M6	5	M6
4.62	A1	4.84	M1
4.62	A7	4.83	A1
4.18	M5	4.18	M5
4	A3	4	A3
3.6	P1	3.6	P1
3.42	A2	3.06	A2
2.55	P4	2.89	P4

DISCUSSION OF RESEARCH FINDINGS

A further evaluation of the research outcome in Figure 2 denotes that limited II axes (i.e., probability of occurrence, severity) on the matrices fall in the (Medium (3), high (4)) bands highlighted in Figure 1. It is an essential initial outcome demonstrating that, for most of the 27 Kuwaiti projects evaluated, the contributors did not confront country or project risks that had important influence on the project and firms. This designates that companies engaged in projects located in Kuwait are utilizing risk control tools to prevent the growth of country and project risks to frightening stages. Yet, the outcomes in both Tables 4 and 5 together with the evaluation that the research team implemented denote that particular risks need to be managed properly to enhance the project performance as they have high Risk Importance (RI) with respect to severity on project cost and schedule. Project contributors must consider these risks if employed on Kuwaiti public projects to be able to control these risks at early stages of the project and minimize their impact on the project and their firm.

COUNTRY RISKS

Stability risks

Based on the overall matrices in Figure 2, stability risks group was discovered to have small importance with respect to two major project success measures (i.e., cost and schedule). According to the detailed risks analysis, where all risks factors II were reflected in the matrices, it was recognized that all of the five stability risks were located on the low zone in both matrices, illustrated in Figure 3. Additionally, stability risks (S1, S3, S4, and S5) were having a very low RI (2.1 – 2.55) compared to other country risks and were at the end of the list (Table 4) with respect to the influence on project cost and schedule. Yet, S2: Government Act (Override) had low SS of 3.42 for both the impact on project cost and schedule

Economy risks

The overall matrices depicted in Figure 2 show that the economic risks are among the low impact risks with respect to project cost and schedule. Instead, Resources Availability (E2) and Resource Quality (E3) had low impact on project cost, and schedules, however, were located in the upper corner of the low zone. Additionally, both risks were the top two risks with high significant scores of 7.83 and 7 presented in Table 4 and had a considerable effect in Kuwait specifically from the manpower viewpoint. Also, Price inflation (E1) was ranked as the fifth risk with respect to the RI (4.62) from the project cost perspective. Price escalation was a notable risk in the State of Kuwait as a consequence of the enormous request on material and resources used in construction and ranks among the top five significant risks in Table 4. El-Shayegh (2008) concurs with this result. He found that price inflation was one of the significant risks in UAE construction industry from a multinational firm's perspective.

Regulatory risks

After examining the overall matrices shown in Figure 2, regulatory risks impose a low impact on all matrices. The detailed investigations showed that Public Authorities Regulation and Requirements (R2), Permits and Licenses (R3), and Contract Harsh Clauses (R4) had low impact with regard to project cost and schedule; however, it ranked among the top 5 significant risks in Table 4. Authorities and regulations requirements were low significance risks on project cost and schedule. Instead, Local Products and Services (R1) had a low meaning on entire of the severity attributes. The regulatory risks are governments' customary risks and are far from the contracting company's power; nevertheless, it is constantly beneficial to examine countries procedures and protocols before proceeding with any public project to minimize any complication that could be encountered.

Community risks

Community risks were found to be low importance risks. Public holidays and observation (C1) were the only community risks that were addressed in this study and impose low influence on all project's success measures. Kuwait

always observes the number of formal celebrations to include all traditions and beliefs. It could truthfully influence project schedule and ultimately direct to difficulties with project costs if not considered.

Environmental risks

Environmental risks were the last of the country risk group, which had a low impact in all two matrices. Inclement weather (N1) was ranked fifth with respect to the RI for the severity on project schedule with a value of 5.06. Inclement weather was among the significant country risks see Table 4. This is predictable, as the climate in Kuwait is severe during the summer and working in open construction site on direct sun exposure is forbidden; therefore inclement weather should be considered in developing project cost estimates and schedule.

Project risks

Engineering risks

The engineering risks group allocated in the low significance strip in both matrices was demonstrated in Figure 2. It was observed from the detailed analysis that design risks were not ranked between the best five utmost importance risks in Table 5 and were low importance risks on both project cost and schedule. The low impact of the engineering risks is expected as most of the projects implement the lump sum contract (92%– See Table 3), which is usually associated with the Design Bid Build (DBB) delivery system where the contract documents are fully completed prior to start of construction.

