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**BUILDING PROJECTS RISKS SOURCES: CONCEPTUAL FUZZY ASSESSMENT
APPROACH**

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ABSTRACT

This work aimed to identify building risk environment as approach to be integrated within project management system for construction industry. Most risks in building focusing on the need of determining the relative significance of different sources of risk to guide subsequent risk management effort. This will ensure that process being cost effective. A common approach aim to rank these risks in terms of probability and impact to identify sources of risk that will receive the most attention.

This study utilized a set of data collected via previous researches, interviews with experts and field survey, data analysis, including a statistical comparison and interpretation. Statistical probability and relative impact factor for each risk source was determined. To explain the interrelated effects between integrated project management system requirements and their impact risks factors statistical analysis was done. The procedure reduce confrontation and conflict of risk effect on the project progress. Moreover the result of this work enables project team to utilize fuzzy logic and inference system to smartly create risk management strategies.

KEYWORDS: Risk Management, Project environment, quality, Environment management.

INTRODUCTION

All content should be written in English and should be in 2 column.

The every project especially in construction is truly dynamic, risky and challenging. Risk and uncertainty are obviously occurred by internal or/and external factors that are inherent in nature of construction industry. To control and minimize a risk, it needs to know how to manage properly whether the risk should be transferred to others or shared fairly to the competent parties to assess risks. However, most contractors have developed a series of rules of thumb applied when dealing with risk. These rules generally rely on the project team experience and judgment. Rarely project team do quantify uncertainty and systematically assess these involved risks. Furthermore, even if they assess, they will less frequently evaluate the consequences (potential impacts) associated with these risks. One reason might be lack of a rational straightforward way to combine all the facets of risk systematically into a prioritized and manageable scheme [1,2,3,4,5,6]. Risk management is an important part of the decision making process. Due to the fact that it can affect schedule, performance, quality and budget of a construction project. However, risk can not be truly

eliminated but it can be minimized, transferred or shared from one party to another [7,8,9,10].

Risk management is a systematic way of looking at risk and consciously determining how each should best be treated. It is a management tool which aims at identifying sources of risk and uncertainty, determining their impacts and developing appropriate management responses. Assessment of the impact of risks is a complex problem, which must be approached systematically by breaking down the task into four stages that are Risk Classification, Risk Identification (including Data Elicitation), Risk Analysis and Risk Response.

To fully understand risk, one must understand that risk factors vary greatly in level of importance as well as in their contribution to overall risk exposure. Certain risk factors have the potential to cause a business interruption or failure themselves, while other risk factors must work in combination with factors of equal or greater importance to cause such consequences. This paper is first to identify project based risks that are likely to impact on the project, second to rank the identified risks according to its impact on the project and finally study the interaction effect between these factors each to the other.

RISK IDENTIFICATION

The major steps involved in risk management of a project are risk identification, risk assessment and the processes of prioritization and response to the risks [6,11,12,13]. Identification process is of considerable importance because the process of risk analysis and response management may only be performed on identified potential risks. Schatteman mentioned that the risk identification process involves identification of the major potential sources of risk associated with the project objectives [14,15,16,17]. Therefore, risk identification process must involve an investigation into all possible potential sources of project risks and their potential consequences and documenting their characteristics. Project managers identify as many risk events as possible on their own, then use a departmental checklist to identify risks events that may have been missed [18,19,20,21]. The objective of this step is to identify all potential risks and clarify how they affect the overall time duration, quality and cost of the project. After all the risks have been identified and linked together, 65 risks are chosen and ranked as most critical risk variables.

RISK ANALYSIS

Risk analysis involves the qualitative and quantitative assessment of the identified risk factors. Project management has to estimate the probability of occurrence of the risk factors as well as their potential impact [15]. The risk management database can then be updated with the new information. It is commonly submitted in the risk management literature that part of the project risk management process requires the analysis of identified risks in terms of their potential consequences and probability of occurrence. The risk analysis is the vital link between systematic identification of risk and rational management of the significant ones. It forms the foundations for decision making between different management strategies [16,17,18,19]. This allows risks to be ranked for management priority. So, once project risk events and causes have been identified, the next stage is to analyze and prioritize them to guide risk management action. Therefore, the aim of risk analysis is to determine which risk events warrant response. As points out, having identified the risks in the project, that will usually have insufficient time or resource to address them all; so the next requirement is to assign realistic priorities.

