

## CHALLENGES AND BENEFITS OF APPLYING RISK MANAGEMENT TO CONSTRUCTION PROJECTS IN JORDAN

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**ABSTRACT:** *Construction projects have several characteristics including: defined scope, predefined timeline, defined budget and specific quality requirements. Therefore, investment in construction projects is a tough decision to be made. Especially when we know that construction projects involve risk complicated issues, which will influence project objectives. Risk management is an integral part of the construction management process. The overall objective of this study is to understand the depth to which risk management is applied in construction projects in Jordan and identify the barriers and challenges that may hinder the risk management process. The study will also highlight the benefits of applying risk management and how construction companies can improve their risk management process by adopting set of best practices. This study is based on findings from a questionnaire-based survey on risk management application to construction projects in Jordan*

**KEYWORDS:** project risk, risk management, risk mitigation, risk score, project team

### INTRODUCTION

Risk is uncertain events or condition that, if it occurs has a positive or negative impact on project objectives. In Construction, risks are important factors to be considered through the different project development stages starting from initiating and planning and ending with construction and commissioning. If risks are not considered in projects this could lead to adverse effect on project objectives mainly: time, cost and quality of work completed. Therefore, it becomes increasingly important to address risks at the very early stages of the project and be able to plan for the consequences of risks happening on the project, this should not be a haphazardous process. Therefore, Risk management is defined as “the systematic process of identifying, analyzing and responding to project risks”. It includes maximizing the probability and impact of positive events and minimizing the probability and impact of negative events. The risk management process is composed of 6 key steps: risk management planning, risk identification, risk analysis, risk response planning and risk monitoring and control. Schoonwinkel, S, Fourie, C J, & Conradie, (2016).

The construction industry has changed rapidly over the past ten years; companies are faced with more risk and uncertainty than before. Clients are more likely to engage in litigation when things go wrong. Risk in construction has been the object of attention because of time and cost overruns associated with construction projects. Jaffari, defined risk as the exposure to loss, gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude ( Jaffari, 2001). Kartam has defined risk as the probability of occurrence of some uncertain, unpredictable and even undesirable events that would change prospects for the probability on a given investment. (Kartman et. al. 2001)

There exist no comprehensive study explaining the cause of risks among construction companies; moreover research covering the subject matter has tended to identify the symptoms rather than causes. A number of authors have attempted in their studies to ascertain the causes of threats and categorize the risks in the construction industry (Rwelamila et. al, 1997). A number of researches have examined the issue of risk management of construction projects. Bajaj et al (1997) investigated and evaluated the process of risk identification. Ramcharra et. al, 1997 identified the risks usually faced by the construction firms in a foreign country. Other researchers identified the risks that are specific to the developing countries arguing that investors should bear the exchange and interest rate risks. (Kalayjian, 2000)

A number of variations of risk management process have been proposed. Raz and Michael (2001) suggested a process consisting of two main phases: risk assessment, which includes identification, analysis and prioritization, and risk control which includes risk management planning, risk resolution and risk monitoring, tracking and corrective action. Tummala & Burchett (1999) identified risk management approach as a multiphase 'risk analysis' which covers identification, evaluation, control and management of risks.

In the following sections, we will discuss the topic of risk management in construction projects from the perspective of both parties contractors and consultants and how risk management practices affect the overall project performance in construction projects in Jordan.

### **The Problem of Risk Management in Construction Projects in Jordan**

The construction sector is one of the most important economic sectors as it is characterized by the diversity and complexity of its sub-sectors. It has developed steadily in the last year as growth is influenced by many interrelated factors, the most important of which is the general political climate, the safe investment environment and the good infrastructure. There is no doubt that construction is a key activity in any economy, it influences and is influenced by the gross domestic product (GDP) of any nation (Cox & Townsend, 1998).

Construction projects are complex and time-consuming undertakings. Projects must be designed in accordance with applicable codes and standards, culminating in working drawings and specifications that describe the work in sufficient details for its accomplishment in the field. Construction industry needs a proper application of business practices. The many variables and complex relationships that exist between variables that must be considered in the process, coordination and use of many types of labor skills, materials and equipment that are used to build a project require daily application of proper business practices. Bethke (2003).

