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RISK MANAGEMENT DURING PROJECT LIFE CYCLE

Mr. Kundan Kumar[1], Er. Alvin Harison[2]

[1] P.G student in M. Tech Civil Engineering, SHIATS. E. mail: kundanvictoria1986@gmail.com
[2] Faculty, Dept. of Civil Engineering, SHIATS. E. mail: alvin.harison@shiats.edu.in

ABSTRACT

Risk is considered an uncalled problem, over the decades Risk Management is treated as threat because it has not been dealt in structured manner. This research is about probability of risk at initial phase and its impact during complete Project Life Cycle. Based on Bennett(2003) PLC frame work which consist of six phase of different length and start with pre-project phase followed by planning, design, contractor selection, Project-mobilization, operation, close-out and termination phase. Project undertaken in construction sector are *widely* complex and have often significant budget, where focus must be on time, cost and quality at each phase of PLC. However based on conducted interviews the research presents how risk changes during PLC. All analysis is based on theoretical background regarding risk, risk-management and PLC approach in construction sector.

Key words: Risk; Risk management; Risk management method; Project life cycle.

INTRODUCTION

Risk management is very important concept and needs to be handled in very efficient manner as it has various uncertainties; it is even more puzzling during project life cycle to evaluate the use of Risk management process in construction industry. To control the in construction industry working with Risk management method or techniques during PLC. To define Risk at each phase of PLC with suggestion for each recognized Risk at initial level. Risk is present in all project sectors. Ex., IT, automobile, agriculture sector to construction sector.Risk is the stage where possibilities of loss or injuries can take place due to lack of proper information, knowledge and can be handled on past experience by providing proper Risk management techniques during project life cycle. (Gajewska and Ropel, 2011)Risk analysis is second stage in RMP where collected data about the potential Risk are analyzed. In the analysis of identified Risk, two categories of method- qualitative and quantitative have been developed. The factors which mostly affecting the risk are availability of skilled or experienced staff, specialized management team, resources. There are management related risk, technical risk and environmental risk are comes under risk classification.(Smith et.al., 2006) The term Project Life Cycle is used as management tool to improve project performance. It varies among industries and involves different phases which start from feasibility report to project completion phase and between these two numbers of phases like selection of site, planning, operation etc. comes. To determine Risk during PLC everybody connected with project must be aware of Risk and one common definition of Risk should be drawn up for the purpose of particular project. (Bennett 2003) PLC is the planning and design phase which is relatively longer than the others.

This project development process consists of three sequential stages for more convenient phase completion and project delivery.

LITERATURE REVIEWED

A lot of research has been undertaken in the field of Risk management in construction industry in the past. Conclusive remarks of few are narrated as follows:

Perry(1996)- The process of Risk management are identification of Risk source, assessment of their effects, development of management response to Risk which is not be tied down to a set of rules. Pinto and Prescott(1998)- A field study was conducted to investigate changes in the importance of project critical success factors across four stages in project life cycle and result indicate that relative importance of several of the critical factor change significantly based on life cycle stages. Noor(2008): This research reviews the literature on case study as strategy qualitative research methodology.

MATERIALS AND METHODS

A research process consists of number of sequential steps for finding the research area and formulating research question. It follows qualitative method for quick assessment of Risk. By applying the method called Risk probability and impact assessment, specific Risk to occur is evaluated.

Defined conditions for Impact scales of a Risk on Major Project Objective (Examples are shown for negative impacts only)					
Project objectives	Relative or numerical scale 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	Only very demanding applications	Quality reduction requires	Quality reduction unacceptable	Project end item is effectively

	noticeable	are affected	sponsor approval	to sponsor	useless
This table presents examples of risk impact definitions 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 definitions can be developed for opportunities in a similar way.					

Probability/impact risk rating matrix:

Probability and impact are used as base for qualitative analysis and risk response which will be explain further in the paper.

Probability	Threats					Opportunities				
0.90	0.05	0.09	0.18	0.36	0.72	0.72	0.36	0.18	0.09	0.05
0.70	0.04	0.07	0.14	0.28	0.56	0.56	0.28	0.14	0.07	0.04
0.50	0.03	0.05	0.10	0.20	0.40	0.40	0.20	0.10	0.05	0.03
0.30	0.02	0.03	0.06	0.12	0.24	0.24	0.12	0.06	0.03	0.02
0.10	0.01	0.01	0.02	0.04	0.08	0.08	0.04	0.02	0.01	0.01
	0.05	0.10	0.20	0.40	0.80	0.80	0.40	0.20	0.10	0.05

Threats with high impact are identified as high-Risk and may require immediate response, while low score threat can be monitored by taking action if required.

