



Everyone's Smart University

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Project Risk Management

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INTRODUCTION:

Many risk events adversely affect the timely completion, cost, quality, and scope of construction projects. Therefore, it is important to understand risks that occur during planning, execution and maintenance of construction projects, their probability of occurrence, and consequences of their event and likelihood of results.

The researchers aim to present a simple yet valuable system for getting a direct estimation of actual risks that a construction project may face in terms of cost and provides a rational basis to make decisions related to risk response strategies. The system developed for risk quantification in construction projects results from extensive study of Literature and guidelines on risk management. The basic concepts and principles related to risks and their management are discussed first, followed by the proposed risk qualification system description. The scope of the submitted paper is restricted to the quantification of risks in construction projects.

The risk causes can be categorized into internal risk causes and external risk causes (Zia 1995). Thus, the risks related to RMC plants can be classified as internal as well as external risks. Internal risks and External risks cannot be avoided altogether; yet, suitable strategies can be adopted to manage these risks.

Literature review:

In the Literature, the word 'Risk' has been used in many different meanings with many other words such as hazard or uncertainty (Boodman 1977, Faber 1979, Lifson and Shaifer 1982, Hertz and Thomas 1983). Webster's dictionary defines risk as 'The possibility of loss, injury, disadvantage or destruction. According to Jamal and Keith (1990), risk can be written as,

Risk = f (Uncertainty of event, Potential loss/gain from event)

The concept of risk varies according to the viewpoint, attitudes and experience of an individual, and thus risk has a different meaning to different people. Engineers, designers, and contractors view risk from the technological perspective. Lenders and developers tend to view it from economical and financial sides; health professionals, environmentalists, and chemical engineers take safety and environmental perspective. Risk is, therefore, generally seen as an abstract concept whose measurement is complicated (Baloi and Andrew, 2003).

The term 'risk management has multiple meanings. Many use this term synonymously with risk identification. For many others, it is synonymous with risk analysis, risk monitoring and risk control. These all are the phases of risk management. According to Hillson(b) (2000), risk management is a process aimed to identify and assess risks to enable the risks to be clearly understood and managed effectively. Risk Management continues to be a major feature of the project management of large construction, engineering, and technological projects to reduce uncertainties and achieve project success (Akintoye, 2008). According to Royer (2000), risk management is the critical part of project management as 'unmanaged or unmitigated risks are one of the primary causes of project failure.' PMBOK (PMI 2004) defines project risk management as 'the process concerted with identifying, analyzing and responding to uncertainty throughout the project life cycle.'

A proposed approach for risk assessment:

The proposed approach in this paper considers risk as a future event that harms the production and supply cost for a company running an RMC plant and for which possible

outcomes can be predicted based on probability. The proposed approach has three stages as below:

- Risk identification, categorization and classification
- Risk prioritization
- Risk quantification.

1-Risk identification, categorization and classification:

As no previous record of the different types of risks in the RMC plant in India is available, authors had to interview a team of plant managers and key personnel working at respective RMC plants. The risk management concept was explained to this team of plant managers and critical personnel before interviewing them. The outcome of these interviews is a list of 121 risks in different categories and classifications. This established a base for risk quantification.

No.	Category	Risks	Internal	External
1.	Political Risks	Change in Govt. and Govt. policies		*
		War, Riots etc.		*
		Interference of local Politicos		*
2.	Legal/Contractual Risks	Contractual liability (breach, third party action)	*	
		Contractual liability (breach, third party action)	*	
		The conflict between various agencies	*	
		Errors in the contract price calculation	*	
		Misinterpretation of contract terms	*	
3.	Environmental Risks	Air Pollution	*	
		Water Pollution	*	
		Noise Pollution	*	
		Environmental Litigation	*	

2-Risk prioritization:

Risk prioritization is done in order to screen the risks so that risks having substantial influence on RMC business objectives can be selected for quantification. For this, probabilities and consequences are assigned to individual risks on a subjective basis using the following tools.

- QRA sheet (Qualitative Risk Analysis sheet)
- P-C Matrix (Probability – Consequences Matrix)

3-QRA sheet:

QRA Sheet is designed, in particular, to assess individual risks subjectively. It has a list of identified and categorized risks on the left-hand side column of the sheet. It shall ask for the probability and consequence of each risk in a subjective way. For probability assignment, a probability scale shall be used. This scale shall be used for assigning the probability, ranging subjectively from rare, unlikely, possible and likely to almost certain. In the context of risk consequences, the same scale shall be used. This scale shall be used for assigning consequences subjectively from insignificant, minor, moderate and major to catastrophic consequences

Identified and classified risk	Probability					Consequences				
	Rare	Unlikely	Possible	Likely	Almost certain	Insignificant	Minor	Moderate	Major	Catastrophic
A). Political Risk										
R1										
R2										
R3										
B). Contractual Risk										
R1										
R2										
R3										
R4										

Risk Quantification using EMV analysis:

In this step of the proposed approach, risks which actually may cause substantial cost increase shall be quantified to get an idea about total project risks in term of production and supply cost. A quantification format is proposed for this purpose, which shall be used to gather the data related to probability and consequences of the "significant" and high" exposure risks in terms of cost. The effect of the time factor, i.e. cost related to delay, shall also be included in each risk. Team of project manager with key personnel at respective plants shall discuss together and, after reaching consensus, shall fill required details about individual risks as well as about their interdependency, if exists. This approach is explained stepwise in the following paragraphs.