When risk management is applied at an early stage of the project, it will help to raise level of confidence in the project and the information available about it to all stakeholders involved. Therefore, Risk management helps project owners to anticipate the problems that might happen before it happens and take the necessary precautions to avoid or at least minimize its impact on project objectives. Newell & Grashina (2004)

The contribution of this paper is that it will address the topic of risk management in construction companies by identifying the barriers and challenges that will prevent consulting and contracting firms from applying risk management in projects, it will also help define a set of enablers that will facilitate the risk management process to construction companies in Jordan

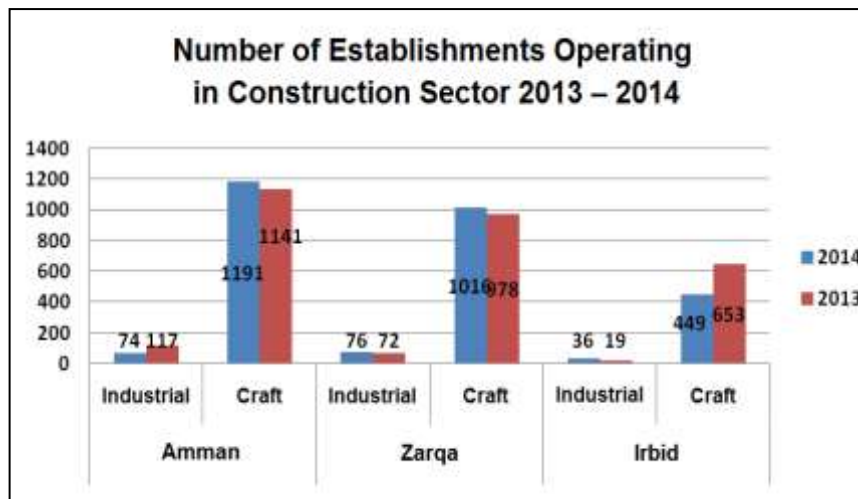
Looking at the history of construction projects in Jordan and the number of projects which were suspended during construction or experienced problems of cost and schedule overrun, and looking back at some of the reasons for project failure, there is an evidence that the concept of risk management is neglected in the planning phase of these projects. In Jordan, The total number of companies operating in the construction industry sector registered in the three chambers of industry (Amman, Zarqa and Irbid) in the year 2014 has amounted to 2842 companies, compared to their number in the year 2013 in which the number of enterprises reached 2980.

**Table (1): Number of Establishments in the Construction Sector in (2013 – 2014)**

Source: Jordan Chamber of Industry

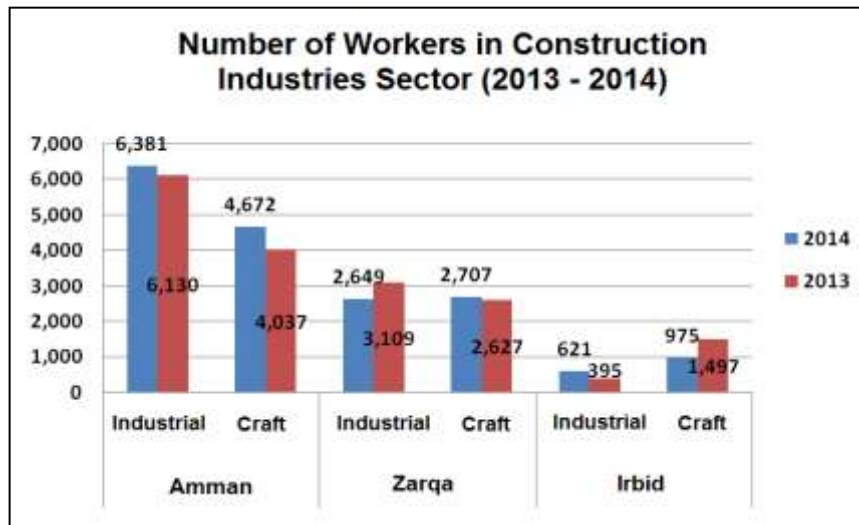
Local Chambers	Industrial Establishments			Craft Establishments			Total		
	2013	2014	Growth	2013	2017	Growth	2013	2014	Growth
<i>Amman</i>	117	74	-37%	1141	1191	4%	1258	1265	0.6%
<i>Zarqa</i>	72	76	6%	978	1016	4%	1050	1092	4%
<i>Irbid</i>	19	36	89%	653	449	-31%	672	485	-28%
<b>Total</b>	<b>208</b>	<b>186</b>	<b>-11%</b>	<b>2772</b>	<b>2656</b>	<b>-4%</b>	<b>2980</b>	<b>2842</b>	<b>-5%</b>