Production risks

The production risks had a low overall impact for all of the metrics. It was further recognized that inadequate project duration (P9) has a moderate importance with respect to project time and cost and was the best substantial risks with respect to RI on the project's cost (RI of 8.1) and was classified third with respect to schedule severity (RI of 8.37). Performance of Subcontractors (P6) was moderate importance regarding the project schedule and cost, was at the top of the list in the RI with regard to schedule (RI of 9.36), and was classified 2nd with respect to cost influence (RI of 8.06). However, performance of preselected subcontractors (P7) was with moderate significance on both project cost and time and had RI of 8.1 and 6.75 on both project schedule and cost, respectively. Three out of five risks of the significant internal risks shown in Table 5 are performance of preselected subcontractors, performance of subcontractors, and insufficient project duration schedule. This is due to the scarcity of professional and skilled labor in the State of Kuwait, and the restrictive rules applied to regulate their flux, which leads construction firms to prevent expansion and continuation of stable managerial staff, skilled labor, and an suitable taskforce of essential equipment.

Monetary risks

Momentary risks had a low significance with respect to all of the overall matrices. The detailed analysis showed that late or deficiency in processing monthly payment (for contractor or subcontractor), assessment of liquidated damages, error in bids and quotations, variation orders, major changes, and retention magnitude had a low impact over all the metrics. Major Changes (M4) were shown to be among the significant internal risks listed in Table 5 with RI of 8.1 and 6.75 on both project schedule and cost, respectively.

Administrational risks

Administrational risks were found to have a low impact with respect to the overall matrices. However, the detailed analysis showed that Subcontractors/Suppliers Coordination (A6) had a reasonable significance with regard to cost and time. Subcontractors/Suppliers Coordination (A6) was ranked third with (RI of 8.7) and (RI of 7.5) on impact on schedule and cost, respectively. Additionally, Transmittal Process (A8) was ranked second and imposed moderate impact on the project schedule with RI of 8.99. Care should be taken in following the submittal and approval process as any delay caused by such process will adversely influenced the project schedule.

SUMMARY

The State of Kuwait construction industry has been experiencing an unexpected boom over the previous period, with growing concern from local and foreign construction firms. Conversely, Kuwait construction industry, like any other booming construction region, is filled with distinctive range of risks that must be recognized and controlled effectively to decrease any hostile increases or influence on the project construction process. Although numerous studies focused on risks specific to construction market, many of these studies have examined risks encountered by firm executing projects at specific countries located in different geographic regions as Kingdom of Saudi Arabia, the United Arab Emirates, Egypt, Lebanon, Jordan, Libya, Hong Kong, China, and many more. However, there is no literature that recognizes risks confronted by construction companies performing construction public projects in the State of Kuwait construction market in general and quantifies the frequency and impact of these risks.

Evaluating previous research studies, present construction contracts used in Kuwait, discussion with expert in the industry, and initiating an open-ended survey recognized forty-three risks factors. Recognized risk factors were categorized into country and project risks. The country risks were further categorized to stability, economy, regulatory, community, and environmental risks. The project risk factors were categorized to engineering, production, monetary, and administrational risks. The recognized risk factors were then included in a comprehensive questionnaire that was intended to study the recognized risks from their probability of occurrence and influence on cost, and schedule for construction firms who executed public projects in the State of Kuwait. The questionnaire initial outcomes reveal that all the risks were of low importance on both schedule and cost projects. None of the risk factors examined in this research denoted a severe risk situation.

The study also investigated the top significant country and project risks associated with Kuwait construction industry. The recognized country significant risks were Price Inflation (E1), Resources Restrictions (E2), Resources Quality (E3), Public Authorities Regulation and Requirements (R2), Permits and Licenses (R3), Contract Harsh Clauses (R4), and Inclement Weather (N1). The top project risks were Performance of Subcontractors (P6), Performance of Preselected Subcontractors (P7), Insufficient Project Duration (P9), Subcontractors/Suppliers Coordination (A6), Transmittal Process (A8), and Major Changes (M4).

