International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072

QUALITY RISK RESPONSE PLANNING IN CONSTRUCTION MANAGEMENT

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Abstract: The best quality, time and cost are the important aspects of successful construction project which fulfils the main goal of construction industry. In Indian construction industries like residential, commercial, educational, etc risk is the main factor that can affects the period of construction and cause the delay of construction work. In this study, the various risks such as financial risk, environmental risk, material risk, labour risk, political risk are analysed by primavera risk analysis (PRA) software. Scheduling is done properly by risk management to obtaining the required time for construction and probability of start and finish date of construction project was done by PRA software.

Keywords: Planning, Project management, Resource constraints, Risk analysis, Primavera

1. Introduction

A development venture's mission is to create an ideal office, such as a lodging complex or a compost plant, with predetermined execution targets defined in terms of quality determinations, completion time, budgeted costs, and other specified specifications. It is not a common occurrence, such as the routine maintenance of buildings or highways [1]. Quality is one of the main factors in the success of construction projects. Quality of construction projects, as well as project success, can be regarded as the fulfillment of expectations (i.e. the satisfaction) of the project participants. Quality, cost and time have been recognized as the main factors concerning the client [2]. However, for the majority of projects, the cost and time parameters are the main pre occupying factors for construction project. The quality in the construction industry is linked with satisfaction of the client and the implementation of a quality management system is a key tool in consistently and reliably managing the goal of client satisfaction. Quality management system (QMS) could be implemented either at the organization level or at the project level itself [3]. Construction industry is the second largest industry in India. The time available for achieving its goal is shrinking. There are so many taken care of as Project management is the procedure of the utilization of learning, aptitudes, devices, and strategies to extend exercises to meet venture prerequisites [4].

The economic and financial effects have undesirable impact in construction sector. Construction sector, are one of the engines in economic growth over the past decades, which is facing with serious challenges as companies closures, increase in unemployment and even investment cancel. Due to increase in competition among different companies of the construction sector increases the pressure to improve the quality, efficiency and reduce cost is necessary for project strategies and management which can appropriately and effectively manage project risk [5]. Construction projects can be extremely complex and fraught with uncertainty. risk and uncertainty can potentially be damaging consequence for the construction project. It is always unique and risk raise from a number of the different sources. They are extremely difficult and dynamic involving in huge multiple processes. Lots of individuals, workers in construction industry, organisation are actively involved in the construction projects participation may be positively and negatively affects the result of project

completion [6]. Which naturally ends with risk like time, cost and quality outcomes. Present challenges and economic development is highly competitive in construction sector which require contractors to manage risk by their own. The various types of risk in construction project are (a) Pure and particular risk (b) Fundamental risk and (c) Speculative risk.

Previously many literatures have done the various risk analysis on construction Abdul Aziz et al. (1999) analysed the quality systems involved with the internal and external aspects. The Successful implementation of quality management system can contribute to an increase in product quality [7]. Mohamed et al. used the PERT-Master Primevera risk analysis tool for information gathering techniques. A total number of fourty four risk events related to different risk categories were identified by the end of risk identification process [8]. According to Danish Ali and Alvin Harison the risk management concept is essential in reducing losses [9]. Gupta et al suggested that risk management in the construction project management context is a comprehensive and systematic way of identifying, analysing and responding to risks to achieve the project objectives [10].

Primavera is project portfolio management software for businesses. It has project management, scheduling, risk analysis, chance management, resource management, collaboration, and control features, as well as the ability to integrate with other enterprise software like Oracle [11]. It is the software which can be used for small as well as large project. In this software we can control and monitor as many projects at one time.

