

“RISK ASSESSMENT OF CONSTRUCTION PROJECT BY EARNED VALUE APPROACH”

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ABSTRACT

Risk management is the systematic process of identifying, analyzing, and responding to project risk. The process of risk analysis includes qualitative and quantitative analysis. The qualitative risk analysis is done by prioritizing the identified risk factors based on their probability and impact. The quantitative risk analysis is expressed in terms of monetary value and schedule. The aim of this study is to use earned value management as a quantitative method to risk analysis. The earned value analysis can be used to predict the cost at completion and percentage of completion with reference to the baseline estimate, schedule and actual. This method of quantitative analysis considers financial risk and schedule risk as major factor in the execution of project. When the difference between planned value and earned value is observed the risk factors involved can be identified using Deviation Report of Project. Similarly, the quantification for risk can be made by the performance indicators obtained in the earned value analysis. In this way progress of the project can be analyzed and also proactive risk analysis can be done for further completion of the project. Thus earned value management, risk management and material management can be integrated to prevent delay and improve performance of the project.

Key Words: Earned Value Management, Quantitative Risk Analysis, Quantitative Risk Analysis, Project BOQ Sheet (Measurement Sheet and Abstract sheet), Deviation Report of Project

1. INTRODUCTION

1.1 General

The phenomenon of risk is a subject of investigation for many both practitioners and theorists. However, only a few of them take these problems and try to formulate the problem within the framework of a procedure. In many publications, the authors deal with the problem of identification of hazards areas and their classification in different groups, among others, due to the source of origin, the impact size, etc. The number of papers proposing a methodology of quantifying of the risk and elaboration of procedures for the adoption of appropriate actions (so called “an appropriate strategy on risk response”) is relatively lower. This paper briefly outlines the area of risk management in the construction project.

Risk analysis is regarded as the procedure involving the critical evaluation of prospective risks, arranging them according to importance, and allowing the management team to select the important ones. Risk analysis is the most tasking procedure in managing risk. This is due to the fact that it involves assessing the chances of the event of a risk and their outcomes on a project's objectives. Its main aim is to evaluate risk by separating the unnecessary events, the chances of the unwanted event happening, and the size of such events. Risk analysis includes uncertainty in a qualitative and quantitative manner to evaluate the potential effects of risk. The evaluation should largely focus on risks that have high chances or effects.

In risk analysis, two main approaches are broadly used. They are: qualitative risk analysis and quantitative risk analysis and sub-category semi-quantitative. The choice of method depends on the following: the type and magnitude of the intended project, available information, the financial implication and time available, the experience of the analysts, the extent of innovation and the ultimate purpose of the results. Quantitative approach is primarily based on probability spreading of risks. However, if sufficient data are available it can provide objective results. Qualitative method on the other hand, is subject to personal experience, intuition and judgment.

The outcomes can therefore significantly vary from one analyst to another. Consequently, the quantitative

approach remains the preferred option by most practitioners.

1.2 Problem Identification-

In the any MNC construction Building project, risk is always available in the procurement process, we have to minimize the risk by identifying that risk and prevent remedial on Particular risk. The earned value analysis can be used to predict the cost at completion and percentage of completion with reference to the baseline estimate, schedule and actual. This method of quantitative analysis considers financial risk and schedule risk as major factor in the execution of project When the difference between planned value and earned value is observed the risk factors involved can be identified using Deviation Report of Project. Similarly, the quantification for risk can be made by the performance indicators obtained in the earned value analysis. In this way progress of the project can be analyzed and also proactive risk analysis can be done for further completion of the project. Thus earned value management, risk management and material management can be integrated to prevent delay and improve performance of the project.

