

Risk Identification & Its Mitigation in Construction Industry

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Abstract— Combining in itself the potential for employment for practically any economic activity, construction industry plays a decisive role in healthy development of any nation. Not only large but even small construction project have an abundance of risks and need effective risk management, intuition, experience, skills plays a very vital role in decision making process of risk management. This paper emphasizes on the various risks which a construction project faces during its construction stage. How it can be mitigated. Data was collected interviewing of contractor’s team of project managers and senior engineers. Collected data were the reviews from contractor’s point of view. In any risk management program, it is necessary to pay serious attention to risk qualification and also qualitative analysis. Risk quantification leads to an estimate of risk exposure for the project and aids in risk response planning. In this paper mitigation plan, has been proposed.

Key words: Risk, Risk Management, Mitigation plan, Qualitative analysis, Quantitative Analysis

I. INTRODUCTION

The nature of the construction project makes the industry unique in that the manufacturing facility or the plant must move to the construction site (Hinze, 2001). There is no other industry that requires the proper application of business practices much as construction industry. Construction Industry is a High Hazard industry. It comprises of various activities from construction to repair of the structure. The construction industry is subject to more risk and uncertainty than in any other industry. Construction project are initiated in complex and dynamic environments resulting in circumstances of high uncertainty and risk, which are compounded by demanding time constraints. Construction industry has changed significantly over the past several years. It is an industry driven primarily by ¹private investors; the presence of securitized real estate has increased considerably. It is vulnerable to the numerous technical & business risks that often represent greater exposures than that are traditional.

Thus, risk assessment need arises. Risk assessment is a tool to identify those risks in a project and manage it accordingly with proper treatment. The general methodology of this study relies largely on the survey questionnaire which was collected from the building contractors of different sizes by mail and by personnel meeting. The procedure of taking a project from inception to completion, and then into use is a complex one that entails time consuming design and production processes (Ahmed & Azhar, 2004). Some of the risks associated with construction are poor quality of work, premature failure of the facility, a lack of safety, poor or incorrect design, and financial risks (Mahesh & Kumaraswamy,2007).

II. NEED OF THE STUDY

As we know construction industry is an industry full of hazards and risks. Which if ignored can reads to great losses. Risk management basically helps in identifying various risks, monitoring and controlling them periodically. A construction project has three objectives namely, by risk management the three objectives can be prevented from facing risks. It is very difficult to during the probability of risk to 0%, but however it can be reduced to such an extent such that its impact will not lead to disaster to project in terms of financial risk, or big stop in the project. The theory of the risk management process will be compared to the actual practice in order to investigate similarities and differences.

- Cost
- Time
- Quality

A. ³Two Characteristics of Risk

- Uncertainty – the risk may or may not happen, that is, there are no 100% risks (those, instead, are called constraints).
- Loss – the risk becomes a reality and unwanted consequences or losses occur

III. SCOPE OF STUDY

- 1) Due to time limitation, this research is concerned with building project only and will not take into account that other categories of construction industry like heavy engineering construction (tunnels, bridges, dams, etc.), industrial projects (factories and workshops), and infrastructure projects (Sewage and water supply).
- 2) Study is done only for contractors
- 3) This study is limited to one type of contracts, which is Lump-Sum contracts

The risks identified with the help of the discussions with the professionals and with the help of the literature study done.

Risk variables are as below:

RISK CODE	CATEGORY OF RISK
O	Organizational Risk
O1	Inexperienced Staff assigned
O2	Losing critical staff at crucial point of the project
O3	Insufficient time to Plan
O4	Unanticipated Project Manager Workload
O5	Inconsistent cost, time, scope & Quality objectives
O6	Functional units not available, overloaded
O7	Not Enough time to plan
O8	Priorities change on existing program
O9	New priority project inserted into program