2. Objectives

The salient objectives of the present study have been identified as follows:

- To prepare construction schedule for selected plan
- To assign uncertainity in the schedule prepared
- To perform simulation in order to get expected duration of the project
- To compare the result obtained in simulation with PERT calculations
- To conclude on period of completion of construction of project with the help of PRA
- To rank the different risks as per significance of activities and probability of event utilizing Primavera software
- Handing over the risk appraisal activity for accomplish the risk
- For getting great consideration to task and activity-oriented process
- Examination of risk factors for mitigation purpose

3. Methodology

Identifying risks and documenting their features is the process of assessing which risks may affect the project. Because new risks may emerge or become recognized as the project progresses through its life cycle, identifying risks is an iterative process. The process of creating a schedule begins with the gathering of information such as the project start date and the activities involved in its construction. Any structural activity sequences, durations for each and every activity, resources required for each and every activity and their quantities, and costs spent on each and every activity. The data is entered into the software, and the relationships between the operations are listed in the order in which they were gathered. The process of numerically assessing the impact of identified risks on overall project goals using modeling and simulation is

known as quantitative risk analysis. We quantify the cost of the execution work and the planned time for the project's construction work by assessing the risk and scheduling. The efficient growth of infrastructure through construction is an increasing source of interest and research. One of the difficulties in achieving optimal construction is the risk and uncertainty that projects face as a result of assessing and immerging conditions in the project lifecycles, organization, and environment. We examine the impacts on the cost and duration of construction work by assessing risk and uncertainties. The PERT and PRA techniques are often used in simulations. In a simulation, the project model is computed several times (iterated), with the input values selected at random from the probability distributions of these variables for each iteration. The iterations are used to create a histogram.

4. Results and discussion

Problem in excavation in foundation: In this project, excavation and compaction work (A1010) causes delay in the project. Because very big boulder is present in the place where the excavation was has to be done. Large amount of time was to be taken for breaking these boulders. It takes two days. This activity can also affect the others activities, which was started after the ending of excavation. These delays can because of the improper testing of the soil strata.

Late start of work: The water proofing and pile head treatment was late started because the excavation in foundation can take more time as compared to as planned schedule. The excavation and compaction work are delayed for two months. And due to this the water proofing and pile head treatment was two days late started.

Data analysis: Response analysis table is created and its results are tabulated. At the time of calculation, only the probability parameter is taken into consideration. In this analysis probability is taken as per filled in survey report and impact is taken from cost. Table 1 shows priority score calculation and table 2 shows Priority Score Criteria.

For example:

Probability = 5
Impact = 5
Probability score = 5 x 5 = 25

As per this data, the sheet is filled for all risks and analysis was done. In the analysis table 3 shows activity status report, table 4 represents resource and role assignments, table 5 shows work-breakdown structure (WBS) earned value, table 6 shows WBS costs, table 7 shows activity labour and table 8 represents resource assignments. Figure 1 shows____ and Figure 2 shows ____.

Probability	Impact	
5>70%	5 = Critical	Priority Score = Probability x Impact
4>50%	4 = Severe	
3>30%	3 = Major	
2>10%	2 = Moderate	
1>0%	1 = Minor	

Table 1 Priority score calculation

Name	Probability	Impact	Probability Score
1) Time			
Logistical risk	4	3	12
Centring work not completed in time	2	2	4
Financial problems of the firm	5	5	25
Windows are not ready to fix	3	4	12
2) Quality			
Not proper supervision	1	2	2
An improper mixture of material	3	2	6
3)Project Management			
Improper selection of site	3	4	12
Planning and designing	2	2	4
Government rules and regulations	2	2	4
Rera effect on booking	3	3	9
4) Contract			
Change in contractors demand	2	2	4
Not using a selected material	2	1	2
5) People			
Health and safety of labours	4	4	16
Strike of labours	5	5	25
Thieves on site	2	2	4
Lack of skilled labour	1	3	3
Line out of blocks is improper	3	3	9
Unskilled labours doing electrical work	3	3	9
Scaffolding not properly	2	2	4