2. METHODOLOGY

The assessment of time and cost related risk is made through the application of Earned Value Management. Earned value management (EVM) and risk management (RM) processes share a common aim of providing decision makers with the best information available when setting objectives and considering management strategies. However, they take differing approaches. The Earned Value Management can be used for forecasting the time schedule and cost estimation and hence can be integrating to predict the unexpected occurrence of risk in the project. EVM establishes project performance status and extrapolates that information to gain an understanding of future trends and the allocation of resource needed to successfully meet these objectives. RM looks to the unknown future to identify risks (threat and opportunity) and recommend early action to be taken to limit the impact and probability of threat occurrence or maximize the exploitation of opportunities. Both EVM and RM are, in their own way, informing project baseline estimates by using both objective and subjective data. Estimating uncertainty can be reduced by comparison of data outputs from both disciplines, providing a better understanding of project progress and predicted future trends.

Earned Value Management Index (CPI, SPI) shows advanced deviations from the program and can show the effectiveness of risk process in the assessment of uncertainty-

- 1) If CPI or SPI is less than 1, project progress is further back to program, and one of its reasons is risk process failure in keeping project on the primary base. And when these risks are turned into problems, there will be delay or additional cost in project. In this case, the manager should consider risk management and evaluate its efficiency.
- 2) If CPI or SPI is higher than 1, the development project has been more than the program and the risk. process must focus on the use of available opportunities, it examines the best risk management process and the opportunity together and seeks to minimize risk and maximize opportunity. When the Earned Value Management represents opportunities in the project, the risk process identifies these opportunities.
- 3) 3. It should be noted, being too high CPI or SPI (much greater than 1) does not represent an opportunity for project but also show there are other problems in the project. Usually, if real progress is so much more expected program, it can be concluded that in determining the initial baseline, a poor planning has been done or areas. have been marked by mistake.
- 4) Similarly, if the CPI or SPI is so much less than 1, it is not only the result of not managed risks, it can also be the result of problems in the program or scope baseline.

3. DATA COLLECTION

The data for the study is collected from the project involving the construction of Police Station at Kopargaon Dist. Ahmednagar. This is a Government Project having Contract Value was 2 Crores and the planned duration for the project was 12 months. The project commenced on 02.07.2019 and the completion period was planned to be 01.07.2020. Only 70.56% of work is accomplished in the contract period. After that Project is extend 4 months more and then Complete that Project on 10.10.2020. As Per the BOQ Sheet Tender Calculations and Calculation of actual execution, In this we Prepared Deviation Report Which Gives Us Actual Cost(AC), Planned Value(PV), Execution Value (EV). Following Results are coming,

