RISK MANAGEMENT IN CONSTRUCTION PROJECTS USING QUANTITATIVE METHOD

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Abstract

The center part of the study is to deal with various risk encountered in construction projects. It hasbeen recognized as important part of project life cycle in order to achieve the objectives in terms of time, quality, cost and scope. Based on the conditions of construction projects this study identifies and analyze them with appropriate risk managing techniques to give solution to various risks.

All analysis are based on theoretical background regarding risk, risk management process and project life cycle approach in the construction sector. This study presents the risk management in the pre-execution stages, execution, post -execution of project life cycle of construction project. This study proposes to apply risk managing techniques which includes well-documented procedure for the one stop solution all types of hazard most likely to occur during any construction.

Keywords – *Risk management, Risk identification. Risk classification, Risk analysis and Risk response, ATMA*

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1. INTRODUCTION

1.1 Risk Management

Project risk management is the art and science of managing risk caused by unforeseen (uncertainties) which may require deviation from the plan of approach and therefore may affect the project objective set during initial stage. It involves various steps such as identification, analyses, mitigation and controlling them.

Risk management can be described as the systematic way of looking into areas where the risk is commonly encountered and how it can be treated. It is management tool which helps in identifying the uncertainties and develop a strategic response to mitigate it. The systematic process of risk management is associated with risk classification,risk identification, risk analysis and risk response. Risk response can be handled with four action accept, transfer, mitigate and avoid (ATMA).Risk management is a such an effective method is does not only help to understand various risk but even helps in managing risks in various stages of the project.

1.2 Necessity of Risk Management

Construction conditions vary from region to region, project to project, time to time. Few projects are complicated and encounter more risks. Few risk can occur on site and few in planning stages. Hence various parties sign in the contract and agree to follow the conditions as per the contract. Due certain obstacles and problems project can face serious issue such as delay and idling of resources. Hence the project may get complex. To solve these risks encountered risk management technique was introduced.

Risk identification and planning helps to enhance profitability in the project. Construction company has many practical risks. Hence companies have to plane for hazard occurring during the project execution stage depending on the past experience safety and environmental risks have to planned in initial stage of the project and pre-cautionary step has to be taken.

2. OBJECTIVE OF STUDY

Although this work is in its in early stages, it is anticipated that it will cover some or all of the following objectives.

Phase-I

- Risk Identification with brainstorming sessions, expert advice, past experience, interviews.
- Group the various risks caused during the pre-execution.execution and post execution stages and risk owners responsible for them.
- Prioritization of risks by quantitative method.(analysis)

Phase-II

- Handling risk by (ATMA) avoidance, transfer, mitigation,accept.
- Rank the risks encountered according to average risk factor.

3. METHODOLOGY

The suggested research objectives and subsequent questions listed at the beginning at this document, require the use of different data sources and research methods. Thus the research is expected to employ varies different methods particular to each facet of the research problems.

The research is expected to be done in several stages determined by the achievement of the predefined objectives. As seen at this very early stage it is expected that the possibilities of this work include the following methodologies.

- A significant portion of what is known on the topic will be obtained by interviewing some of the head construction managers and various risk's are grouped associated with construction projects.
- Then the following risk's are subjected for analysis. Depending on the type of risk's either qualitative or quantitative assessment is performed. Here its quantitative method.
- Qualitative and quantitative have several types of techniques. With these techniques all risk's can be Rated and prioritized.
- Through the questionnaire answered by the construction manager and site engineer we get to know the rating of probability and impact of various risks. i.e all risks are rated on a scale of 0-100.
- Then, next to get significance or importance index, products of probabilityand impact are taken dividing it by 100.

For example,
Risk of time and cost overrun,
Probability=90 impact=86
(90*86)/100= 77.40
Therefore importance index=77.40

- Risks are ranked according to the average risk factor.

Average risk factor = $\sum$ I.I/ n
Where,
I.I=significanceindex or importance index
n= number of risks.

Method of ranking various risks:

i) Probability index will arranged in descending order and highest will be ranked 1 and lowest will ranked last.
ii) When same impact index is observed, give the same rank to both risks and omit the next rank.
iii) Probability index with high rate will be ranked low and probability index with low rate will be ranked high.

Table-1: Risk-Allocation

Sl. No	Possible Risks	Occurance			Risk Allocation		
		Pre-Execution	Execution	Post Execution	Employer	PMC	Contractor
1	Tight Project Schedule		yes			y	y
2	Project Funding Problems	yes	yes		y		y
3	Variation by client		yes			y	y
4	Design variation		yes		y	y	y
5	inadequate program scheduling		yes			y	
6	Inadequate site information		yes			y	y
7	Incomplete/Incaccurate cost estimation		yes		y		
8	Contractor's poor management ability		yes			y	y
9	Contractor's difficulty in reimbursement			yes		y	y
10	Poor competency of laboureres		yes				y
11	Unavailability of sufficient managers		yes		y	y	y
12	Major equipments do not have insurance					y	y
13	Inadequate safety measures		yes			y	
14	Lack of readility available utility		yes				y
15	Unavailability of sufficient skilled labourers	yes	yes				y
16	Legal issues due to unlawful disposal of construction waste		yes	yes			y
17	Air pollution caused by construction		yes	yes		y	y
18	Noise pollution caused by construction		yes			y	y
19	Water pollution caused by construction		yes			y	y
20	Low Management competency of sub contractors		yes				y
21	Suppliers incompetency to deliver materials on time		yes				y
22	Bureaucracy of govt.	yes			y		
23	Excessive procedures for govt approvals	yes			y		
24	Price inflation of construction materiials		yes		y		y
25	Act of God		yes		y		y
26	Adverse weather conditions		yes		y		y