DETERMINING THE RISK FACTORS

There are several approaches to identify the risks in construction projects [22,23]. Wongvanichtawee has classify the risk factors into corporate and project risks

and each one divided into internal and external risks, he investigate 32 risk factors under this classification and he set a procedure to rank these risks [22,24,25,26,]. While Baccharini and Archer describe a methodology to risk ranking depend on prioritize risk in projects and linking the targets with the likelihood vs. consequence, figure (1) show the generated risk rating model for time, cost and quality [5, 27,28,29].

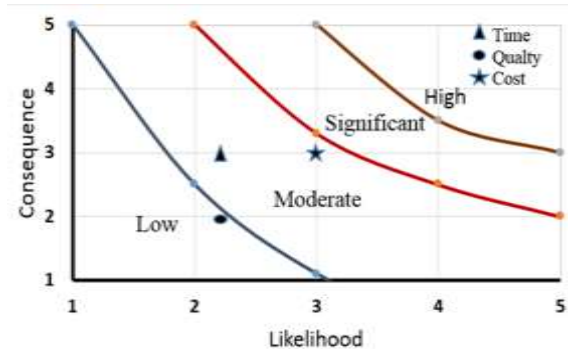


Figure 1. Final risk rating for time, cost, quality [5].

Important 23 risks determined by Andi et. al. for building and infrastructure projects, it is found that the risks considered as important in building projects are also important in infrastructure projects [8]. Kindinger and Darby applied a systematic qualitative project risk analysis technique called RFA as cost effective tool in which the risks classified into four broad categories; technical, schedule, cost and funding risks, and use quantitative scale of low, medium and high impact to the project[5,30]. The risk factors also can grouped to five categories; project related, government related, client related, design related, contractor related, consultant related and market related risks [22]. In this paper we will deal with 56 risk factors depending on the above literature review. The risks categorized relative to there source into groups:

1. project Environment
2. Integration
3. Scope & Change Control
4. Time Management (Schedule)
5. Quality & Inspection
6. Cost Management
7. Human Resources Management
8. Communications. & Reporting
9. Safety, Insurance & Risk
10. Procurement & Contracts
11. Issue Management

Each of these groups include number of risks according to the project life cycle; Planning, Project initiation, Design, Construction, Testing, Close-Out and Operations and Maintenance.

RISK RANKING METHODOLOGY

After the potential risks have been identified and analyzed, it should be ranked based on their impact to project. Data will be processed in order to quantify the effect of the major risks to the project. There are two methods in eliciting the data: Objective and subjective method. The Objective method is preferred because of its consistency and accuracy in identifying the risks but we need to retrieve data from databases or to generate data through random experiment.

These data might not available in adequate amount due to lack of historical data and particular method of each project. The parties in project are generally reluctant to document or record data as they come from field during construction or as project proceeds. Even if they do so, the data is incomplete. Therefore this information is not sufficient to be used by objective method. The data elicitation will be done by subjective method based on probability data from the decision makers who give their present state of knowledge and past experience. The data will be put as the input variables, which can be expressed as probability distribution, but it is difficult to be measured.

In this research, methodology of three element was used to determine the risk impact on project cost, quality and time. First, the type of risk levels (N, L, M, H and E) was used to measure the risks level (e.g. change the supplier, insufficient resources and violent conflict with supplier consider as low, moderate and high level respectively). second, the severity of risk impact also measured by scale of three level by the same way.

Risk level: N=1, L= low =2, M= medium =3, H= high =4, E=5

Severity of risk: N=1, L= low =2, M= medium =3, H= high =4, E=5

		Impact Intensity				
		N(1)	L(2)	M(3)	H(4)	E(5)
Risk level	E(5)	EN	EL	EM	EH	EE
		(5)	(10)	(15)	(20)	(25)
	H(4)	HN	HL	HM	HH	HH
		(4)	(8)	(12)	(16)	(20)
	M(3)	MN	ML	MM	MH	MH
		(3)	(6)	(9)	(12)	(15)
L(2)	LN	LL	LM	LH	LH	
	(2)	(4)	(6)	(8)	(10)	
N(1)	NN	NL	NM	NH	NH	
	(1)	(2)	(3)	(4)	(5)	

Figure 2. Risk level and impact severity ranking.

