Risk Management in Construction

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Abstract: **The main objective of this research was to study the impact of risk management on construction projects success. The survey which was directed to the participants was developed according the research design, approach, and data. This survey includes two major sections. The first section asked about the procedure followed in the organization to manage the risk. In section two, the survey attempts to specify if the project they experienced achieved the success criteria, this was according 7 criteria factors were defined for construction project success listed in the questionnaire. The distributed questionnaires were 230 questionnaires and got 200 questioners back with percentage of 87.4%. The results of the current study indicate that there is an impact exists between both Risk identification and Risk assessment on project success, scheduled time, planned budget, and the ability to comply with technical specifications. While there is no impact between Risk assessment and avoiding lawsuits or claims. Also, the study indicates that there is an impact of Risk response on project success, meeting the scope of work, scheduled time, and achieving the quality standards.**

Keywords: Impact; Risk management; Construction projects; Success; Employees perspective.

I. INTRODUCTION

The Hashemite Kingdom of Jordan is attractive country for investment, such as construction projects; that because of its strategic location, political stability and cultural particularities. All of this is essential for a successful experience. Because of the above-mentioned reasons, the construction projects are rapidly increasing in Jordan as well as other investments. In addition, the construction industry has changed rapidly over the past 10 years; companies are faced with more risk and uncertainty than ever before. Clients expect more, most importantly, they do not want surprises, and are more likely to engage in litigation when things go wrong, these things make the project managers in Jordan and worldwide to think more about the relationship between these new risks and uncertainties and the success of the project they are managing and forced them to ask ―Does risk management contribute to project success? ‖. Risk management has become an important part of the management process for any project. In fact, Risk management came into the foreground of business literature during the last two decades of the 20th century (Loose more et al., 2006). Actually, Akintoye et al. (2003) believes that the circumstances within the construction industry had led to adopting risk management and analysis into practice. Risk is one of key factors that can positively affect working effectively inside the firm if it was practiced in the proper way. By doing such organization can achieve capital value of rareness and capital value of limitability via which the firm can build stronger competitive advantage by developing maintaining and retaining core competencies; which can in its turn maximize the organization's market share, reputation maximize shareholder equity and stake holder goals and maintaining the maturity stage of the firm's life cycle in which it can maintain the peak stage for all of its activities by recognizing, encouraging and retaining the peak performance. An effective use of project management techniques such as risk and value management are considered as key supporting processes and to add to them quality, cost, time and change control (Fewings, 2005); all together generate an integrated approach to the project success. While, project risk management is a scalable activity and should be commensurate with the size and complexity of the project under consideration. Yet, simpler projects mean utilizing simple qualitative analysis such as Project Management Online Guide in the Risk Management Plan spreadsheet, in similar vein, Larger more complex projects may wish to use more robust analysis techniques via Monte-Carlo simulation models. Risk management requires top-level management support, acknowledgment that risks are realities, and a commitment to identify and manage them. One discriminator of a successful organization or project is the use of risk management to anticipate potential negative conditions, problems, and realities. Ineffective projects are forced to react to problems; effective projects anticipate those (Loose more et al., 2006). The main challenges facing management are to estimate the level risk by the position holder, also to estimate whether the management is aware of the risk and are they implying their knowledge in the avoiding risks. Top management should investigate various types of risks facing it is business , and how to manage the risk via education or past experience and other sources, also we can know how risk can affect the success degree of projects. Accordingly, this research sets sights on introducing the impact of risk management on construction projects success from the owners' and employees' perspectives.

Research objectives:

The main objective of this research is to

study the impact of risk management on construction projects success. The study also aims at:

- Studying and identifying the nature of relationship between implementing effective risk management and construction projects success.
- Identifying key risk factors that could stand in front of construction processes by reviewing the literature.
- Assessing the severity and the allocation of each identified risk factor
- Investigating management awareness of risk management, and applying their knowledge

while managing these projects.

- Identifying the success criteria that were achieved in construction projects.

Research importance:

This research importance stems from the essence of risk management itself, for the reason that risk management has been identified as one of the most important tools in determining any project success; yet, few studies investigate the nature of this relationship (Fewings, 2005). As a result, this research will drive the attention to the importance of a high level of awareness to risk management problems. In addition, studying the relation between risk management and project's success is important because most of projects are operating in a very dynamic and rapidly changing environment not always fixed circumstances and uncertainty factors are surrounding the firm, in such environment adopting changes very quickly is a must for the project overall to grow or even survive. Adopting overall project changes can't be applicable without the management ability to adapt model in risk management and make the new changes. Accordingly, the results of this research may help the managers to better evaluate the risks around them and better respond to these risks and present them methods that may enhances their projects risk management. Research Design and Approach This study examines the impact of risk management on construction project success. A Likert scale survey was used to measure the dependent variable of project success and the independent variable of Risk Management. The participants were employees in Consulting and Contracting companies who experienced previous project. Response choices on the questionnaire were coded as 1 (Highly Agree), 2 (Agree), 3 (Neutral), 4 (Disagree) and 5. (Highly Disagree).

