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Optimization of the Objective Function in Building and Construction of Project under Risk Management System

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ABSTRACT: The financial and economic crisis has had an adverse impact on the Indian economy and construction industry. Some industries, such as construction, trade, transport and communications and the industry sectors were most affected by the crisis. Risk management is a concept which becomes very popular in a number of businesses. Many companies often establish a risk management procedure in their projects for improving the performance and increase the profits. Projects undertaken in the construction sector are widely complex and have often significant budgets, and thus reducing risks associated should be a priority for each project manager. Today the construction sector, one of the engines of economic growth. Risk management is about thinking ahead and calculating the risks and uncertainties involved in a project, which is most often part of the quality management system in an organization. The systems available have been developed to focus on medium to large sized projects, leaving behind the smaller projects needs, conditions and application, and how the theoretical framework in the field of risk Management corresponds to routines in the involved companies. This paper also presents previous research in the field of risk management in construction. Finally, the drivers and obstacles for risk management in small projects are also focused upon.

Key words: Risk management, Risk management process; Risk management methods, Project life cycle

I. INTRODUCTION

Literature shows that risk management in construction projects is full of deficiencies that affect its effectiveness as a project management function and in the end, projects' performance. For many years, risk management in construction projects has been approached using a reductionist approach that produces poor results and limits the quality of project management. For example, most of the times risk is handled through the application of contingencies (money) or floats (time) that are not determined based on a comprehensive analysis of the risks that can affect a particular project, and that in many cases are clearly insufficient to cover the consequences of risks that do occur during the project realization. Then, in most of the cases projects end with costs overrun and late.

The construction industry has a long history. Housing has been built ever since humans left caves and the construction project as a business branch has probably been around since before the pyramids. There have always been considerations about uncertainties and risk. This is a study that captures the work in minor construction projects today regarding risk management. The aim of this theory is to give an understanding of the context and purpose of the study.

One concept which is widely used within the field of RM is called the risk management process (RMP) and consists of four main steps: identification, assessment, taking action and monitoring the risks (Cooper *et al.*, 2005). In each of these steps, there are a number of methods and techniques which Facilitate handling the risks. The construction industry operates in a very uncertain environment where conditions can change due to the complexity of each project (Sanvido *et al.*, 1992). The aim of each organization is to be successful and RM can facilitate it. However it should be underlined that risk management is not a tool which ensures success but rather a tool which helps to increase the probability of achieving success. Risk management is therefore a proactive rather than a reactive concept.

Table 1: Planning scheduling and controlling the work.

Project Planning	Project Schedule	Project Control
❖ Objectives ❖ Team Organization ❖ Project Plan ❖ Performance criteria: Time-Cost ❖ Requirement of resources ❖ Developing a network diagram.	❖ Resources availability: Human Material, Financial. ❖ Estimation the duration of activities. ❖ Managerial technique ❖ Network (PERT,CPM)	❖ Monitoring ❖ Revision and updating. ❖ Rescheduling ❖ Measures or reallocation of the resources

A. Aim and research motives

In this research the aim is to uncover how risk management is carried out in small sized Projects. The contribution of the study is to reach an understanding of the risk process.

If a greater understanding about the issues in small sized projects is achieved, it will be easier to focus on the right efforts of the companies to increase value in the construction Process. The research questions for this study are:

-What are the methods and tools for risk management in small construction projects?

-How are these methods and tools used?

-What kind of risk management is applied in the construction companies' Management systems?

-What are the results from previous research done in the field of risk management in construction processes?

-What are the obstacles and drivers for risk management in small sized construction projects?

B. The risk management

Many explanations and definitions of risks and risk management have been recently developed, and thus it is difficult to choose one which is always true. Each author provides his own perception of what risk means and how to manage it. The description depends on the profession, project and type of business (Samson, 2009). Risk management in general is a very broad subject and definitions of risk can therefore differ and be difficult to apply in all industries in general. For the purpose of this thesis one definition of risk and risk management will be chosen, in order to have a clear understanding of these concepts in construction industry.

Fig. 1. Different focuses in research problems.

Risk management is one of the nine knowledge areas propagated by the Project Management Institute. Furthermore, risk management in the construction project management context is a comprehensive and systematic way of identifying, analyzing and responding to risks to achieve the project objectives. The benefits of the risk management process include identifying and analyzing risks, and improvement of construction project management processes and effective use of resources.

Construction projects can be extremely complex and fraught with uncertainty. Risk and uncertainty can potentially have damaging consequences for the construction projects.

Therefore nowadays; the risk analysis and management continue to be a major feature of the project management of construction projects in an attempt to deal effectively with uncertainty and unexpected events and to achieve project success.

Cost of risk is a concept many construction companies have never thought about despite the Fact that it is one of the largest expense items. Risk management helps the key project participants client, contractor or developer, consultant, and supplier to meet their commitments and minimize negative impacts on construction project performance in relation to cost, time and quality objectives. Traditionally, practitioners have tended to associate construction project success with these three aspects of time, cost and quality outcomes.