Despite the decline in the number of the industrial establishments operating in this sector, there has been a growth in the registered capitals of these companies as they rose from 297 million Jordanian Dinars in the year 2013 to about 316 million Jordanian Dinars in the year 2014, indicating a 6.3 % growth as shown in Figure 1



**Figure (1): Total Capital of the Craft and Industrial Establishments in 2013- 2014 According to Chamber of Industry (Million Dinars)**

The total number of workers in the companies operating in the construction industry sector that are registered in the three chambers of industry (Amman, Zarqa, Irbid) has amounted to 18005 workers in the year 2014 compared to their number in the year 2013 which reached 17795 workers indicating a 1.2% growth as shown in Figure 2.



**Figure (2): Number of workers at Craft and Industrial Establishments and Their Distribution According to Industry Chambers in Jordan in (2013 – 2014)**

**Their**

Several major projects in Jordan are experiencing major problems in time, cost and quality of the work performed, these problems result in major delays and losses to the owners. Research studies have found that so many of these problems are due to lack of risk management understanding and application among project stockholders. The concept of risk management is normally not very much appreciated by construction contractors and there is little understanding of the concept of risk and its implication to projects in particular and to construction organizations in general.

The main objectives of the research study was to examine the risk management application by contractors and consultants working in construction projects in Jordan and determine the benefits of applying risk management in construction projects.

In order to achieve the main objective, the following sets of goals were determined:

- A) To understand the level of awareness of risk management among construction contractors in Jordan
- B) To identify the barriers and factors that prevent the contractors from applying risk management to their projects
- C) To identify the solutions and proposed actions to be taken by construction companies to facilitate the implementation of risk management in their projects.

## METHODOLOGY

The Research method used in this study in order to achieve the stated objectives was a questionnaire survey used to collect data from large population. A population consists of "the totality of the observation with which we are concerned with". (Walpole & Myers, 1998).

In this study, the population is the total number of contractors and engineering firms who have valid registration by the Contractors Union and Jordan Engineering Association and are classified as Grade 1 & 2 only. This number was found to be 152 companies registered in Jordan.

The questionnaire survey was conducted to determine the opinion of contractors and consulting engineers regarding the main factors affecting the application of risk management in construction sector. A questionnaire accompanied with a covering letter was delivered to 152 contracting & consulting companies. The letter indicated the objectives of the research study and explained to the participants that the results of the questionnaire would be used to improve the ability of contractors to identify and analyze the most challenging factors impacting the application of risk management processes in construction. Online questionnaire was used for its advantages as it is easy and quick way to answer questions; they require little effort by the respondents.

The questionnaire was composed of four sections to accomplish the objective of this research study, as follows:

- General Information
- Risk Management Assessment
- Constraints and challenges of risk management
- Benefits of applying risk management

To ensure obtaining complete and effective response to the questionnaire, respondents explained their answers and were given the chance to propose solutions for the challenges and constrains of the risk management process. The questionnaire was delivered online Goggle Forms.

After collecting all the questionnaires and consolidating the data. The analysis process started. Analysis is an interactive process to see whether these results support the hypothesis underlying each question. The analysis of data is made to rank the severity of causes. Ranking was followed by comparison of mean values within groups and for the overall sub-factors.

## **DISCUSSION & RESULTS**

### **Risk Management Assessment:**

In this section of the survey we focused on general questions related to the overall understanding of the risk management concept within the construction industry in Jordan and how much of it is applied in real projects. We asked general equations to engineering and construction professionals to try to understand the level of awareness of risk management among people in general. Below is a discussion of these questions and the response obtained from participants.

Q1) is the concept of risk management clear to you?