4. RESULT AND DISCUSSION

Deviation Report

DEVIATION STATEMENT													
Name of Work : Construction of 112 Residential Quarter including all infrastructural amenities for S.P. Shirdi at Ahmednagar.													
Contractor- Shrinath Construction						Architect- Ar. Dhanu Bhutada							
Agreement No. : 23/2019-20													
Sr.No	Description	Qty	Rate	Amount	Qty	Rate	Amount	Qty	Rate	Amount	EXCESS	SAVING	CAUSE OF QUANTITY VARIATION
CITY POLICE STATION KOPARGAON													
1	Excavation upto 1.5m	1213.20	165.25	200481.30	1213.20	155.00	188046.00	1555.00	170.00	264350.00	63868.70		20/08/2019 Due to Slippery Black Cotton soil
2	Excavation upto 1.5 to 3m	1564.01	194.50	304101.89	1564.01	175.00	273703.50	2100.00	195.00	409500.00	105298.11		20/08/2019 Due to Slippery Black Cotton soil
3	Filling in plinth and floors	2893.71	651.31	1884383.95	2900.00	600.00	1740000.00	3520.28	620.00	2182573.91	298189.96		20/08/2019 Excess Back Filling Due to excess Excavation
4	Providing rubble stone soling	206.58	1448.95	299124.09	206.58	1448.95	299124.09	206.40	1448.95	299069.90		263.19	28/08/2019 place 230mm soling
5	Providing preconstructional and termite treatment	1184.93	76.87	91085.57	1200.00	76.87	92244.00	1550.00	76.87	119148.50	28062.93		20/08/2019 Excess Excavation
6	PCC M-10 for foundation and bedding	44.92	4813.07	216203.10	44.92	4813.07	216203.10	70.54	4813.07	339523.34	123319.24		20/08/2019 Change in Footing Size
7	Cement concrete M-25 for R.C.C. work in foundations and footings	132.46	6121.93	810910.85	132.46	6000.00	794760.00	138.53	6000.00	831204.00	20243.15		20/05/2019 AS PER GFC DRAWING
8	Cement concrete M-25 for R.C.C. work for												
i	Ground Floor	16.62	11126.87	184928.58	16.62	11100.00	184482.00	17.39	11100.00	192973.50	8044.92		20/05/2019 AS PER GFC DRAWING
ii	Column upto Ground to Plinth	6.95	11126.87	77331.75	6.95	11100.00	77145.00	5.22	11100.00	57892.05	19439.70		20/05/2019 AS PER GFC DRAWING
iii	GF Slab Beam	20.86	11230.58	234196.51	20.86	11100.00	231546.00	20.86	11100.00	231546.00		538.31	20/05/2019 AS PER GFC DRAWING
iv	Column for First Floor	26.86	11230.58	301653.38	26.86	11100.00	298146.00	26.87	11100.00	298201.50		3451.88	20/05/2019 AS PER GFC DRAWING
9	Cement concrete M-25 for R.C.C. work for Beam & Lintel												
i	Ground Beams	11.97	10002.63	119701.88	11.97	9950.00	119131.50	13.00	9950.00	129350.00	9979.12		20/05/2019 AS PER GFC DRAWING
ii	Plinth Beams	34.06	10002.63	341370.78	34.06	9950.00	338970.00	35.82	9950.00	356406.99	15036.21		20/05/2019 AS PER GFC DRAWING
iii	Lintel Beams	4.57	10002.63	45803.42	4.57	9950.00	45471.50	4.57	9950.00	45471.50			
iv	GF Slab Beam	41.34	10002.63	414335.52	41.34	9950.00	411333.00	41.96	9950.00	417531.80	2803.72		20/05/2019 AS PER GFC DRAWING
v	First Floor Lintel Beams	4.37	10115.71	44205.65	4.37	10100.00	44137.00	4.43	10100.00	44760.68	555.02		20/05/2019 AS PER GFC DRAWING
vi	First Floor Slab Beams	40.12	10115.71	406842.29	40.12	10100.00	405212.00	39.64	10100.00	400410.86	5431.42		20/05/2019 AS PER GFC DRAWING
10	Cement concrete M-25 for R.C.C. work for Slab												
i	Ground Floor	60.78	11340.38	677112.30	60.78	11340.38	677112.30	60.79	11340.38	677225.73	113.44		20/05/2019 AS PER GFC DRAWING
ii	First Floor	80.22	11244.22	902011.33	80.22	11244.22	902011.33	80.19	11244.22	901665.71	345.62		20/05/2019 AS PER GFC DRAWING
11	Cement concrete M-25 for R.C.C. work for RCC												
i	Ground Floor	3.09	11000.14	33990.43	3.09	11000.14	33990.43	3.10	11000.14	34056.43	66.00		20/05/2019 AS PER GFC DRAWING
ii	First Floor	3.97	11102.63	44077.44	3.97	11102.63	44077.44	3.98	11102.63	44156.26	88.82		20/05/2019 AS PER GFC DRAWING
12	Cement concrete M-25 for R.C.C. Part												
i	Ground Floor	34.78	12351.62	429589.34	34.78	12351.62	429589.34	34.50	12351.62	426167.94	3421.40		20/05/2019 AS PER GFC DRAWING
ii	First Floor	19.35	12467.12	241238.77	19.35	12467.12	241238.77	20.00	12467.12	249342.40	8033.63		20/05/2019 AS PER GFC DRAWING
13	Reinforcement steel												
A	Quantity Of Reinforcement upto Plinth												
i	Foundations	5.37	66476.97	357180.76	6.00	65200.00	391200.00	6.00	65200.00	391200.00	34019.24		20/05/2019 AS PER GFC DRAWING
ii	Plinth Beams	9.01	66476.97	598891.02	8.00	65200.00	521600.00	9.50	65200.00	619400.00	20508.98		20/05/2019 AS PER GFC DRAWING
iii	Columns, Lift well	7.01	66476.97	466289.47	7.50	65200.00	489000.00	7.81	65200.00	457312.88			
iv	Septic tank Water Tank	2.08	66476.97	138072.67	2.20	65200.00	143440.00	2.25	65200.00	146700.00			
B	Quantity Of Reinforcement upto Ground Floor												
i	Columns	5.29	66476.97	351330.79	5.29	65200.00	344582.00	5.29	65200.00	344582.00			
ii	Beams	7.16	66476.97	475642.72	7.16	65200.00	466596.00	7.16	65200.00	466596.00			
iii	Slab, Chajja, Part, St. case	6.77	66476.97	449783.18	6.77	65200.00	441143.20	6.77	65200.00	441143.20			
C	Quantity Of Reinforcement in First Floor												
i	Columns	4.63	67116.91	310617.06	4.63	65300.00	302208.40	4.63	65300.00	302208.40			
ii	Beams	6.07	67116.91	407389.64	6.07	65300.00	396371.00	6.07	65300.00	396371.00			
iii	Slab, Chajja, Part, St. case	9.14	67116.91	613112.97	9.14	65300.00	596515.50	9.14	65300.00	596515.50			
14	Providing Autoclaved Aerated Concrete Block Masonry of Escalite												
i	Ground Floor	52.50	5512.91	289427.78	52.50	5512.91	289427.78	53.84	5512.91	297366.37	7938.59		20/05/2019 AS PER GFC DRAWING
ii	First Floor	96.11	5565.98	534946.34	96.11	5565.98	534946.34	97.97	5565.98	544998.20	10052.16		20/05/2019 AS PER GFC DRAWING
15	Providing Autoclaved Aerated Concrete Block Masonry of Escalite												
i	Ground Floor	249.06	712.62	177485.14	249.06	712.62	177485.14	249.06	712.62	177485.14			
ii	First Floor	188.10	719.48	135334.19	188.10	719.48	135334.19	188.10	719.48	135334.19			