Table 2 Priority Score Criteria

WBS Activity ID	Activity Name	Original Duration	Remaining Duration	Activity % Complete	Primary Resource	Early Start	Early Finish
APARTMENT BUILDING CONSTRUCTION							
SUB STRUCTURE							
A1000	SITE CLEANING	5	0	100%	Ap.Engineer	01-Mar-21 A	05-Mar-21 A
A1010	EXCAVATION	3	0	100%	R B 3.MEN MAZDOOR	08-Mar-21 A	10-Mar-21 A
A1030	FOOTING AND COLUMN REINF WORKS	10	0	100%	HB-12.HB STEEL FABRICATION	08-Mar-21 A	22-Mar-21 A
A1020	COLUMN MARKING	2	0	100%	Ap 2 .surveyor	11-Mar-21 A	12-Mar-21 A
A1080	GF SLAB CONCRETE	1	1	0%		15-Mar-21	15-Mar-21
A1040	FOOTING CONCRETE	1	0	100%	HB-8.HB MASON	22-Mar-21 A	22-Mar-21 A
A1050	REFILLING	2	2	0%		23-Mar-21	24-Mar-21
A1060	COLUMN CONCRETE	1	1	0%		25-Mar-21	25-Mar-21
A1070	SLAB AND BEAM REINF WORKS	10	10	0%		25-Mar-21	07-Apr-21
GROUND FLOOR							
A1090	COLUMN MAKING	1	1	0%		15-Mar-21	15-Mar-21
A1100	COLUMN CONCRETE	1	1	0%		15-Mar-21	15-Mar-21
A1120	SILL CONCRETE	1	1	0%		15-Mar-21	15-Mar-21
A1130	LINTEL CONCRETE	1	1	0%		15-Mar-21	15-Mar-21
A1110	BRICK WORK STARTING	10	10	0%		15-Mar-21	26-Mar-21
Total		**28**	**18**			**01-Mar-21 A**	**07-Apr-21**

Table 3 Activity status report

Activity Name / Resource ID	Name	Cost Account	Budgeted Units	% Complete	Actual Units	Actual This Period Units	Remaining Units	At Completion Units
A1000	A1000 SITE CLEANING	RD 0	01-Mar-21 A	05-Mar-21 A				
Ap.Engineer			40	100%	40	40	0	40
Ap 1 .Site Engineer			40	100%	40	40	0	40
Ap 2 .surveyor			40	100%	40	40	0	40
R B 3.MEN MAZDOOR			40	100%	40	40	0	40
Subtotal			**160**	**100%**	**160**	**160**	**0**	**160**
A1010	A1010 EXCAVATION	RD 0	08-Mar-21 A	10-Mar-21 A				
R B 3.MEN MAZDOOR			24	100%	24	24	0	24
R B. SITE ENGINEER			24	100%	24	24	0	24
R B 4.WOMEN MAZDOOR			24	100%	24	24	0	24
R B 5.JCB			24	100%	24	24	0	24
Subtotal			**96**	**100%**	**96**	**96**	**0**	**96**
A1020	A1020 COLUMN MARKING	RD 0	11-Mar-21 A	12-Mar-21 A				
Ap 2 .surveyor			16	100%	16	16	0	16
Ap 1 .Site Engineer			16	100%	16	16	0	16
R B 2.MASON			16	100%	16	16	0	16
R B 3.MEN MAZDOOR			16	100%	16	16	0	16
Subtotal			**64**	**100%**	**64**	**64**	**0**	**64**
A1030	A1030 FOOTING AND COLUMN REINF WORKS	RD 0	08-Mar-21 A	22-Mar-21 A				
HB-12.HB STEEL FABRICATION			80	100%	80	80	0	80
Subtotal			**80**	**100%**	**80**	**80**	**0**	**80**

Table 4 Resource and role assignments

WBS Code	WBS Name	Planned Value Cost	Earned Value Cost	Actual Cost	Budget At Completion	Estimate To Complete
ABC	APARTMENT BUILDING CONSTRUCTION	Rs61,920	Rs79,600	Rs79,600	Rs79,600	Rs0
ABC.SUB ST	SUB STRUCTURE	Rs61,920	Rs79,600	Rs79,600	Rs79,600	Rs0
ABC.GF	GROUND FLOOR	Rs0	Rs0	Rs0	Rs0	Rs0
ABC.FF	FIRST FLOOR	Rs0	Rs0	Rs0	Rs0	Rs0
ABC.SF	SECOND FLOOR	Rs0	Rs0	Rs0	Rs0	Rs0
ABC.FINAL	FINISHING WORKS	Rs0	Rs0	Rs0	Rs0	Rs0
Total		**Rs61,920**	**Rs79,600**	**Rs79,600**	**Rs79,600**	**Rs0**