When this question was raised surprisingly most of the respondents answered yes (91%) indicating that they understand the concept of risk and what risk management means to construction projects. We were under the impression that this concept is not clear to large number of construction companies in Jordan and that is why it is not being implemented. It appears that most of the construction professionals especially people working on site were familiar with this concept, however, most of them were not applying this concept to their work practices.

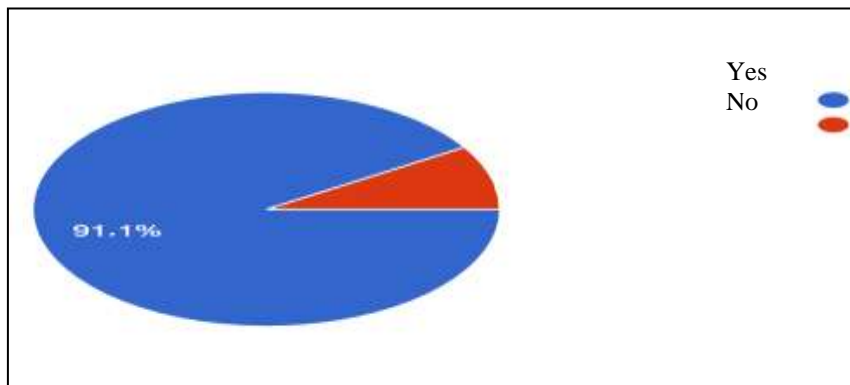


Figure 3: Answers to Questions “Is the Concept of risk management clear to you?”

Q2) Is there any risk management application in your company?

From the below figure we can see that 64.3% of the respondents answered Yes and 35.7% answered No for one of the following reasons as stated by participants:

- 1-The company does not have sufficient budget to apply risk management.
- 2-Most of the company's projects are simple and small projects, with no high risk, and therefore risk management is not required.
- 3-The Company's main business area is design which involves less complicated and less expensive risks.

From the answers stated above, it seems there is a misunderstanding of when risk management should be applied; one third of the respondents only think that risk management should be applied on complex projects. While complex and large project defiantly needs risk management more than smaller projects. Small projects sometime could be complex and could result in major risks to the project if not properly managed. Moreover, the fact that senior management in some construction companies are not allocating sufficient budget to apply risk management indicates that there is less awareness and no leadership support for this activity in the project, due to the fact that benefits of risk management are not properly demonstrated. It is also interesting to see that risk management is not seen as important for engineering and design firms compared with construction firms in Jordan. While in reality, many problems that we face during construction are due to design errors and lack of alignment between engineering and construction which could lead to major risks impacting the project.

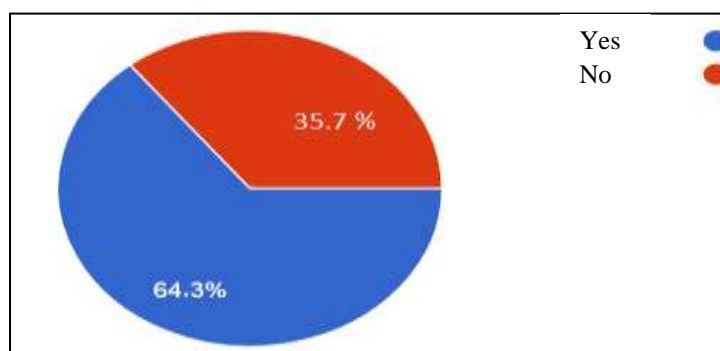
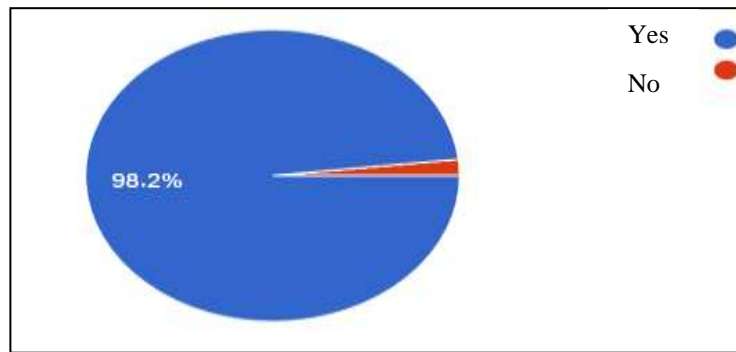


Figure 4: Answers to question: “Is there any risk management application in your Workplace?”