Application of the probability and impact method:

Interview was conducted with the different company personal to focus on previous identified risk which was based on scale given below.

Probability	Very low	Low	Moderate	High	Very high
Risk a	0.1	0.3	0.5	0.7	0.9

Undefined	Project objective	Very low (0.05)	low (0.10)	moderate (0.20)	High (0.40)	Very high (0.80)
	Cost	Insignificant	<10% cost	10-20%	20-40% cost	>40% cost

		cost increase	increase	cost increase	increase	increase
Risk A	Time	Insignificant time increase	<5% time increase	5-10% time increase	10-20% time increase	>20% time increase
	Quality	Quality degradation barely noticeable	Only very demanding applications are affected	Quality reduction requires sponsor approval	Quality reduction unacceptable to sponsor	Project end item is effectively useless

Depending on the type of probability, a rate between 0 and 1 is assigned to the risk. This number is multiplied together with the rate of impact in order to get a results and shows the level of risk which is given below. Risk marked in the upper right corner (red color) is greatest and left bottom has low influence on the project and remaining on the middle as moderate effect.

0,80	0,080	0,240	0,400	0,560	0,720
0,40	0,040	0,120	0,200	0,280	0,360
0,20	0,020	0,060	0,100	0,140	0,180
0,10	0,010	0,030	0,050	0,070	0,090
0,05	0,005	0,015	0,025	0,035	0,045
IMPACT ↑ → PROBABILITY	0,1	0,3	0,5	0,7	0,9

RESULT AND DISCUSSION

As emerged from the interview, dealing with Risk was performed in rather unstructured ways. Whereas some organization had procedures or used checklists to minimize risk, other failed more comfortable with transferring it to experts in the relevant area, moreover a discussion had again been mentioned as yet another till use to mitigate the problem.

Further on for each problem identified during interview, Respondent was asked to purpose and action which should be taken in order to respond to the Risk. The results are gathered below.

Result from interview:

PLC		Phase no	Type of risk	Response	
				Type of response	Description
Pre-project phase	Identifying business opportunity	1	Misunderstand the client	Mitigate	Frequent discussion with the client
			Miscalculation[1]	Mitigate	Detailed discussion with the client
	Choosing delivery system		Miscalculation[2]	Mitigate	Checklists
			Choosing not the right consultants[1]	Mitigate	Check up on the companies
	Chosing contract type		Choosing not the right consultants[2]	Retain	Biding process is regulated by law and they have no impact on it
Planning and design phase	Establishing project objectives and draw up of project brief	2	Lack of cooperation between actors in project	Mitigate	Facilitate cooperation by organizing project team meeting
			Shortage of resources	Mitigate	making adjustments in a number of resources used in order to fit in the schedule
			Cheap, not efficient solutions which can be more expensive over time	Mitigate	By being active in the project and questioning unclear issues
	Actual design		Problems with design		Transferring risk by involving experts in the process
			Users do not take decisions necessary for work progress	Mitigate	Make a pressure for decisions make on time
	Preparing contract documents		Not achieve a good final result	Mitigate	Highlight all potential risks or problems on the workshop or a meeting
			Gap of knowledge	Mitigate	Being active in the process and

					take an action when problem occurs
Contractor selection phase	Setting tender conditions by the owner	3	Not finding the right contractor[1]	Avoid	Make sure that the contractor has enough knowledge & resources to perform the project
	Contractor decisions whether to bid or not		Not finding the right contractor[2]	Mitigate	Check up on the companies
	Submitting offers		Not finding the right contractor[3]	Mitigate	Well prepared bidding requirements
Contract or	Preparation for construction phase				
Project preparation phase	Monitor and control	4	Contractor has not enough knowledge or experience	Avoid	Well prepared procurements
	Resource management		Moisture	Mitigate	Involve specialist from the field
			Losing control over the project	Mitigate	Using quality system and self control
	Documentation and management		Delays in construction schedule	Mitigate	Being active in the process and take an action when any problem occurs
			Delays in construction schedule	Transfer	Transfer risk to the project team
Project close and out	Final inspections	5			
	Project summary				

Evaluation of result:

Identified risk	Project objective	Probability	Impact	Matrix
Misunderstand the client	Cost		0.10	0.030

	Time	0.3	0.10	0.030
	Quality		0.20	0.060
Lack of cooperation between actors in the project	Cost	0.7	0.20	0.140
	Time		0.20	0.140
	Quality		0.05	0.035
Not finding the right contractor[1]	COST	0.3	0.10	0.030
	Time		0.40	0.120
	Quality		0.05	0.015
Contractor has not enough knowledge or experience	Cost	0.1	0.10	0.010
	Time		0.40	0.040
	Quality		0.05	0.005
Miscalculation[1]	Cost	0.3	0.40	0.120
	Time		0.20	0.060
	Quality		0.05	0.015
IDENTIFIED RISK	Project objective	PROBABILITY	IMPACT	MATRIX
Shortage in resources	Cost	0.5	0.20	0.100
	Time		0.20	0.100
	Quality		0.05	0.025
Delay in construction schedule[1]	Cost	0.5	0.80	0.400
	Time		0.80	0.400
	Quality		0.40	0.200
Cheap, not efficient solution which can be more expensive over time	Cost	0.9	0.80	0.720
	Time		0.80	0.720
	Quality		0.40	0.360
Delay in construction schedule[2]	Cost	0.5	0.05	0.025
	Time		0.40	0.200
	Quality		0.20	0.100
Gap of knowledge	Cost		0.10	0.050

	Time	0.5	0.10	0.050
	Quality		0.05	0.025
Identified risk	Project objective	Probability	Impact	Matrix
Miscalculation[2]	Cost	0.5	0.20	0.100
	Time		0.80	0.400
	Quality		0.10	0.050
Problems with design	Cost	0.3	0.10	0.030
	Time		0.10	0.030
	Quality		0.05	0.015
Choosing not the right consultants[1]	Cost	0.5	0.40	0.020
	Time		0.40	0.020
	Quality		0.80	0.400
Users do not take decisions necessary for work progress	Cost	0.5	0.20	0.100
	Time		0.80	0.400
	Quality		0.80	0.400
Not finding right contractor[2]	Cost	0.7	0.40	0.280
	Time		0.80	0.560
	Quality		0.80	0.560
Identified Risk	Project objective	Probability	Impact	Matrix
Moisture	Cost	0.5	0.80	0.400
	Time		0.40	0.200
	Quality		0.80	0.400
Choosing not the right consultants[2]	Cost	0.3	0.20	0.600
	Time		0.10	0.300
	Quality		0.20	0.600
Not achieving the good final result	Cost	0.3	0.20	0.060
	Time		0.10	0.030

	Quality		0.20	0.060
Not finding the right contractor[3]	Cost	0.1	0.20	0.020
	Time		0.10	0.040
	Quality		0.10	0.010
Loosing control over the project	Cost	0.1	0.05	0.005
	Time		0.05	0.005
	Quality		0.10	0.010

Graph:

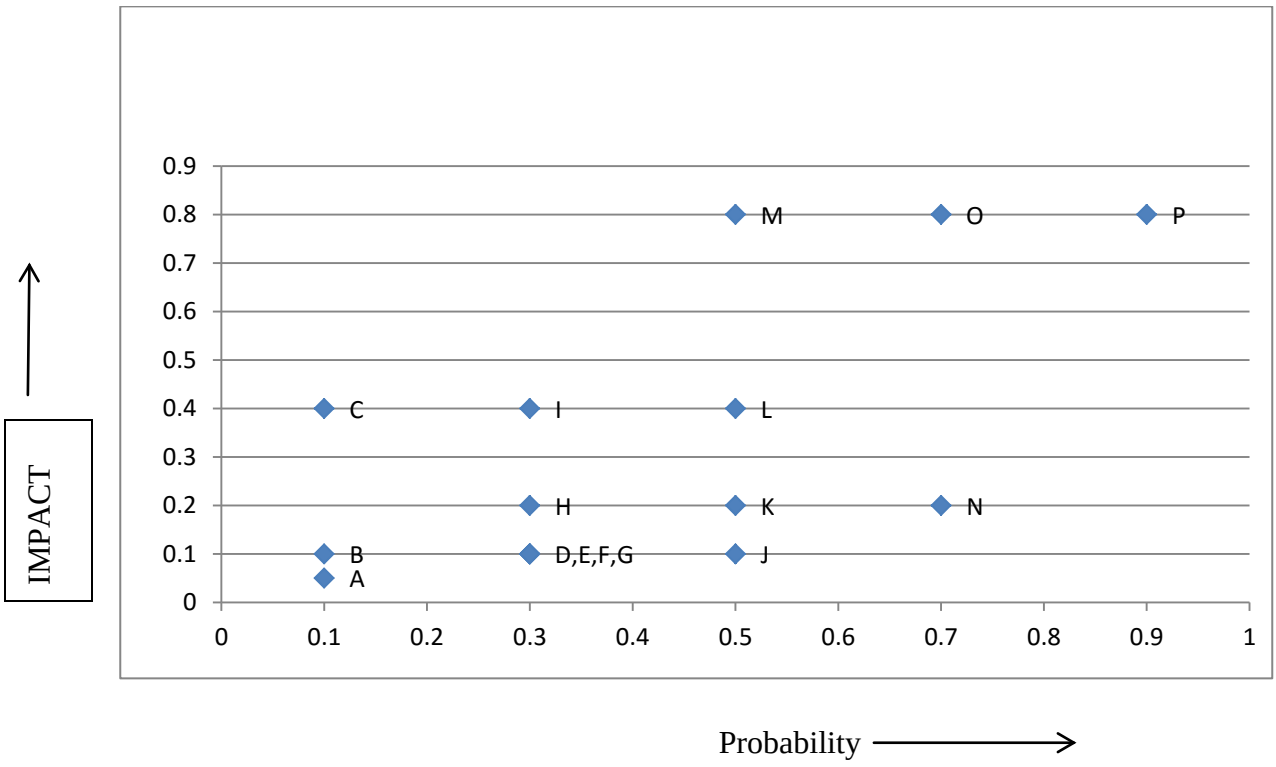

Fig 4.1: Time matrix.

Where:
A – Losing control over Project.
B – Not finding right contractor [3].
C – Contractor has not knowledge/experience.
D – Misunderstand the client.
E – Choosing not the right consultant.
F – Problem with design.

G – Not achieving good final result.
H – Miscalculation.
I – Not finding the right contractor.
J – Gap of knowledge.
K – Shortage in storage.
L – Choosing not the right consultant.
M – Miscalculation.
N – Lack of cooperation between workers.
O – Not finding right contractor.
P – Cheap solution.

