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A Study on Risk Assessment in Construction Projects

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***Abstract**: Risks are very common in construction sector. Risk management includes identifying risks, assessing risks either quantitatively or qualitatively, choosing the appropriate method for handling the risks, and then monitoring and documenting risks. By identifying risks in an early stage of planning and assessing their relative importance, project managers can identify methods used to reduce risks and allocate the best people to mitigate them. Thus, this research focuses on risk identification, as opposed to other processes of risk management. "Brain-storming sessions" is the most popular method used frequently to identify the risks in projects as deduced from a questionnaire survey from participants in large construction projects. Time and cost management need to be fully integrated with the identification process. Time constraints and project managers with sufficient experience are critical when identifying the level of risk for large and/or complex projects. The most considerable types of risk in construction projects are financial risks, construction risks, and demand or product risks.*

***Keywords:** Risk, Risk identification techniques, Risk management, and Construction Projects.*

I. INTRODUCTION

Construction companies and firms, such as the government, consultants and contractors, normally face different kinds of risks (e.g., environmental, physical, political, social and economic risks) during construction. However, most of them do not predict risks when they are considering bids and tenders. Construction risk is generally perceived as events that influence project objectives, i.e., cost, time and quality. In project management terms, the most serious effects of risk can be summarised as follows:

1. Failure to keep within the cost estimate.
2. Failure to achieve the required completion date.
3. Failure to achieve the required quality and operational requirements.

This study aims to better understand the risk identification process and other risk processes. Risk identification is the first process in risk management. Therefore, this study focuses on risk identification because it is important to know how the players in the construction industry handle risk identification. Without having any perspective on or approach for risk identification, construction participants cannot make appropriate decisions in other risk management processes. This study evaluates risk identification by better understanding the processes and guidelines related to the risks in large and infrastructure construction projects, so that project risk management can be more effective. It has already been recognised that a clear understanding of the risks born by each participant leads to better risk allocation. The objective of this study is to find means of identifying risk management and other processes that can be utilised and to make new suggestions on the use of these risk management methods. It is of particular interest to find the means to manage risks that are the most effectively managed with the co-operation of several project participants.

II. Methodology

To achieve the objectives of this research, questionnaires were deemed to be the most effective tool for gathering information. These questions helped identify any projects that should definitely not be undertaken by the parties and those which, although risky, should be examined further after a more rigorous examination of the potential sources of risk. The questionnaire was designed based on the knowledge of government, consultant, or contractor in large or infrastructure construction projects; the questions were meant to identify their method of risk identification and possible effects of those risks.

The general methodology of this study relies largely on the survey questionnaire which will be collected from the various multi project construction contractors and project manager of different sizes by mail

or by personnel meeting. A thorough literature review was initially conducted to identify the risk factors that affect the performance of construction industry as a whole. This study has adopted the more general and broad definition of risk as presented by Shen et al (2001) on china's construction joint ventures and more risk factors from other literature. Also some interviews with industrial practitioners were conducted to produce to check of questionnaires.

III. QUESTIONNAIRE STRUCTURE AND DESIGN

. The questionnaire was tested with a pilot survey for clarity, ease of use, value of the information that could be gathered. The questionnaire survey is divided into two parts. The first part consists of general information like type of company, experience, value of their project etc., and the second part consists of the construction risk factors for evaluation.

Risk factor for this study classified into eight categories, namely: financial risk, legal risk, management risk, market risk, policy & political risk, technical risk, environmental risk, social risk.

The survey questionnaire survey is designed to probe the cross-sectional behavioral pattern of construction risks construction industry. The questionnaire was prepared for the pilot survey was formulated by seeing the relevant literatures in the area of construction risk. The interviewer was free to ask additional questions that focused on issues arising during the course of the interview. The freedom to follow the interviewee, to ask for clarifications, and to focus on the specify projects, risk practices and knowledge, made the interviews insightful

3.1 Risk Rating

A Likert scale of 1-5 was used in the questionnaire. A Likert scale is a type of psychometric response scale questionnaire, and is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement. The scale is named after Rensis Likert, who published a report describing its use. The respondents were required to indicate the relative critically/effectiveness of each of the probability of risk factors and their impact to the management.

3.2 Design of Survey

The respondents were requested to judge the significance or "expected loss" of each risk. There are many criteria that respondents may need to consider. One alternative approach adopted by previous researches is to consider two attributes for each risk: the probability level of risk occurrence, denoted by *o;* and the degree of impact or the level of loss if the risk occurs denoted by p. The same type of evaluation is followed in this study also. Therefore, risk significance, denoted as RS, can be described as the function of the two attributes RS=f (α, β).