Q3) Do you think that identifying risks and evaluating them is useful in construction projects?

From the below figure we can see that 98 % of the respondents answered Yes and only 2% answered No to this question. This further emphasize the fact that risk management is well appreciated by construction professionals.

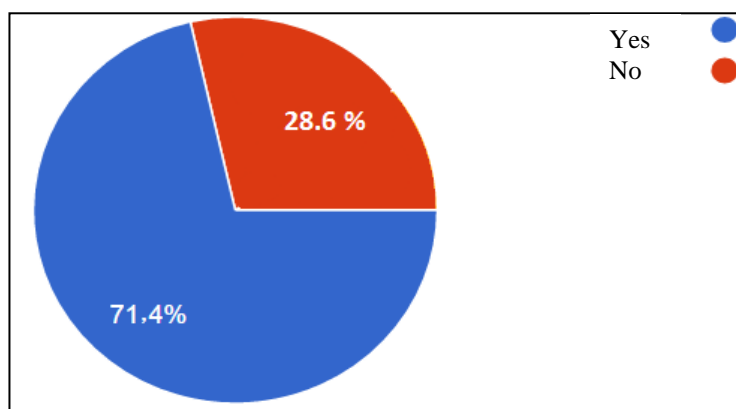


**Figure 5: Answers to question: “Do you think that identifying risks and Evaluating them is useful in construction projects?”**

Q4) Does your company have the physical capability to apply risk management in construction projects?

As shown below, 71.4% of the respondent’s answered: Yes and 28.6% answered No for one of the following reasons:

- 1- Lack of adequate expertise in applying risk management in projects
- 2- Resource limitation. (Not enough resources in the company)

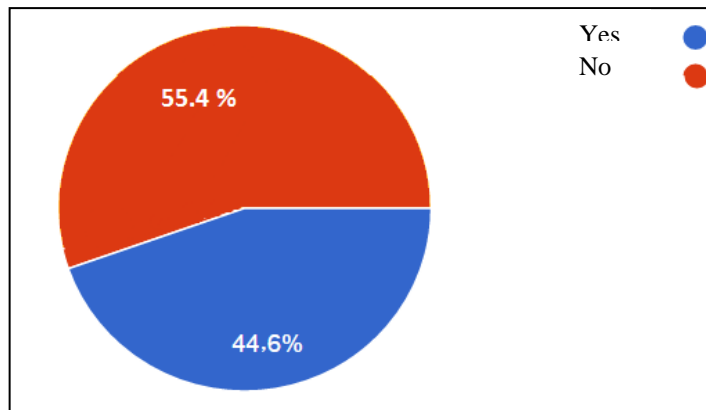


**Figure 6: Answers to question:" Does your company have the physical Capability to apply risk management in construction projects?"**

Q5) Does a large number of employees have the required skills and experience to apply risk management to projects?

From the figure below we can see that 44.6. % of the respondents answered Yes and 55.4% answered No for one of the following reasons:

- Lack of appropriate training courses to practice risk management professionally. Few trained risk management professionals are available and therefore not so many courses are offered for the public
- Risk management needs a team of several individuals that are not often available. Risk management is a group exercise that required collaborative effort by the whole project team, this rarely happen due to lack of time and dedication by the project team.

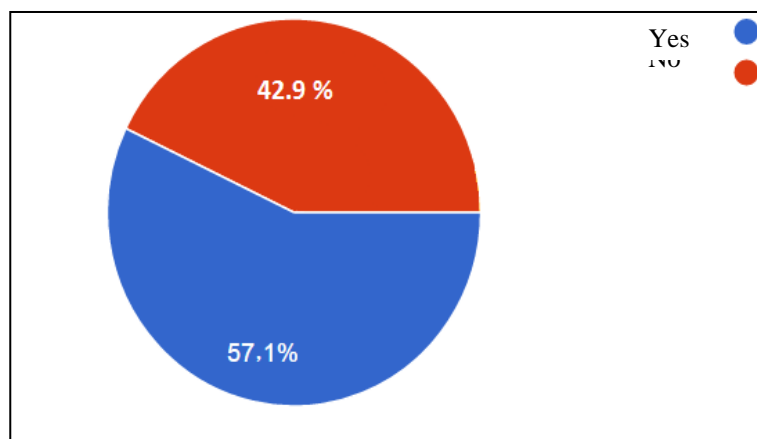


**Figure 7: answers to question: “Does a large number of employees have the required skills and experience to apply risk management to projects?”**

Q6) Is there any risk management software used in the construction projects in your company?