Cost Consequences(In terms of Average Monthly Production and supply cost of RMC)	0-1% (In terms of average monthly production and supply cost of RMC - specify)	1%-2% (In terms of monthly production and supply cost of RMC - specify)	3% -5 % (In terms of the monthly production and supply cost of RMC - specify)	5%-10 % (In terms of the monthly production and supply cost of RMC (specify)	10 % and above (In terms of average monthly production and supply cost of RMC - specify)
Probability					

Selecting scale for probabilities for different cost consequences In the proposed system, a scale for cost consequences shall be used where a range of cost consequences in terms of percentage of the average monthly production and supply cost of RMC shall be given, and associated probabilities shall be filled by team members after reaching consensus. This scale is shown below in Table:

(Here it means: What is the probability that consequences due to a particular risk will lead to 0-1% cost consequences (loss) with respect to the average monthly production and supply cost of RMC from the respective plant, 1 to 2% cost consequences (loss) with respect to the average monthly production and supply cost of RMC from the respective plant and so on)

It is not that all risks are independent. Many risks have interdependency relations with other risks, i.e. occurrence of one risk can lead to some effect on the cost consequences due to another risk. A quantification format is suggested for this purpose that shall be used to get these details. There may be an increase or decrease in the cost consequences, but these values are needed for the calculations proposed in this approach for risk quantification. The format for obtaining cost consequences due to independencies is presented below in Table

Effect on(say) Risk R1	% Increase in cost consequence	% Decrease in cost consequence
Due to occurrence of (say)Risk R2		
Due to occurrence of (say)Risk R3		
Due to occurrence of (say)Risk R4		

The calculations using EMV analysis in the proposed risk quantification approach shall be as below:

1. The lowest and highest cost consequences related to each risk are considered as "Low1" and "High 1" values. As the consequences are described in scales, the mid-point of each class is taken as cost consequences for calculation. Example
 – For class 1-2% - 1.5% taken for calculations Similarly,
 –For class 3-5% - 4% is taken for calculations

Expected Monetary Value 1 = Cost consequence of an individual risk x Probability of this cost consequence

Expected Monetary Value 2 = Basic occurrence Probability of an individual risk x Expected Monetary Value 1

Low 2 = Low 1+ [(Low 1 x %change in a particular risk say R1 due to occurrence of

another risk say R2) x Basic occurrence probability of risk R2] + [(Low 1 x %change in a particular risk say R1 due to occurrence of another risk say R3) x Basic Occurrence Probability of Risk R3] + [(Low 1 x %change in a particular risk say R1, due to occurrence of another risk say R4) x Basic occurrence probability of risk R4]

High 2 = High 1+ [(High 1 x %change in a particular risk say R1 due to occurrence of another risk say R2) x Basic occurrence probability of another risk R2] + [(High 1 x %change in a particular risk say R1 due to occurrence of another risk say R3) x Basic Occurrence Probability of Risk R3] + [(High 1 x %change in a particular risk say R1 due to occurrence of another risk say R4) x Basic occurrence probability of another risk R4]

Final Expected Monetary Value = Expected Monetary Value 2 + [(Expected Monetary Value 2 x %change in a particular risk say R1 due to occurrence of another risk say R2) x Basic Occurrence Probability of R2] + [(Expected Monetary Value 2 x %change in a particular risk say R1 due to occurrence of another risk say R3) x Basic Occurrence Probability of R3] + [(Expected Monetary Value 2 x %change in a particular risk say R1 due to occurrence of another risk say R4) x Basic Occurrence Probability of R4]

The total risk, in terms of cost, varies between the sum of Low 2 values and the sum of High two values for all the risks considered for quantification. The proposed approach also gives the sum of Expected Monetary Value of all the risks, which is calculated in a proposed approach as 'Final Expected Monetary Value'

Discuss and Conclusion:

The proposed Research presents the risk quantification approach for internal as well as external risks in RMC plants. The information is gathered through the interviews and discussion with the team of key personnel working in RMC plants at Mumbai, Navi Mumbai, Noida, Bangalore, and Pune in India. A checklist of risk is generated as an outcome of this study. Subjective Ratings for both probabilities of occurrence and consequences were also gathered from the same teams for screening the risks having substantial influence on the objective of a company running RMC plants.

The risk quantification approach proposed in this Research, using EMV, is a simple and effective tool to quantify risks in terms of cost. The system can be used to find:

- Range within which the individual risk (in terms of cost) may vary
- Range within which the total risks in the RMC plant (in terms of cost) may vary
- Expected monetary value of the risks in RMC plant

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