M	Material Risk
M1	Non-Availability of material
M2	Defective Material
M3	Poor Transportation Facility
FM	Force Majeure
FM1	Inclement Weather
FM2	Earthquake
FM3	Flood
FM4	Fire
FM5	Terrorism
A	Activity Delay Risk
A1	Construction delay
A2	Delay in payment, handling over drawing
A3	Unavailability of material, manpower, machinery
A4	Delay in approvals
A5	Mobilization of Sufficient resources on time and to budget
A6	Poor quality of work
A7	Site condition causing problems-loose soil, water level etc.
RISK CODE	CATEGORY OF RISK
A8	Low productivity of labour, machinery
A9	Breakdown of mechanical handling plan
F	Financial Risk
F1	Inflation
F2	Penalty for activity delay
F3	Change in design/variation in design
F4	Foreign exchange fluctuation
F5	Theft
F6	Taxation, vat etc.
E	Environmental Risk
E1	Environmental analysis incomplete
E2	New alternatives required to avoid, mitigate or minimize environmental impact
E3	Water pollution
E4	Air pollution (Impact of dust from construction activities)
E5	Noise Pollution (activities like blasting etc.)
P	Project management risk
P1	Project scope of work is poorly defined
P2	Schedule and deliverables are not clearly defined
P3	Inexperienced workforce / resource availability
P4	Too many projects
P5	Local agency issues/local issues
P6	Estimating and scheduling errors/faulty quantities
P7	Unplanned work that must be accommodated
P8	Pressure to deliver project on an accelerated / Crashed schedule
P9	Lack of communication
P10	Lack of upper management support
P11	Priority of client changes
C	Construction Risks
C1	Inaccurate estimate of project duration
C2	Permit work system
C3	Utility

C4	Incorrect surveys
C5	Change in methodology
C6	Buried man-made objects / unidentified hazardous waste
CO	Completion risk
CO1	Receipt of all planning and other approvals
CO2	Proper design of the project
CO3	Obtaining land & access to the site
CO4	Project management capabilities
CO5	Project is not finished
L	Legal Risk
L1	Work overlapping with another contractor or subcontractor
L2	Price escalation not provided
L3	Project duration not real
L4	Extension of concession period

Table 1: Risk Variables

IV. STRUCTURE OF THE INTERVIEW

The interview was conducted with the project manager, planning managers, senior engineers of contractor's team having the experience of 1-5 years. This is because aim of survey is to get the probability & impact factor of the risks listed above. And this acquired by interviewing people having experience and skill in the same field. Now, the data was collected and mode method is used to get resultant response from the samples of questionnaire interviewed. For case study, again same risk variables were used to identify what all risks were faced by the project during its construction.

Data analysis was undertaken using probability-impact matrix & Severity analysis. In the probability-impact matrix risks gets categorized in more concern zone (red color), less concern zone (yellow color) & very less concern zone (green color).

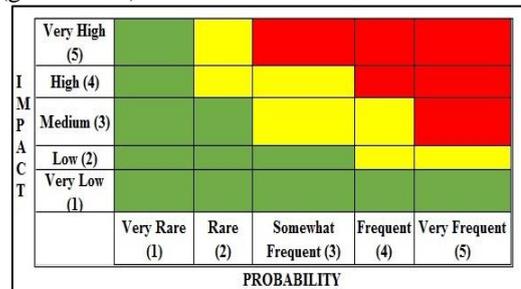


Fig. 1: Probability-Impact matrix

Whereas, in severity analysis risks gets ranked according to their severity value. For case study, overall evaluation of the risks was done. How it has affected the project duration, cost and quality. Result of both the analysis says that more concern which should be mitigated immediately are:

- Priorities change on existing program
- Pressure to deliver project on an accelerated schedule
- Project not finishing during completion stage
- Price escalation
- Non-availability of material
- Delay in payment, handling over drawings
- Lack of upper management support

And these are risks which after analysis was there in the red region of the probability-impact matrix & when kept on the severity scale were having severity above 15 and very high effect on the project.

A. ⁵Overall Evaluation of the Risk Factor on the Project Duration, Cost and Quality of GIFT CITY

The Following information is according to the project teams, evaluation, contractor's claims and according to progress reports of the case study:

- According to the project teams, the duration of the project is estimated to increase from 21 months to 24 months i.e. 90 days
- The overall project cost has increased from 212 crores to 260 crores

Due to increase in scope not only project duration has increased & also the overall cost.