From the figure below we can see that 57.1% of the respondents answered yes and 42.9% answered No for one of the following reasons:

- 1- The firm has not allocated budget for such tool.
- 2- Not familiar with available and reliable software tools in risk management

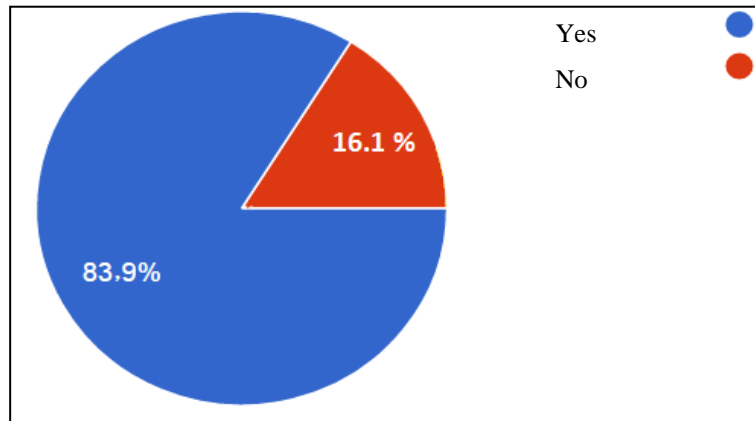


**Figure 8: Answers to question: “Are risk management software used in the construction Projects in your company?”**

Q7) Are you interested in participating in training and risk management courses?



It was apparent that 83.9% of the respondents answered: Yes and 16.1% answered No because most of the courses offered are unprofessional but are basic principles of risk management. Respondents were more interested in specialized hands-on risk management courses in the construction industry that they can apply and benefit from it in their projects. Unfortunately, such courses are rare in the market due to lack of specialized risk management professionals

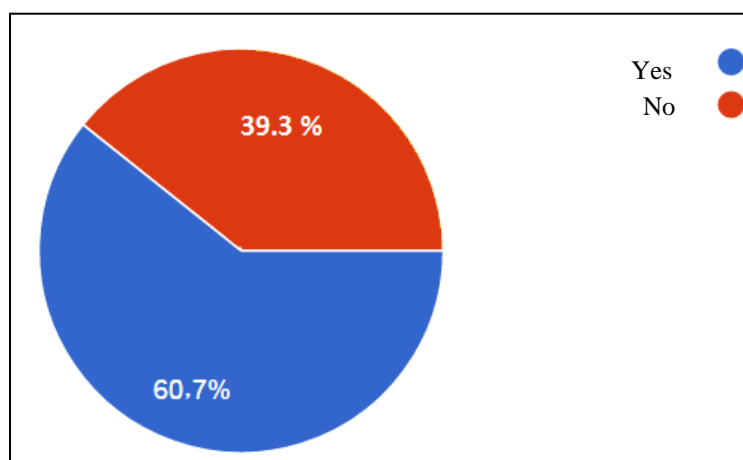


**Figure 9: Answers to question: Are you interested in participating in training and risk management courses?**

h) Is the contractor the most influential party in risk management in construction projects in your opinion?

From the figure below we can see that 60.7% of the respondents answered yes and 39.3% answered No and identified other stakeholders that are involved with the risk management process. The respondent answers were as follows::

- 1- Project manager is the most influential
- 2- Project team is responsible for risk analysis.
- 3- This a joint effort between the contractor and the consultant
- 4- Contractor, owner and designer are all responsible for risk management.



**Figure 10: Answers to question) Is the contractor the most influential party in risk management in construction projects in your opinion?**

Q9) in your opinion, is there an awareness and knowledge of risk management and its importance to employers?

From this figure we can see that 39.3% of the respondents answered yes and 60.7 % answered No for one of the following reasons:

- 1-The construction industry is subject to many difficulties that limit the owners of engineering companies from allocating the budget to apply risk management appropriately.
- 2- The concept of risk management is often unclear to the client because of his focus on implementing the project at the lowest possible cost.
- 3- The concept of project management is limited to large and complex project owners who require analysis at all stages of the project.