Table-2: Risk Response Startegies Plan

Risk response strategy	Risk-handling method	Response code
Risk avoidance	• Increase unit cost or overhead	RA-1
	• Develop alternatives for risk events	RA-2
	• Remove risk events by avoiding them	RA-3
Risk transfer	• Use insurance companies	RT-1
	• Make a subcontract	RT-2
Risk mitigation	• Train or educate employees	RM-1
	• Provide best supplies (e.g., computer, software, equipment, and so on)	RM-2
	• Develop a strategic staffing plan	RM-3
	• Use proven construction methods and materials	RM-4
	• Safeguard both workers and property	RM-5
Risk retention	• Prepare contingency planning	RR-1
	• Accept profit losses	RR-2

Table-3: Risk Handelling Method

Risks	Risk handelling method
1. Risk of time and cost overrun	RA-1,RA-2
2. Risk of design variation by client	RA-2
3. Risk of receiving inadequate site information	RM-1
4. Risk of selecting contractors incapable of handling project well	RM-1,RM-2
5. Risk of scope changes	RM-3
6. Risk of decline in quality of work due to change in top management	RR-1
7. Risk of unforeseen circumstances due to lack of communication	RR-1
8. Risk of delay from consultant/contractor	RR-1,RR-2
9. Risk of delay due delay in obtaining permits	RR-1,RR-2
10. Risk of unrest due to labour strikes	RR-2
11. Risk of dispute between architects and structural engineers	RR-2,RA-1
12. Risk of cost variation due to changes in cost of procurement	RT-1
13. Risk in execution due to adverse weather conditions	RT-2
14. Risk in execution due to social unrest	RT-2
15. Risk in execution due to war	RT-2
16. Risk of delay due to excessive red tapes in govt. proceedings	RA-3
17. Risk of rework due to defective construction work	RM-3
18. Risk of payment delay	RM-3
19. Risk of restricted availability of site	RM-3
20. Risk of inadequate safety measures on site	RM-3,RM-4
21. Risk of complaints from neighbours due to pollution caused (air, water and noise)	RR-1
22. Risk of not meeting accelerated deadlines	RR-1
23. Risk of sudden change in govt. regulations	RR-1,RR2
24. Risk of damaging underground utility lines during excavation	RR-1,RR-2
25. Risk of execution due to poor quality of procured material	RT-1,RR-1,RR-2
26. Risk of opposition from local population	RT-1,RT-2,RM-3

Table-4: Questionnaire Analysis

Risks	Frequency	Impact	Significance	Rank
1. Risk of time and cost overrun	90	86	77.40	1
2. Risk of design variation by client	70	66	46.20	5
3. Risk of receiving inadequate site information	61.67	46	28.37	
4. Risk of selecting contractors incapable of handling project well	56.25	52.33	29.44	
5. Risk of scope changes	63	54.75	34.49	11
6. Risk of decline in quality of work due to change in top management	44	58.875	25.91	
7. Risk of unforeseen circumstances due to lack of communication	61.75	45.9	28.34	
8. Risk of delay from consultant/contractor	71.25	60.33	42.99	7
9. Risk of delay due delay in obtaining permits	67.5	63.86	43.11	6
10. Risk of unrest due to labour strikes	54	69.14	37.34	9
11. Risk of dispute between architects and structural engineers	57.25	48.18	27.58	
12. Risk of cost variation due to changes in cost of procurement	62.25	56	34.86	10
13. Risk in execution due to adverse weather conditions	64	43.67	27.95	
14. Risk in execution due to social unrest	47.25	44.5	21.03	
15. Risk in execution due to war	25.5	57.125	14.57	
16. Risk of delay due to excessive red tapes in govt. proceedings	48.67	49.33	24.01	
17. Risk of rework due to defective construction work	59	55.67	32.85	
18. Risk of payment delay	75	83	62.25	3
19. Risk of restricted availability of site	46.67	63.33	29.56	
20. Risk of inadequate safety measures on site	75	85.67	64.25	2
21. Risk of complaints from neighbours due to pollution caused (air, water and noise)	57	60	34.20	12
22. Risk of not meeting accelerated deadlines	69.75	70	48.83	4
23. Risk of sudden change in govt. regulations	62	63.44	39.33	8
24. Risk of damaging underground utility lines during excavation	52.67	63.33	33.36	
25. Risk of execution due to poor quality of procured material	57.25	54	30.92	
26. Risk of opposition from local population	40	44	17.60	
	TOTAL	∑ I.I =	936.70	
Average Risk factor		∑I.I/n =	36.0268	

4. RESULTS

- Classification of risks according to the projectlife cycle.
- Prepared mathematical modeling and calculated the average risk factor, through which we canunderstandnumber of risks hazardous to construction project w.r.t to average risk factor.
- To enhance profitability in construction by maintaining the schedule and plan of the project.
- To plan for risks in initial stage of the project.
- Prepare for risk handling method by having astrategic response without wasting time at the point of emergency.

5. CONCLUSION

- According to studies conducted, risk management has to be followed by the all firms to maintain the decorum of construction site and organization.
- The team working on the project should have ability to look through the contract and site details and recognize the risks.
- It's better to know and plan for risk in the initial stage of the project and Implement that technique at the time of emergency.
- The mitigation method may vary from site to site depending on the geographical factor.
- The charts formed may be helpful to similar construction projects and shall no doubt be of use.

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