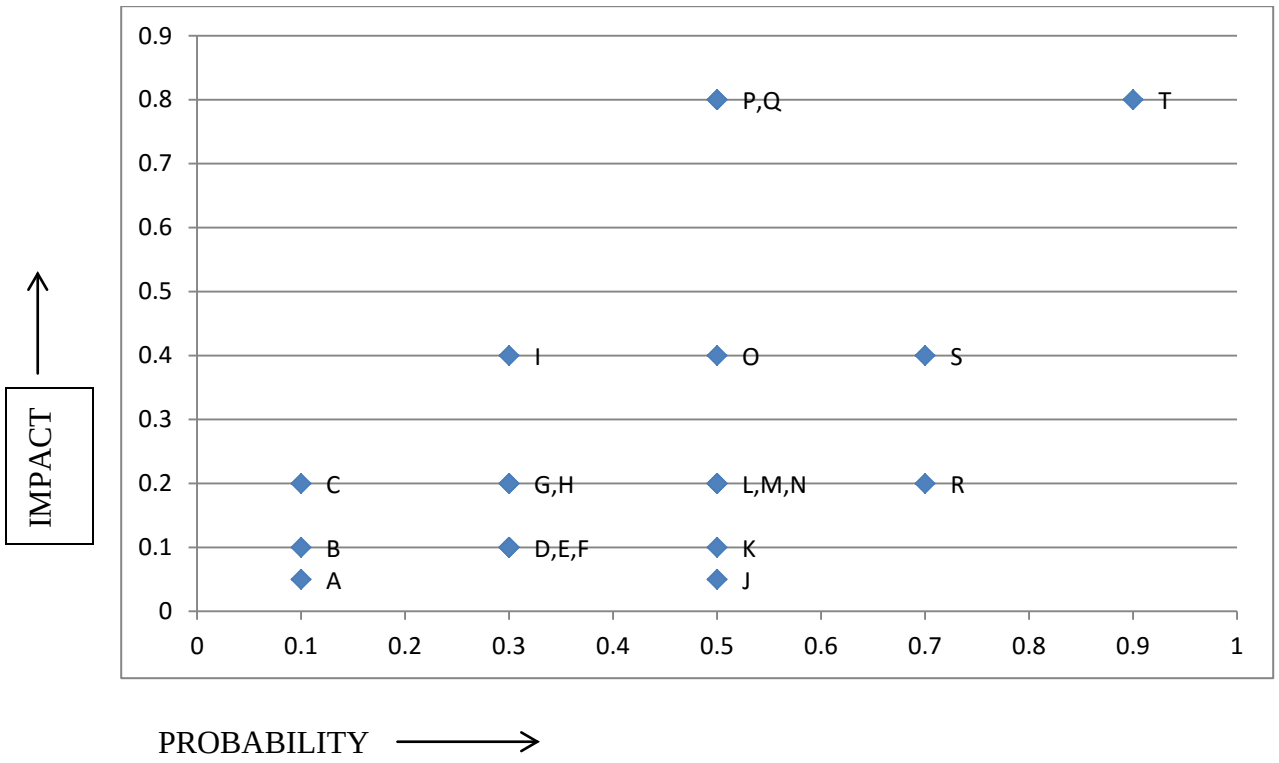

Fig 4.2: Cost Matrix.

Where:
A – Losing control over the project.
B – Contractor has no knowledge/experience.
C – Not finding right contractor.
D – Misunderstand the client.
E – Not finding the right contractor.
F – Problem with design.
G – Choosing not the right consultants.
H – Not achieving final result.

I – Miscalculation.
J – Delay in construction schedule.
K – Gap of knowledge.
L – Miscalculation.
M – Not able to take decision.
N – Shortage in resource.
O – Choosing not the right consultant.
P – Delay in construction schedule.
Q – Moisture.
R – Lack of cooperation between workers.
S – Not finding right contractor.
T – Cheap solution.