### Constraints and Challenges of Risk Management

This section discusses constraints and challenges that prevent the application of the concept of risk and risk management in construction projects in Jordan. The degree of importance for each factor was determined in the questionnaire. The questionnaire was designed to examine respondent's observations and judgments in determining the relative significance of each risk item. Each respondent was required to rank each risk on a scale from: Very Important (4) to Not Important (1) based on how much he/she thinks this constrain affects risk management.

The following data were obtained and the factors were arranged depending on their degree of importance from the most important to the least important. The number in the table represents number of respondents' ranking each risk item based on the scale from 1-4. A score representing the average weight for all the responses obtained for each risk item was calculated as shown in the table below. Constrains and challenges were organized in an ascending order.

**Table 2: Constrains and Challenges of risk management in Construction projects**

Constraints and challenges of risk management	Very important 1	Important 2	Less important 3	Not Important 4	Score
lack of awareness of the concept of risk management and its application among project stakeholders	37	17	1	1	1.392
Lack of faith in risk management on both contractor and client's side	31	20	4	1	1.554
The additional cost of implementing risk management and the unwillingness of any party to bear it	30	16	7	3	1.696
Lack of expertise and qualifications required to implement risk management in projects	23	25	6	2	1.767
Lack of practical experience in construction projects necessary to conduct risk management	26	17	11	2	1.803
Difficulty collecting the necessary information about project risks	21	24	10	1	1.839
Difficulty analyzing and evaluating	21	21	10	4	1.964

the impact of risk on project performance indicators (time, cost, quality).					
The difficulty of identifying mechanisms and methods of treatment of risks in projects	21	21	9	5	1,964
The application of risk management needs extra time and effort that is normally not provided	16	22	14	4	2.107
Difficulty linking risk management to better achieve project objectives in terms of saving time or cost to the employer	13	22	15	6	2.250

From the above table, we can see that the biggest challenge and constrain to risk management application is the difficulty linking risk management to project objectives. If someone can demonstrate the advantages of risk management to project objectives mainly in terms of saving time and reducing project cost, this will justify investment in risk management in construction projects to owners. The second biggest challenge is that the application of risk management needs normally investment in time and resources that resembles additional cost to the project nobody is willing to carry.

In order to apply risk management you need resources and dedicate team and you need to invest time in planning for the risk management process right from the beginning of the project. Normally, project owners are reluctant to do so unless they feel the need and benefit of applying risk management in their projects. The third biggest constrain to applying risk management in construction projects in Jordan is the "the difficulty of identifying mechanisms and methods of treatment to risk in projects". Normally in complex projects, it becomes difficult sometimes to treat the risk and determine a proper mechanism to deal with it. The least important constrain to risk management application is the "lack of awareness of the concept of risk management and its application among project stakeholders". As we have seen from the questionnaire, most of the respondents stated that they are familiar with this concept.

### **Benefits of Applying Risk Management**

This section discusses the benefits and advantages achieved in the project from the application of the concept of risk and management in construction projects. The degree of important for each factor was determined in the questionnaire. The questionnaire was designed to examine respondents' observations and judgments in determining the relative significance of each risk category. Each respondent was required to rank each risk on a scale from 1-4 as follows; Very Important (4) to Not Important (1) by considering its contributions to apply risk management. The following data were obtained and the factors were arranged depending on their degree of importance from the most important to the least important. A score representing the average weight for all the responses obtained for each risk item was calculated as shown in the table below

From the below table we can see that the most important benefit of applying risk management in construction projects is to increase and improve communication efficiency between project stakeholders as stated by respondents. Communication is a key issue in project management and risk management helps to address the issue of communication because it requires planning and coordination among stakeholders in order to manage their expectations and requirements. By

improving communication among project stakeholders, we can a better understand the risks and agree on risk mitigation plans and therefore reduce the impact of the risk to the project and eliminate any chances for conflicts among stakeholders who may have competing interests in the project. The second most important benefit to applying risk management in construction projects is to help avoid or minimize project delays and therefore achieve project objectives. It is well-known large construction projects faces schedule delays and challenges that may turn the project feasibility upside down in some cases. Proper risk planning helps to address this issue and ensure the project will meet its schedule or at least minimize the delay to an acceptable limit to the owner.