Table 5 WBS earned value

WBS Code	WBS Name	BL Total Cost	Actual Total Cost	Remaining Total Cost	Variance - Total Cost
ABC	APARTMENT BUILDING CONSTRUCTION	Rs79,600	Rs79,600	Rs0	Rs0
ABC.SUB ST	SUB STRUCTURE	Rs79,600	Rs79,600	Rs0	Rs0
ABC.GF	GROUND FLOOR	Rs0	Rs0	Rs0	Rs0
ABC.FF	FIRST FLOOR	Rs0	Rs0	Rs0	Rs0
ABC.SF	SECOND FLOOR	Rs0	Rs0	Rs0	Rs0
ABC.FINAL	FINISHING WORKS	Rs0	Rs0	Rs0	Rs0
Total		**Rs79,600**	**Rs79,600**	**Rs0**	**Rs0**

Table 6 WBS costs

WBS / Activity ID		Activity Name	Activity Status	BL Labor Units	Actual Labor Units	Remaining Labor Units
AE	APART ENGGINEER					
ABC	APARTMENT BUILDING CONSTRUCTION					
ABC.SUB ST	SUB STRUCTURE					
A1000		SITE CLEANING	Completed	160	160	0
A1010		EXCAVATION	Completed	72	72	0
A1020		COLUMN MARKING	Completed	64	64	0
A1030		FOOTING AND COLUMN REINF WORKS	Completed	80	80	0
A1040		FOOTING CONCRETE	Completed	24	24	0
A1050		REFILLING	Not Started	0	0	0
A1060		COLUMN CONCRETE	Not Started	0	0	0
A1070		SLAB AND BEAM REINF	Not Started	0	0	0
A1080		GF SLAB CONCRETE	Not Started	0	0	0
Subtotal				**400**	**400**	**0**
ABC.GF	GROUND FLOOR					
A1090		COLUMN MAKING	Not Started	0	0	0
A1100		COLUMN CONCRETE	Not Started	0	0	0
A1110		BRICK WORK STARTING	Not Started	0	0	0
A1120		SILL CONCRETE	Not Started	0	0	0
A1130		LINTEL CONCRETE	Not Started	0	0	0
Subtotal				**0**	**0**	**0**