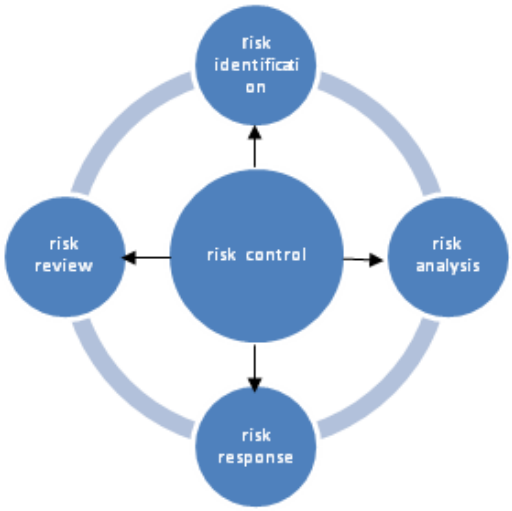

Fig. 2. Risk management process.

C. Risks in construction projects

Due to the nature of the construction sector, RM is a very important process here. It is most widely used in those projects which include high level of uncertainty. These types of risk investments are characterized by more formal planning, monitor and control processes. The easiest way to identify risk is to analyze and draw a conclusion from projects which failed in the past. To make sure that the project objectives are met, the portfolio of risks associated with all actors across the project life cycle (PLC) should be considered (Cleland and Gareis, 2006). In the early stages of the project where planning and contracting of work, together with the preliminary capital budget are being drawn, risk management procedures should be initiated. In later stages, RM applied systemically, helps to control those critical elements which can negatively impact project performance. The performance by the project management team highly influences the success of a construction project. Some of the incidental risks associated with poor project management performance is:

(i) Unclear or unattainable project objectives;
(ii) Poor scoping;
(iii) Poor estimation;
(iv) Budget based on incomplete data;
(v) Contractual problems;
(vi) Insurance problems;
(vii) Delays;
(viii) Quality concerns;
(ix) Insufficient time for testing.

D. Framework for the assessment tool for the risk management function to optimize the objective

The questions that are addressed by this research are:

(i) What are the best international practices currently applied in risk management on construction projects and how they compare with the Chilean current practices?

(ii) How can risk management practices in organizations and companies involved in construction projects be assessed?

Table 2: Approach for the assessment of the risk management function of an organization and comparison with the risk management benchmark.

Assessment tool

Evaluation Variables

	Factors						
	f1	f2	f3	f4	f5	…	f n
RM Tasks							
Risk Management planning							
Risk identification							
Risk analysis							
Risk response planning							
Risk mounting and control							

Evaluation of the key factor "f4" in the task "Risk analysis"

Contrast

Risk management benchmark

(iii) What knowledge is needed for an effective and efficient management of risk in construction Projects?
(iv) How can needed risk management knowledge be obtained, organized and made available in a Systematic and useful way?
Both, the model and the tool will be validated by two panels of experts on risk management and be applied initially in two companies, an owner and a contractor for calibrations purposes.

E. Risk probability and impact assessment

By applying the method called risk probability and impact assessment, the likelihood of a specific risk to occur is evaluated. Furthermore, risk impact on projects objectives is assessed regarding its positive effects for opportunities, as well as negative effects which result from threats. For the purpose of this assessment, probability and impact should be defined and tailored to a particular project . This means that clear definitions of scale should be drawn up and its scope depends on the project's nature, criteria and objectives (Cooper et al. 2005). PMI (2004) identifies exemplary range of probability from 'very unlikely' to 'almost certain', however, corresponding numerical assessment is admissible. The impact scale varies from 'very low' to 'very high'. Moreover, as shown in Figure 3, assessing impact of project factors like time, cost or quality requires further definitions of each degree in scale to be drawn up. Each risk listed under the identification phase is assessed in terms of the probability and the impact of its occurrence (PMI, 2004).

Defined Condition for Impact Scales of a Risk on Major Project Objectives

(Examples are shown for negative impacts only)

Project Objective	Relative or numerical scales are shown				
	Very low/.05	Low/.10	Moderate/.20	High/.40	Very high/.80
Cost	Insignificant cost increase	<10% cost increase	10-20% Cost increase	20-40% Cost increase	>40% cost increase
Time	Insignificant time increase	<5% time increase	5-10% time increase	10-20% time increase	>20% time increase
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Scope reduction unacceptable to sponsor	Project end item is effectively useless
Quality	Quality degradation barely noticeable	Only very demanding application are affected	Quality reduction requires sponsor approval	Quality reduction unacceptable to sponsor	Project end item is effectively useless

This table presents examples of risk impact definition for four different project objectives. They should be tailored in the Risk Management planning process to the individual project and to the organization's risk thresholds. Impact definition can be developed opportunities in a similar way

Fig. 3. Definition of Impact Scales for Four Project Objectives.

II. CONCLUSIONS

An effective risk management process encourages the construction company to identify and quantify risks and to consider risk containment and risk reduction policies. Construction companies that manage risk effectively and efficiently enjoy financial savings, and greater productivity, improved success rates of new projects and better decision making.

Risk management in the construction project management context is a comprehensive and systematic way of identifying, analyzing and responding to risks to achieve the project objectives. The contractor must understand risk responsibilities, risk event conditions, risk preference, and risk Management capabilities. Qualitative methods of risk assessment are used in construction companies most frequently, ahead of quantitative methods. In construction project risk management, risks may be compared by placing them on a matrix of risk impact against a probability. Mitigation options are then derived from predefined limits to ensure the risk tolerance and appetite of the construction company. The risk management framework for construction projects can be improved by combining qualitative and quantitative methodologies to risk analysis.

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