Sampling techniques:

The survey which was directed to the participants was developed according the research design, approach, and data. This survey includes two major sections. The first section asked about the procedure followed in the organization to manage the risk, and investigation on if their organization practices effective risk management. In section two, the survey attempts to specify if the project they experienced achieved the success criteria, this was according 7 criteria factors were defined for construction project success listed in the questionnaire. These questions were analyzed to determine impact of risk management on construction project success. The survey was directed to employees who in companies that worked on Construction Projects in Amman. These companies were consultant Companies and contracting Companies.

Research Population:

The scope of this research includes construction projects in Jordan. It was necessary to sample this research because it is impossible to conduct all the construction companies, the population consists of 4 leader consulting and contracting companies in Amman including 21 construction projects in Jordan. These companies are Sigma Consulting Engineers, Concorde Construction Company, Consolidated Contractors and Jo- Sadeen Contracting Company.

Research sample:

The sample consists of employees who are related to risk management, in order to make sure about the quality of collected data. The sample consists of two hundred and thirty questionnaires, which were handled to various employees with deferent level of education, positions and experiences. To assure the maximum level of research sample engagement, the questionnaire was translated from English to Arabic which can help employees with various levels and backgrounds to better understand the phrases within the questionnaire that can lead to maximize their participation. The distributed questionnaires were 230 questionnaires and got 200 questioners back with percentage of 87.4%.

II. DATA COLLECTION METHOD

The data for this research are collected via primary and secondary sources. The primary data was developed by questionnaire which was directed to the employees in the construction companies in order to collect data for statistical analysis of the research in order to test the hypothesis. Secondary Sources can be gained from book, specialized International Journals, Publications and the World Wide Web; also the researcher can make use of what was written in the literature in similar fields.

III. RESEARCH HYPOTHESIS

The following hypotheses were tested: Ha1: There is an impact exists between Risk identification and project success.

Ha1-1: There is an impact exists between Risk Identification and the scheduled time.

Ha1-2: There is an impact exists between Risk Identification and the planned budget.

Ha1-3: There is an impact exists between Risk Identification and the ability to comply with technical Specifications.

H a2: There is an impact exists between Risk Assessment and project success.

Ha2-1: There is an impact exists between Risk Assessment and planned budget.

Ha2-2: There is an impact exists between Risk Assessment and avoiding lawsuits or claims.

Ha2-3: There is an impact exists between Risk Assessment and the ability to keep future work with other entities involved with this project was important

H a3: There is an impact exists between Risk Response and project success.

Ha3-1: There is an impact exists between Risk Response and achieving the quality standards which was originally specified in the specifications

Ha3-2: There is an impact exists between Risk Response and meeting the scope of work.

Ha3-3: There is an impact exists between Risk Response and the scheduled time.

Theoretical model and variables:

Three independent variable and seven dependent variable are in this research, the independent variables are: Risk Identification, Risk Assessment and Risk Response for the Construction Companies, the dependent variable are: Achieve the quality standards, Comply with technical Specifications, Adherence to Schedule, No lawsuits or claims, Within the planned Budget, Scope definition and Ability to keep future work Theoretical Research Model The model of this research consists of two types of variables, the independent variable and dependent.