**Table 3: Benefits of Applying Risk Management**

Benefits of applying risk management	Very important 1	Important 2	Less important 3	Not Important 4	Score
Reduce the likelihood of problems during project execution	39	14	3	0	1.357
Reduce the likelihood of problems and conflicts between project stakeholders	17	13	23	3	1.411
Reduce the number of risks that can occur during project execution	32	23	1	0	1.446
Reduce the impact of problems if they occur during project execution	31	21	4	0	1.517
Risk management gives the project manager the opportunity to pre-plan the project before implementation	28	23	5	0	1.59
Provide alternatives and solutions to address risks if they occur during project implementation	27	22	7	0	1.643
Reduce the incremental cost of risks that may occur in the project	28	20	8	0	1.643
Risk management at the time of project planning helps to decide on the feasibility of the project	31	13	9	3	1.714
Avoid project delays and its impact to project objectives	24	23	7	2	1.768
Risk management helps to increase and improve communication efficiency between project stakeholders	18	16	16	6	2.18

Another benefit to applying risk management, is that risk management enables the project manager to analyze the project thoroughly from all perspectives and reach the root causes of the various risks and challenges that face the project, it will enable the project manager to estimate the impact of the various risks on the project in dollar values and add a contingency to the project estimate to account for all these risks. Thus, the project manager can reflect this contingency number to the feasibility study of the project and can determine if this project is feasible after accounting all these risks in the project cost estimate.

## **Implications to Research and Practice**

This study has helped the construction industry in Jordan, to understand in details, the various factors that prevent project stakeholders from applying risk management to their projects despite the fact that most of them realize the importance of it in improving project performance. The study also helped to define a set of enablers that if adopted by project managers in construction projects can very much help to increase the level of application of risk management and will help project stakeholder to better manage their projects and avoid or at least minimize the impact on project cost and schedule.

## **CONCLUSIONS**

This study revealed important facts about the status of risk management practices in construction projects in Jordan. Despite the fact that the Jordanian construction market is relatively small and is experiencing several challenges and problems, the study has found that there is an acceptable level of knowledge of the risk management concept among Jordanian contractors and consultants, however, the lack of application of this concept in construction projects is due to the inability to link the application of risk management with key project objectives and the difficulty in justifying the value added by adopting risk management practices in construction. The application of risk management normally required allocation of resources and dedicated project teams to plan and manage risks throughout the project life cycle; this is normally difficult to be do when the project team is busy with project tasks and daily work of the project. Therefore, in order to enhance the application of risk management in construction, clients should encourage the application of risk management by dedicating sufficient resources and funds to be used in this process as well as raising awareness among project stakeholders about the value of risk management to construction contractors and consultants. It is also important that there is leadership support and buy-in in the risk management process and not only on project team level.

The study also identified several benefits to the application of risk management in construction projects in Jordan, the most important of which is to improve and enhance communication among project stakeholders which will benefit the project and leads to increased project success. Additionally, by applying risk management we can avoid project delays and cost overrun at the very early stages of project development. Through proper risk management we can develop a mitigation plan to deal with these risks and therefore avoid these problems or at least minimize its impact to the project.

The risk management process is a vital process in construction, due to complexity of the projects itself and the technical challenges that may result in excessive schedule delays and cost overrun and sometimes quality and performance issues. The application of risk management helps to address these problems at the early stages of the project and develop a mitigation plan to deal with these risks if it occurs with minimum cost and time involved.

## **Future Research**

As highlighted earlier in this paper, it was found from this study that among the most important barriers and challenges to the concept of risk management in construction projects, is that the value of applying risk management can't be yet demonstrated through empirical evidence. A suggested area of future research could be in developing various assessment and valuation models

for the impact of risk management on construction projects not only from time and cost perspective, but also on other intangible benefits of risk management that could not be evaluated directly such as: customer satisfaction, project success, and compliance to quality and safety requirements. This is an area of research that worth investigating as it will help to encourage project stakeholders to invest in risk management if the value can be strongly demonstrated.

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