and the Actual value is high.

5. CONCLUSIONS

The character and specifics of the construction industry makes that the analysis of the impact of risk factors on a construction project is more often taken, despite the major difficulties of their quantification. The problem of risk management is not only current but it is essential for the efficient planning and realization of a construction project. Risk Analysis is carried out to mitigate the consequences of a negative event such as risk. The probability and impact are obtained through qualitative risk analysis whereas the quantification for risk is obtained in the quantitative risk analysis.

The study conducted in the initial stages was aimed at identifying the risk analysis method and risk factors through review of literature. Though quantitative risk analysis is carried out after the identifying the risk factors through qualitative risk analysis, this study aimed at considering the cost and time factors and carrying out quantitative risk analysis.

This study is aimed at identifying the factors affecting the progress of construction projects. The study investigates the variances and performance indicators through earned value analysis.

The cost and schedule data collected are subjected to analysis and the results obtained are related to the activities in the project where the probability of risk is Moderate. The basic idea of the study is to obtain quantification to risk in the procurement process of construction project. We get some major factors that causes the delay of project and increase the cost of project given in below,

- The major factors that caused the delay of the project and increase the cost of project are -
 - The delay due to the procurement of Process in the initial Stage, due to Black Cotton Soil in rainy Season Excavation was delay.
 - Delay due to the method of used in the project
 - Delay in land acquisition process of Existing Building from Police office.
 - Delay due to the Lack of Material Management in the January & February month of 2020.
 - Delay caused due to technical issues caused by human errors.

6. FUTURE SCOPE

- With the help of Deviation Report we can actually compare between the Actual cost, earned value and Planned cost and Find out the Risk in the Project and analysis it by the its impact on the project.
- This method of quantitative analysis considers financial risk and schedule risk as major factor in the execution of project When the difference between planned value and earned value is observed the risk factors involved can be identified using Deviation Report of Project.
- Similarly, the quantification for risk can be made by the performance indicators obtained in the earned value analysis. In this way progress of the project can be analyzed and also proactive risk analysis can be done for further completion of the project.
- Thus earned value management, risk management and material management with Deviation Report can be integrated to prevent delay and improve performance of the project.

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