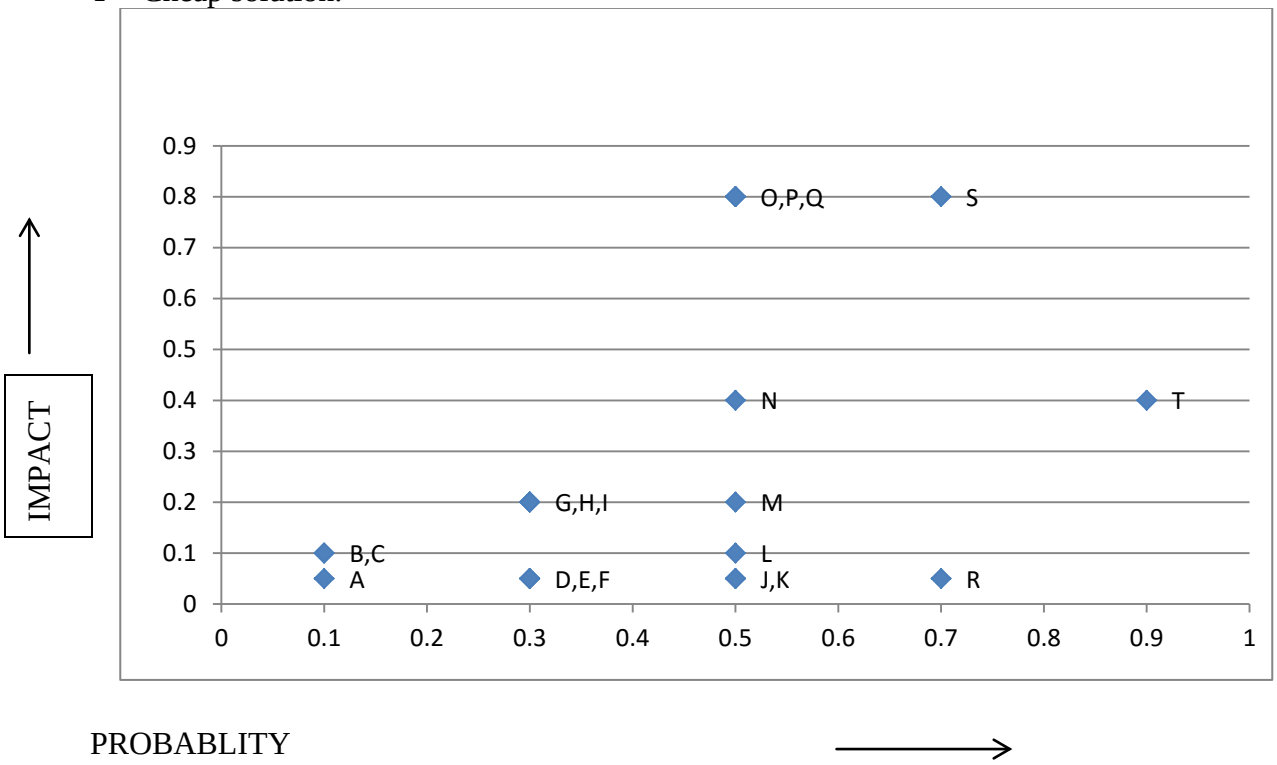

Fig 4.3 : Quality Matrix.

Where:
A – Contractor has not enough knowledge.
B – Not finding right contractor.
C – Losing control over the project.
D – Not finding right contractor [1].
E – Miscalculation.
F – Problem with design.
G – Misunderstand the client.
H – Choosing not the right consultant.

I – Not achieving good final result.
J – Shortage in resource.
K – Gap of knowledge.
L – Miscalculation.
M – Delay in construction schedule [2].
N – Delay in construction schedule [1].
O – Choosing not right consultant.
P – Not able to take necessary decision.
Q – Moisture.
R – Lack of cooperation between workers.
S – Not finding right contractor.
T – Cheap solution.

Graph study:

Graph is plotted regarding the Risk which was identified in the interview. These graphs gives detail of the factors which is present during PLC and shows the impact on time, cost and quality of project.

In Fig 4.1

M, O, P have been identified as high risk problems that might occur and cause delay in the time schedule, therefore if controlled, the time delay can be prevented and thus one will know exactly where to focus for success of project.

In Fig 4.2

Moisture and cheap solution are critical risk that effect the cost and if not controlled then they could result in additional cost for the project.

In Fig 4.3

Quality is very much affected by moisture, and by not finding the right contractor. These risks are large and quality is affected in negative way where project handling becomes very difficult.

Study was done on 20 company of India by giving those questionnaires, all the questionnaire survey was done from the project manager of the project of the site engineer, contractor, sub-contractor and supervisor. In some cases the contractor provided us the answer on behalf of their owner. Managing risk

during project life cycle is very complex and one needs to be very active. Few of them are very aware of the risk but this people do not have enough knowledge to deal with it but few who have some knowledge agreed that risk management as structured way of managing risk and other threats in daily work. Finding from the interviews showed that the term risk was more understood as an undesired event, problem or threat that makes it difficult to achieve project objective. In fact many companies in the construction industry tend to adopt risk management to only some extent and have their own way to control over risk because they were not familiar with Risk management's method but all the people working wanted to know the different risk control method and a guide how to use them. Another finding from interview was lack of information and lack of time as the biggest obstacle preventing implementation of Risk management. Yet another finding from the interview shows a differentiation between how Risk is managed by individual and in a team. Individual and their organization most often use checklist and manuals while the group use discussion as most common technique to identify Risk and problem.

CONCLUSION

- This dissertation described, on the basis of questionnaire survey of general contractor and project management during PLC, the construction industry perceptions of risk associated with its activities and the extends to which the industry uses risk analysis and management techniques.
- It concludes that Risk management is essential during PLC in minimising losses and enhancing profitability.
- Risk during PLC (construction risk) is generally perceived as event that influence project object of cost, time and quality.
- Risk analysis and management during PLC depends mainly on intuition, judgement and experience.
- Formal risk analysis and management techniques are rarely used due to lack of knowledge and to doubt on the suitability of these techniques for construction industries activity.
- Professional in the construction industry are using techniques but are not aware of it. Risk is managed every day in the industry, but not in structured way and knowledge of risk management is close to zero, even though risk management is becoming popular in the construction sector.
- Professional are in favour of using risk management method /techniques with a view of bringing maximum profit to an organisation.

- It is possible to identify potential risk by applying a simple method to detect the possibility of risk having highest impact on time, cost and quality during PLC and those risks should be eliminated or mitigated by taking an appropriate action.
- Risk is present at every phase of PLC and by studying it one can be alert and provide good remedy to come over, for the success of project.
- Lack of knowledge of risk management method and application of method during PLC is needed to be facilitated in construction sector because there are risk which are characteristic for each project phase.

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