Table 7 Activity Labour

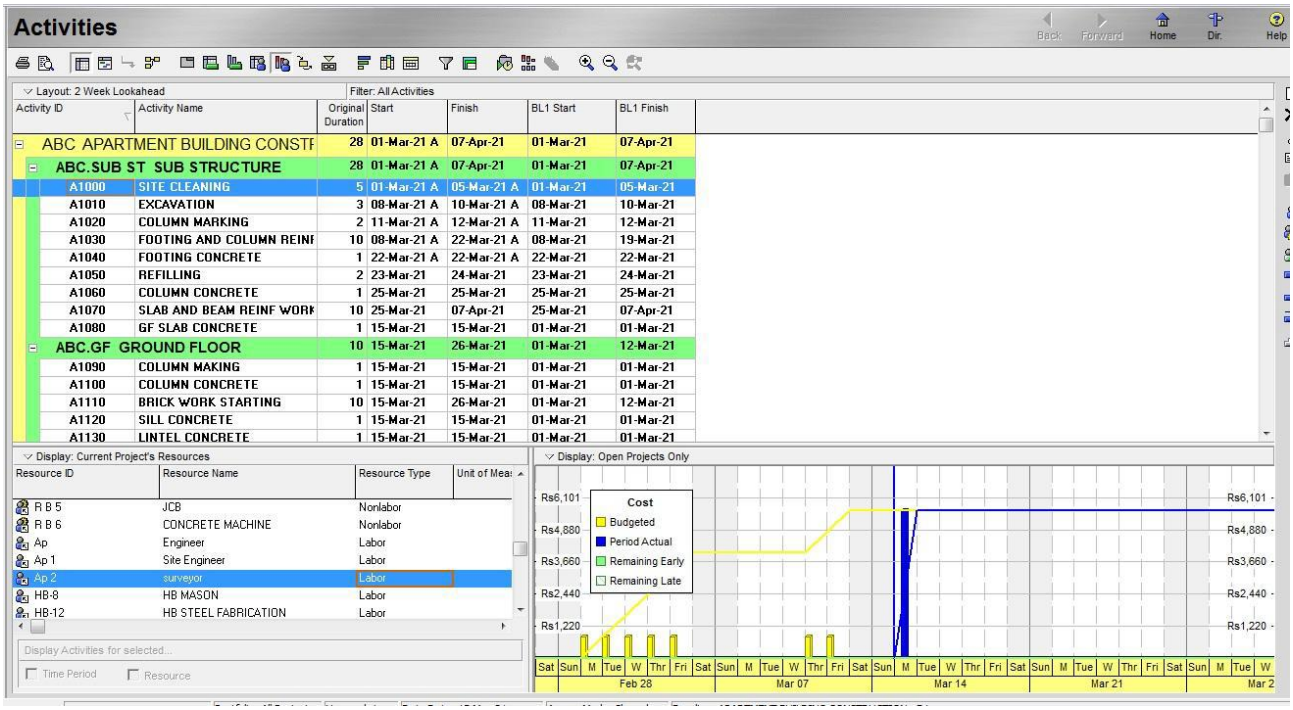

Figure 1

Resource Code / Project Code	Resource Name / WBS Code	Activity Code	Activity		Planned Units	Planned Duration	Planned Start	Planned Finish
R B	**SITE ENGINEER**							
ABC	ABC.SUB ST	A1010	EXCAVATION		24	3	08-Mar-21	10-Mar-21
				Total	**24**			
R B 2	**MASON**							
ABC	ABC.SUB ST	A1020	COLUMN MARKING		16	2	11-Mar-21	12-Mar-21
				Total	**16**			
R B 3	**MEN MAZDOOR**							
ABC	ABC.SUB ST	A1000	SITE CLEANING		40	5	01-Mar-21	05-Mar-21
ABC	ABC.SUB ST	A1010	EXCAVATION		24	3	08-Mar-21	10-Mar-21
ABC	ABC.SUB ST	A1020	COLUMN MARKING		16	2	11-Mar-21	12-Mar-21
				Total	**80**			
R B 4	**WOMEN MAZDOOR**							
ABC	ABC.SUB ST	A1010	EXCAVATION		24	3	08-Mar-21	10-Mar-21
				Total	**24**			
R B 5	**JCB**							