Literature Review Mudau; Pretorius (2009) aim in their study ―Project control and risk management for project success: A South African case study‖ to assess the extent to which project control and risk management contribute to, and how it can be used effectively in ensuring project success and identify the factors that contribute to project success. The results of the questionnaire were processed and analyzed by using a spreadsheet application. The main findings indicated that project controlling and risk management have a significant influence on performance of the project and therefore on the success of the company. It was also found that effective earned value management contributes positively to the project success. By strengthening and focusing more on project controlling and risk management methods and processes, the performance of projects should improve. Ewer (2008) explain in their study ―The Impact of Risk Management on IS Projects Success in Syria‖ the impact of the risk management, on information systems projects in Syria. It uses questionnaire to get information from IS managers and developers in Syria. The conclusion of this research presents that many of Syrian IS companies don't have a formal risk method and using risk management will increase the success rate of IS project. Bakker and Wortmann (2010) present in their paper ―Does risk management contribute to IT project success? A meta-analysis of empirical evidence‖ a meta-analysis of the empirical evidence that either supports or opposes the claim that risk management contributes to IT project success. In addition, this paper also investigates the validity of the assumptions on which risk management is based. The analysis leads to remarkable conclusions. Over the last 10 years, much has become known about what causes IT projects to fail. However, there is still very little empirical evidence that this knowledge is actually used in projects for managing risks in IT projects. This paper concludes with indicating new directions for research in the relation between risk management and project success. Key elements are stakeholder perception of risk and success and stakeholder behavior in the risk management process. Because the delay in construction projects in developing countries which cause financial losses, Luu et al. (2009) described the Bayesian Belief Network (BBN) in their paper ―Quantifying schedule risk in construction projects using Bayesian belief networks‖ and it was applied to quantify the delays in construction projects probabilities in developing counties. The research identified sixteen factors that cause the delay in such projects, those sixteen factors were identified through a questionnaire survey of 166 professionals. The study found that more than half of the first respondents and functional and top managers (48%) and 10% from functional managers. From this percentage, we can make sure that the collected data is real and can be used to identify factors affecting construction delay. Zou et al. (2007) in their paper ―Understanding the key risks in construction projects in China‖ aim to investigate the key risk in construction projects in China in order to develop strategies to manage them. The researcher classifies the risk according to their significance of the influences of typical project objective in terms time, quality, safety and environmental sustainability, and then to investigate from the stake holder's perspective. The researcher achieved his goal and collected data by questionnaire survey, total 25 key risks were ascertained. And then the researchers compared

these risks which found with the same survey in construction projects in Australian to find the unique risks in construction projects in China. The researcher conclude that the responsibility must be held by the clients, designers and government in order to manage their risk and to address potential risk on time, the risk must be minimized in construction projects ad carried out safe, efficient and quality by the contractors and subcontractors with robust construction and management knowledge. In this study Karimi, Azari et al. (2011) obtain Decision criteria from the nominal group technique (NGT). The proposed method can discriminate successfully and clearly among risk assessment methods. This Study concludes that the identification and assessment of project risk are the critical procedures for projecting success, and this study conclude that there must be in Construction project between dissimilar, yet contractually integrated parties, owners, designers, contractors, sub-contractors, suppliers, manufacturers, and others. Bates (2009) analyzed and predicted in his research ―The owners' role in project success‖ project success through providing an efficient method for project success. The objective of the research is to investigate the effect of owner's decisions and actions that occur during a construction project. The research investigated two models; One is classical statistical technique—multiple regression, the other is a modern artificial intelligence technique—neural networks. Both traditional regression analysis and artificial neural networks were beneficial for success analysis. This study shows that the combination of use statistical and artificial neural network yields the best results, while each is appropriate for distinct types of problems because each has unique advantages and disadvantages. The study concludes that the most owners have to focus during the execution of a capital facility project on the following three statements:

1 – Practice the most appropriate level of "owner involvement" during the project.

2 – Focusing on safety must be practiced by owners at every aspect of the project.

3 - Define goals and objectives, a sense of urgency, and emphasize safety. Culler (2009) defined in his dissertation ―The degree of relationship between critical success factors and information technology project performance‖ study was to define the relationships between the 10 critical success factors and information technology project performance. The current research data supported associations between 10 critical success factors and information technology project performance. The current research data confirmed that there is relationship between 10 critical success factors and information technology project performance. This research examined deeper the affect of project demographics on relationships between 10 critical success factors and information technology project performance. This research found that the examination of the data analysis failed to support a significant affect by project demographics on the relationships between 10 critical success factors and performance of information technology project.

IV. THEORETICAL FRAMEWORK

Construction Industry Definition: The construction projects can be defined as the industry that creates infrastructure for cities, towns and industries, and considered to be one of the largest industries in the world. This industry is made out of many types of buildings in addition to civil Engineering jobs. This industry contains carpentry, construction of roads, developing bridges and designing homes.

A. Types of construction projects

There are different types of construction projects according to Grace F. M. (2010):

1- Residential: This type of construction projects includes different types of buildings such as houses, townhouses, apartments, and subdivisions. The process to design the houses is done, in general, by the architects and engineers and the builders (or may hire subcontractors) do structural, electrical, mechanical and other specialty work in the construction process of these houses. Local building authority regulations and codes must be applied in these buildings. The market of this type of building is highly competitive and high risks as well as high rewards.

2- Building: The most popular type of construction project is the Building construction. It can be defined as ―is the process of adding structure to real property‖ (Grace F. M., 2010). The building projects in the most cases are adding a new room and making small renovations. Most new building construction projects are building sheltered enclosures in order to house people, equipment or machinery. Installation of utilities and equipment is included.