Although this study regarded risk factors confronted by Kuwaiti construction companies working in Kuwait, the results of this research have significant implications to local construction firms and multinational firms working beyond Kuwait. First, this study identifies a total of 43 internal and external risk factors that could affect performance of a Kuwaiti firm seeking projects in international markets and allow them to measure their potential influence on project and company performance metrics. Second, this study detailed the unique characteristics of Kuwait (i.e., political instability, volatility, contract forms, price escalation, quality of resources, and inclement climate) that might affect Kuwaiti firms not familiar with the impacts of these issues on their performance. All or some of these characteristics can be encountered in different countries across the world (e.g., strikes and riots that swept Greece this year due to economic situation in the country, the wave of violence resulted from the police strike in Brazil). These characteristics will provide Kuwaiti companies with an initial outline to commence evaluating concerns associated to the countries where they are pursuing to start their business.

Lastly, the methodology developed to combine risk probability of occurrence and severity on project schedule and cost provide a framework to assess significance of a country's specific risks and develop mitigation measures that efficiently address and attempt to mitigate these risks.

Finally, current and upcoming examination is guided to studying the influence of the recognized risks on projects' cost, schedule, and construction firms' performance in the State of Kuwait, and generating models that can be utilized to support Kuwaiti construction companies in investigative the risks-effects' magnitude on their projects success measures and firm performance. Stronger statistical analyses like linear and multiple regression, principal component, and factor analysis will be used in developing these models. Additionally, misallocation of risk factors will be assessed to establish approaches to ease their hostile result on the project development.

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تقييم مخاطر البناء في المشاريع العامة في دولة الكويت

رقية الصباح وعمر رفعت
قسم الهندسة المدنية والبيئية، جامعة الكويت، الكويت

الخلاصة

تعرض الدراسة الحالية المخاطر الكبيرة التي تواجهها شركات المقاولات العاملة في مشاريع عامة تقع في دولة الكويت، وتحدد احتمالية حدوثها ومدى خطورتها. تم تصنيف المخاطر المُحددة إلى فئتين رئيسيتين، هما: فئة المخاطر القُطرية ومخاطر المشروع. كما تم تصنيف المخاطر القُطرية إلى خمس فئات فرعية، تشمل: الاستقرار والاقتصاد والرقابة والمجتمع والبيئة. ومن ناحية أخرى، تم تصنيف مخاطر المشروع إلى مخاطر هندسية وإنتاجية ومالية وإدارية. تم بعد ذلك تقدير هذه المخاطر من خلال مسح تم توزيعه على المقاولين من القطاع الخاص ممن لديهم خبرة في المشروعات العامة في دولة الكويت. تم حساب مؤشر الأهمية العام (II) لمجموعات المخاطر العشرة من حيث احتمال حدوثها وخطورتها على تكلفة المشروع والجدول الزمني للتنفيذ. تم فحص العلاقة بين (II) احتمال الحدوث و (II) ومدى الخطورة من جانبين وتصنيفها باستخدام أداة تقييم المخاطر (RAT). وفي الختام، أظهرت الدراسة أن جميع فئات المخاطر العشر كانت منخفضة المستوى. وأظهر التقييم المُكثف لنتائج الدراسة أن أهم المخاطر هي تضخم الأسعار (E1)، فرض القيود على الموارد (E2)، جودة الموارد (E3)، أنظمة وقوانين المؤسسات العامة (R2)، التصاريح والتراخيص (R3)، بنود العقد القاسية (R4)، أحوال الطقس القاسية (N1)، أداء المقاولين من الباطن (P6)، أداء المقاولين من الباطن المختارين مسبقاً (P7)، عدم كفاية مدة المشروع (P9)، التنسيق بين المقاولين من الباطن (A6)، عمليات النقل (A8)، والتغييرات الرئيسية (M4).

وعلى الرغم من أن هذه الدراسة ركزت على تحديد المخاطر في المشاريع العامة في دولة الكويت، إلا أنه يمكن للمخاطر المعروفة وأهميتها إرشاد المقاولين الذين يتطلعون إلى العمل في مشاريع البناء الواقعة في منطقة الشرق الأوسط وشمال إفريقيا، لا سيما في البلدان التي لديها وفرة من الموارد الطبيعية ولكنها تعاني من عدم الاستقرار الداخلي الشديد. يمكن لهذه الشركات الاستفادة من RAT المُطورة في هذا البحث لتحديد احتمال وشدة حدوث المخاطر على أداء مشاريعهم، وتطوير تدابير مناسبة للتخفيف من تلك المخاطر