The third element is the probability of risk occurrence. In this paper, 65 risk factors will categorized into five levels as explained above according to the impact of the risk on the project cost, quality and schedule. A weight will assign to each requirement of a management system. The rank of risk sources and factors was obtained as below:

$$\frac{\text{score of risksource} \times 100 \%}{\text{total score for all risksources}}$$

also the rank of risk factor within its source was obtained as:

$$\frac{\text{score of risk factor within risk source} \times 100 \%}{\text{score for risk source}}$$

so; the rank of risk factor (RRF) within the system calculated by:

$$\text{risk rank witin sorce} \times \text{rank of risk source}$$

The final risk impact found by:

$$\text{risk impact} = \text{risk level} * \text{risk intensive} * \text{risk probability}$$

Development of risk ranking will enable the project organization to setup strategies and alternatives to manage the risks within the project life cycle. Alternatives will develop for each risk item using value-engineering concepts. The above methodologies will result firstly in developing an administrative system to manage the project risks according to the results obtained and collected. In general,

There are two basic approaches to manage a risk: risk control and risk transfer. Risk control is the way to measure by avoiding or reducing the probability of losses occurring. This is used when the risk can not be transferred. For whatever reason we need to avoid, reduce, or retain them. The risk transfer is the way to handle the risks by transfer or shifting them from one party to another such as from client to contractor or to insurance company. However, in some conditions, risk transfer or shifting may effect reversely to them as well in long term.

CONCLUSION

To identifying project-based risks, bottom up approach namely risk effect-intensive is utilized to determine the 65 critical risks. This will enable each firm to adopt fuzzy inference system and depending on such classifying method to make a decision throughout their expertise or consult an experts to rank those risks in term of the effect on specific project cost, quality and time. The risks are listed in appendix A. However, it enables to apply the briefly given risk management process into variety project cases. In addition, this method can reduce confrontation and conflict as well, in case utilizing it properly. Moreover the result of this process enables project team to smartly create risk

management strategies and problem solutions in each phases of project life cycle.

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Risk factors within project life cycle

Risk sources	Project management life cycle						
	1.0 Planning	2.0 Project initiation	3.0 Design	4.0 Construction	5.0 Testing	6.0 Close-Out	7.0 Ops & Maint
1.project Environment	1.1 Program Planning Process	2.1 Project Purpose Funding & Approval	3.1 Business Needs Review	4.1 Executive Oversight & Support		6.1 Continuous Improvement Review	
2. Integration	1.2 Program Management Policy	2.2 Project Delivery Method	3.2 Project Integration Review	4.2 Daily Project Management Process	5.2 Contract Compliance Review	6.2 Capital Project Review	7.2 Operations Project Planning Process
3. Scope & Change Control	1.3 Facilities Master Plan/Planning Process	2.3 Project Requirements Definition	3.3 Building Design	4.3 Change Control Process		6.3 User acceptance Process	7.3 Operations Acceptance Process
4. Time Management (Schedule)	1.4 Facilities Annual Plan (1-3 years)	2.4 Project Schedule Requirements	3.4 Baseline Project Schedule	4.4 Detailed Schedule Management		6.4 Schedule Completion Check List	
5. Quality & Inspection	1.5 Facilities Design	2.5 Project Concept	3.5 Design Review	4.5 Quality	5.5 Conduct Inspections &	6.5 Close Out Check List	

	and Specification Standards	Design & Themes	& Approval	Assurance Process	Quality Review		
6. Cost Management	1.6 Program Cost Management Guidelines	2.6 Project Funding & Capital Budgeting	3.6 Cost & Schedule Forecast	4.6 Cost Control		6.6 Final Payment/Retention Release	7.6 Operating Budget Process
7. HR Management	1.7 Facilities Management Organization	2.7 Project Management Staffing			5.7 Staff Reductions/Transfers	6.7 Operations Staff Planning	7.7 Ongoing Requirements/Skills Review
8. Comms. & Reporting	1.8 Program Reporting Requirements	2.8 Project Reporting Requirements	3.8 Project	Status 4.8 Project Cost & Budget Variance	5.8 Project Quality Performance	6.8 Project Closeout Performance	7.8 Final Status & Financial Report
9. Safety, Insurance & Risk	1.9 Safety, Insurance & Risk Mgt Policies	2.9 Project Safety Program & Insurance Strategy	3.9 Safety Program Training & Compliance	4.9 Risk Tracking & Resolution	5.9 Safety & Risk Mgt Compliance	6.9 OCIP Close-out Review & Report	

10. Procurement & Contracts	1.10 Contracting Approach & Controls	2.10 AE/CM/GC Selection & Contracting	3.10 Subcontractor Qualification Process	4.10 Subcontractor Selection/ Contracting	5.10 Contract Compliance Review	6.10 Punch List	7.10 Vendor Qualification/ Selection
11. Issue Management	1.11 Issue Management Policy	2.11 Project Issue Management Planning	3.11 Issue Tracking & Resolution			6.11 Confirm Issue Resolution	7.11 Ongoing Issue Management process

Author Bibliography

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