V. QUALITATIVE DATA ANALYSIS RESULT

After getting the probability factor and impact or all the sub factors of risk category, we placed all the sub-factors in the Probability Impact Matrix. And the matrix below shows the result of the data collected.

Result shows that risks in red region are of more concern and should be mitigated immediately. And those risks are:

IMPACT	Very High (5)	FM2, FM3	A7, L2, P5	M1, A2, P11, CO5, L2		
	High (4)	FM5, P2, C6	O2, O4, M2, FM4, A3, L3, P6, P10, L3	O5, O6, A1, A4, F2, F3, L1, P9, C4, CO1, CO3, L4	O8, P8, C1	
	Medium (3)	EN5, EN6	M3, FM1, A6, A8, A9, F1, L4, EN1, P1, P3, P4, CO4	O1, O3, O7, A5, P7, C3, CO2, L1	O9, C5	
	Low (2)		EN3	F6, EN2, C2		
	Very Low (1)	F4	F5			
		Very Rare (1)	Rare (2)	Somewhat Frequent (3)	Frequent (4)	Very Frequent (5)
	PROBABILITY					

Fig. 2: Probability-Impact matrix (Data Analysis)

VI. RISK MITIGATION MEASURES

In order to overcome such risks, some of the mitigation measures are proposed. ⁴They are as follow:

- Ensure timely delivery of materials
- Community involvement
- Acceleration of site activities
- Frequent Progress meeting
- Effective Strategic Planning
- Multidisciplinary project team
- Use up to date technology utilization
- Availability of resources
- Commitment to projects
- Frequent progress meeting
- Offering incentives for early completion
- Proper emphasis on past experience

VII. RISK MITIGATION PLAN

In the end the risk mitigation plan is proposed in which in order to overcome a risk particular risk measures are applied. And there is a possibility that after those mitigation measures if applied then probability of occurrence of that

risk might get reduced. But for some of the risks under category force majeure even after mitigation measures applied its probability cannot be reduced but somehow, impact get reduced. If risk without mitigation plan have probability of occurrence of 3 to 5. Then after proposed mitigation plan it might get reduced to 2, 1 but not 0 because if done so the lot of efforts were done to do so. And project becomes very expensive

VIII. RISK MITIGATION MODEL

It consists of following:

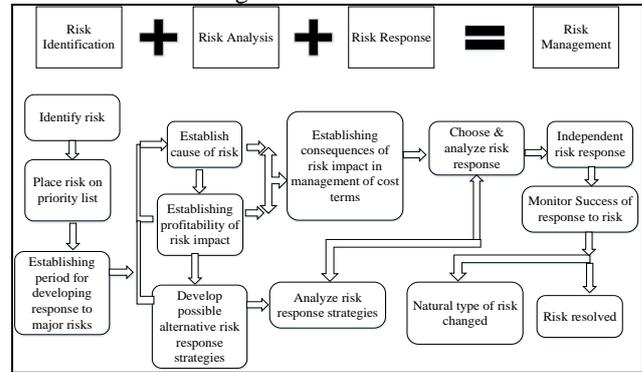


Fig. 3: Risk Mitigation Model

IX. CONCLUSION

The finding obtained show risk factors that seriously caused the project to delay are in a descending order:

- Inaccurate contract time estimates
- Delay in payment, handling over drawings
- Project not finished during completion stage
- Pressure to deliver project on an accelerated schedule
- Priorities change on existing program
- Non-availability of material
- Lack of upper management support
- Price escalation

The Construction industry has characteristics that sharply distinguish it from other sectors of the economy. It is fragmented very sensitive to economic cycles, and highly competitive because of the large number of firms and relative ease of entry. It is basically due to these unique characteristics considered a risky business.

In this study, identifying the risk factors faced by construction industry is based on collecting information about construction risks through personal interviews, their consequences & corrective actions that may be done to prevent or mitigate the risk effects are shown in the risk mitigation plan. Risk analysis techniques were investigated too. However, determination of severity is the main result of this study.

Analysis their risk factors was carried out to measure their effects on building projects. From the case study, it is clear that because of the increase in the scope of project, effect on project duration, cost and quality is happened which if was planned properly could not occurred only.

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