3- Institutional and Commercial: A great variety of institutional and commercial building are available in this industry with different types and sizes such as schools, universities, hospitals, clinics, sports facilities, stadiums, large shopping centers and retail chain stores, light manufacturing plants and warehouses and skyscrapers for offices and hotels. The designs of such building must be done by specialty architects and engineers who are often hired for designing such buildings. Few competitors are competing in this market of these types of buildings because of the high capital needed in addition this type is sophisticated compared to residential construction projects.

4- Industrial: This type represents small percentage of the whole industrial construction. while it is a very important part of the industry. The owners of such projects are generally big, profit, industrial corporations and institutions such as manufacturing, power generation,

medicine, petroleum, etc. highly specialized expertise processes in planning, cost estimating, design, and construction are required for these industries.

5- Specialized Industrial Construction: Very large-scale projects represent this type of construction project and involve high degree of technological complexity such as nuclear power plants, chemical processing plants, steel mills and oil refineries.

6- Highway Construction: Highway construction ―involves the construction, alteration, or repair of roads, highways, streets, alleys, runways, paths, parking areas, etc.‖ (Grace F. M., 2010).

B. Risk Management

Definition of risk and risk management: The royal society (1991) had defined the risk as ―The probability that a particular adverse event occurs during a stated period of time‖. Akintoye et al (2003) emphasized this definition because the probability of happening harmful impact and the duration of exposure were included in his study. The source of risk can't be specified; sometimes, its source is employees' and managers' limited knowledge, limited experience and information cause to arise the risk. The source of the risk may be changes in the parties included in construction process. Sometimes the risk come from financial markets, project failures, legal liabilities, credit risk, accidents, natural causes and disasters and from competitors.

C. Sources of risks

A lot of studies worldwide aim to define the sources of studies. Research Week International Conference, 2005 categorized the sources of risks into two groups: (1) Internal Source and External sources. The Internal (controllable) sources are Client system, Consultants, Contractors and subcontractors and Suppliers. While the external Sources are Economic and globalization dynamics, Unforeseen circumstances, Government/ statutory/ political controls, Environmental constraints, Health and safety issues outside the control of the project team and Socio-cultural issues.

D. Risk assessment

The risk management aims to identify the undesired event to estimate risk, and it aims to like hood the unfavorable event to occur. The risk assessment helps in risk management by measuring, conducting quantitatively and qualitatively in order to estimate the significance level of the industrial risk factors to the project and then to estimate of the risk of the potential factors to project success. The result of this step determines the input to make the optimum decision. After the risks have been identified, it can be evaluated regarding its impact on the projects and the probability of its occurrence. This step is very critical to evaluate and expect the probability of occurrence of the risk and the impact of this risk and its effect on the different components of construction projects.

Risk Attitudes Risk attitude is defined as ―chosen state of mind with regard to those uncertainties that could have a positive or negative effect on objective‖. (hillsor and Murray – Webster, 2007). So, the employees risk attitudes is affected by different characteristics such as; personal and experience characteristics, economic, environment of management that they belong to and the policy that around them. In addition, the individual's positive and negative evaluation of characteristics of different types of behaviors represents the base of the attitude (Teo and Loose more, 2001).

E. Research findings

The study aims at identifying the opinions of the study sample about ―The impact of risk management on construction projects success‖. And to achieve this end we have developed a questionnaire to review the opinions of the study sample. After questionnaires were distribution Answers were recoded into SPSS program, then we have adopted an appropriate statistical analysis it tests the study hypotheses. Cronbach's Alpha used to Reliability test it reaches 96.5% for all statements which is very good due to that it is more than excepted value 60%.

V. CONCLUSION

As one of the first studies in its kind, the present study investigates the CSFs for implementing risk management systems among construction organizations in a developing country. The results showed that support from high-ranked managers is a crucial precursor for higher level of risk management implementation across the industry. The remedial solution to this could be sought through effective management of knowledge on risk management implementation and shifting from traditional delivery of projects to a systematic and knowledge-oriented approach. Other identified important CSFs tended to reinforce this factor, in particular the: 'inclusion of risk management among education and training subjects of construction practitioners'; 'attempting to deliver projects systematically'; and 'awareness and knowledge of the process for implementing risk management'

Recommendations

[1] The responsible managers must understand the risks faces by the organization.

[2] Senior managers are responsible regarding communications about risk and management of risk between staff and management.

[3] The organization should provide appropriate level of control regarding risks that it is faces, which include (transferring the risk and reducing the risk).

[4] Monitoring the effectiveness of risk management is an integral part of management reporting as risk treatment option.

[5] To management the risk effectively and efficiently, the contractor must understand risk responsibilities, risk event conditions, risk preference, and risk management capabilities.

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