Table 8 Resource assignments

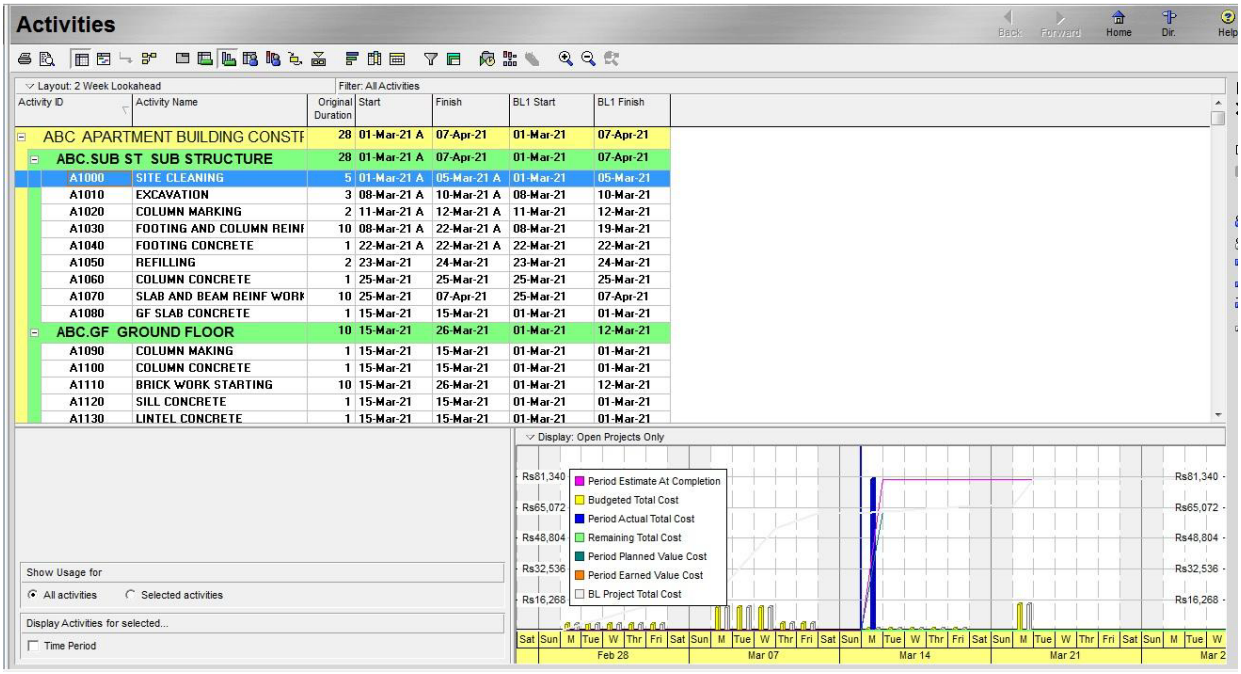

Figure 2

5. Conclusions

The proposed projection of risks impact and analysis will help the company in saving the cost and timelines on implementation. We can estimate at least 20% of cost saving if they implement even to 70% of one proposed suggestion. For the project manager, it is very helpful to take decisions and consider these risk factors during the planning process of the similar projects thus by avoiding the extra expenses due to the risks. The study also conclude the following based on Primavera Risk Analysis

- Using Primavera Risk Analysis, It can be estimated that how long any building project will take.
- We should assign alternate tasks based on the findings of the Primavera Risk Analysis. This would assist in covering the entire project's delay.
- The number of iterations is limited to 10000. This is not appropriate for large-scale projects that require precision in risk analysis.

References

1. Subramani, T., Jabasingh, D. S., & Jayalakshmi, J. (2014). Analysis of cost controlling in construction industries by earned value method using Primavera. International Journal of Engineering Research and Applications, 4(6), 145-153.
2. Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. International journal of project management, 17(6), 337-342.

3. Willar, D., Trigunarsyah, B., & Coffey, V. (2016). Organisational culture and quality management system implementation in Indonesian construction companies. Engineering, Construction and Architectural Management.
4. Walker, A. (2015). Project management in construction. John Wiley & Sons.
5. Kartam, N., Al-Mutairi, N., Al-Ghusain, I., & Al-Humoud, J. (2004). Environmental management of construction and demolition waste in Kuwait. Waste management, 24(10), 1049-1059.
6. Zhi, H. (1995). Risk management for overseas construction projects. International journal of project management, 13(4), 231-237.
7. Bubshait, A. A., & Al-Atiq, T. H. (1999). ISO 9000 quality standards in construction. Journal of Management in Engineering, 15(6), 41-46.
8. Mohamed A. A. Saber K.E And Mohamed A.S,(2018), "Risk Analysis Related To Costing And Scheduling Of Construction Projects",POICOIE,6(8)
9. Ali, D., & Harison, A. (2016). Risk Management Strategies In Construction Companies In India. IJIRST, 2(10), 6-8.
10. Gupta, D., Sharma, M., & Trivedi, A. S. (2015). Risk management in construction projects of developing countries. J Eng Res Appl, 5(11), 154-156.
11. Reddy, B. S. K., Nagaraju, S. K., & Salman, M. D. (2015). A study on optimisation of resources for multiple projects by using primavera. Journal of Engineering Science and Technology, 10(2), 235-248.