By applying this approach, the respondents were asked to respond to the two attributes for each risk. For considering a, the respondents were required to judge the probability level of risk occurrence by selecting one from among five levels namely, very small, small, normal, large and very large. For considering p, the respondents were required to judge the degree of impact if the risk concerned occurs, by selecting one from among five grades namely, very low, low. and medium, high and very high.

3.3 Analysis of Survey

To assess the relative significance among risks, previous literatures study suggests establishing a risk significance index by calculating the significance score for each risk. For calculating the significance score is to multiply the probability of occurrence by the degree of impact Thus, the significance score of each risk assessed by each respondent can be obtained through the model

$$S_p^i = \sigma_j^i \beta_j^i$$

Where S_i = significance score assessed by respondent j for risk i; a, = probability of occurrence of risk i, assessed by respondent j; and p, = degree of impact of risk i, assessed by respondent j. By averaging scores from all responses, it is possible to get an average significance score for each risk, and this average score is called the risk index score and is used to rank among all risks. The model for the calculation of risk index score can be written

$$RS^i = \frac{\sum_{i=1}^{T} S_j^i}{T}$$

Where RS^1 = index score for risk i; and S^1 = significance score assessed by respondent j for risk I and T=Total number of responses. To calculate *S',* the five scales for o and (3, this will be converted into numerical (Likert scale) scales.

3.4 Pilot Survey

A pilot questionnaire survey and follow-up interviews with local contractors was conducted. The purpose was to identify the factors out of the 68 factors that applied overseas could also apply to the construction industry. The small number interviews and the structure of the questionnaire in die pilot study does not allow for statistical analysis.

Responses to the interviews have been used to identify consistent themes, common practices, and insight provided by active and influential project participants that would provide additional guidance and assistance to the research team.

The survey results formed the basis of modifying the questionnaire for the subsequent full-scale survey. The pilot study attempts to short-list locally relevant factors. The criteria for a shortlisting are that the chosen factors are relevant in the local construction industry. As a result, only important and relevant factors can be chosen for inclusion in the full-scale survey in the second phase research.

IV. Risk Identification And Risk Identification Technique

The risk identification phase as being either one of the most important stages within the risk management process, the risk identification phase into three categories.

1. The Risk identification conducted only by a risk analyst and based exclusively in his practice, knowledge and capacity.
2. The Risk identification was conducted through the interview of the risk analyst with one or many members of the project staff in order to analyze the reviewed data and the project life cycle based on the knowledge and expert of the people interviewed.
3. The Risk identification in which the risk analyst guides one or many work groups applying the risk identification techniques.

4.1 Risk Indentification Techniques

1. Brainstorming – An idea generation group technique is divided in two phases. (i) idea generation phase, in which participant generate as more ideas as possible (ii) idea selection phase, the ideas are filtered, remaining only those approved by the entire group

2. Delphi Technique – Delphi is a technique to obtain an opinion consensus about future events from a group of experts. It is supported by structured knowledge, experience and creativity from an expert

3. Interview/ Expert judgment – Unstructured, semi structured or structured interviews individually or collectively conducted with a set of experienced project members, specialist or project

4. Checklist – It consists of a list of item that are marked as yes or no , could be used by an individual project team members, a group or in an interview.

5. Influence Diagram – It is a graphical representation containing nodes representing the decision variables of a problem. A traditional influence diagram is formed by three types of nodes: utility, decision and informational. The causal relationship occurs between utility and chance nodes and represents a probabilistic dependence.

6. Flowchart – Graphical tool that shows the steps of a process. This technique is applied for a better comprehension of the risks or the elements interrelation

7. Cause-and-Effect Diagrams – These are also called Ishikawa diagrams or fishbone diagram, illustrate how various factor might be linked to potential problems or effects. The diagram is designed by listing the effect on the right sides and the causes on the left sides. There are categorized for each effect, and the main causes must be grouped according to these categories .

V. Conclusions

This paper is based on a literature review on the risk assessment methods. The risk assessments approaches are applied in various areas and the problems solve. It was found that the currently used methods for risk assessment are Brainstorming, checklist, Flowchart, Delphi method, Risk significant index method. Each method of risk assessment has their limitation therefore this paper attempt to formulate integrated risk assessment tools. It was observed that currently used risk assessment methods can be integrated into new approach that can aid the decision makers applying the risk assessment effectively. The specifications for

identifying project risk that have been particularised for construction projects have been presented from diverse points of view (from government, consultants and contractors) and construction companies and firms that may be helping the process of dealing with the project in the planning and construction phases. The process can also be adapted to identify the level of risk for a particular project.

The brain-storming sessions and analysis of historical data for similar projects were found to be the most preferred methods of risk identification in the construction industry. The risks associated with construction projects included financial risks (project funding problem), construction risks and demand/ product risks. These risks commonly prevent the completion of construction project objectives.

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