IMPLEMENTATION OF EARNED VALUE ANALYSIS TO TRACK AND FORECAST THE PROGRESS OF THE PROJECT: A CASE STUDY AT PRESTIGE PINEWOOD

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Abstract
Earned Value Analysis is a standard method used in industrial projects to measure the current progress or progress at any given point of time, forecasting the finish date and final cost of the project and it also analyses the various variances like the schedule variance and cost variance of the project as the proceeding of the project takes place. Earned value Analysis gives a detailed statistical data regarding where the project had to be and where the project is and how much cost had to be spent and how much is being spent.
Keywords: Actual Cost, Baseline Schedule, Earned Value, Earned Value Analysis, Earned Value Management, Planned cost.

I. INTRODUCTION

In a project, it is very important to develop the project plan before the actual commencement of the work. This feature of developing the plan is called as project planning. Cost, scope and time are the main aspects of the project planning phase. After the initiation of the first work, tracking of the project is the very next stage of project management. Details collected during the tracking process are called "Actual". Tracking helps in identifying the current status of the project and where the project is heading. Earned value analysis is one of such method which is used in tracking of the progress of the project. Using earned value analysis we can determine the Schedule, cost, and scope performance measurements of a project at the same time

Success of a project can be determined by the synchronization of actual and the planned, cost and schedule. Cost overruns are usually due to the escalation of material cost and delay in schedule.

II. SCOPE AND OBJECTIVES

- To determine the different planning and scheduling activities involved in the project.
- To assign resources to the activities determined.
- Cost estimation of the entire project with respect to schedule, time, materials and the critical activities in the project.
- In order to track the project the variance and indices related to the cost and schedule of the project is developed.
- In order to forecast the project the variance and indices related to the cost and schedule of the project is developed.
- To Measure the project performance at current stage, a cumulative performance till date and forecasting the future performance of the project based on EVM analysis.

III. METHODOLOGY

A. *Plan and schedule the project*:
Scheduling of the activities which is referred as "Baseline Schedule" is prepared using Microsoft Project Software. This is prepared considering the completion date of the project, available resources, productivity of machinery and labor and BOQ. Against this Baseline Schedule, the entire project will be tracked. Tools and methods like Critical Path Method, Program evaluation and review technique, Microsoft Excel and Microsoft Project software are being used.

B. *Earned value analysis*:

Planned value (PV), Actual cost (AC) and Earned value (EV) are the three major parameters that will be considered throughout the project to conduct the Earned Value Analysis. Total budgeted cost, which is allotted for an activity up to its completion time or the total budgeted cost for the entire project until the completion period is termed as Planned Value (PV). The cost incurred during the execution of an activity or the cost incurred during the execution of the entire project with respect to the actual time taken is termed as Actual Cost (AC). Actual cost might include both direct and indirect costs. The approved budget of the work on a given WBS item during the specific time is termed as Earned Value (EV).

C. *Tracking methods*:

Cost variance: It's the difference between Earned Value and Actual cost, which indicates the cost performance of the project. In simpler form it is the difference between what you planned to spend and what you actually spent.

$$CV = EV - AC$$

If CV is +ve then the project is under budget
If CV is –ve then the project is over budget
If CV is 0 then the project is on budget

Cost performance index: It's the ratio between Earned Value and Actual Cost.

$$CPI = EV/AC$$

If CPI>=1 Project is under and on budget
If CPI<1 Project is over budget

Schedule variance: It signifies the schedule performance of the project. It's the difference between Earned Value and Planned Value. In simpler form it is the difference between what you planned to spend and what you actually spent base on being ahead or behind schedule.

$$SV = EV - PV$$

If SV is +ve then the project is ahead schedule
If SV is –ve then the project is behind schedule
If SV is 0 then the project is on schedule

Schedule performance index: It's the ratio between Earned Value and Planned Value.

$$SPI = EV/PV$$

If SPI>=1 Project is ahead or on schedule
If SPI<1 Project is behind schedule

D. Forecasting methods:

Estimate at completion (EAC): To obtain the estimated total cost for a given work breakdown structure item or to estimate the cost at completion multiply the total budgeted cost to the ratio of actual cost by earned value. It shows the current spending pattern which might continue till the completion.

$$EAC = (AC/EV) * \text{total budget}$$

Estimate to completion (ETC): It estimates the total cost which is required at the end of the completion of the project, if the current pattern is maintained. It also helps to give a clear picture of budget needed to complete the project. The difference between Estimation at Completion and Actual Cost Gives Estimation to completion.

$$ETC = EAC - AC$$

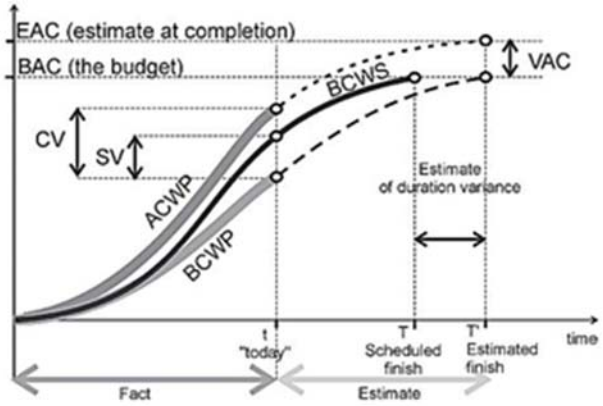

Figure 1.EVM curve and its parameters.

IV CASE STUDY

Prestige Pinewood, Koramangala, Bengaluru is the project selected for the case study. It's a residential apartment with 3 Towers of 2B+G+14 floors in 111715 sft plot area, with club house and amenities. The 2 basements has a capacity of 400 car parking. Total Build up area is 618827 sft . In this project only one tower is considered for the analysis.

TABLE I. PROJECT DETAILS (Tower-3)

Description	Detail
Client	Prestige Group
Contractor	JMC (I) Pvt Ltd
Total duration (T-3)	528days
Total contract Value (T-3)	Rs 290233600

The details required for the Cost estimation and for the Schedule preparation is collected from the site. By using that data total budget for the project and Master schedule is prepared with the help of MS Project software it is shown in TABLE II.

TABLE II. PROJECT COST DETAILS

Description	Cost (Rs)
Preliminary work	14897000
Structural work	152076000
Masonry and finishing	20866000
Plastering work	29236000
Electrical	37318500
Plumbing and sanitary	16335100
Miscellaneous work	19505000
Total	290233600

The baseline for the earned value analysis is obtained in the form of S-curve by plotting duration against planned value of the project. This curve is shown in the below figure.

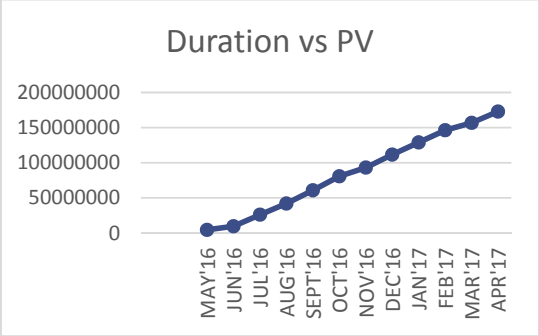

Figure 2. Baseline curve of the Project

TABLE III. CUMMULATIVES OF EV, PV &AC

MONTH	EV	PV	AC
MAY'16	3724250	4469100	4469956
JUN'16	7448500	9686050	9687565
JUL'16	18890400	26185950	26000778
AUG'16	34916740	42108540	42158702
SEPT'16	51845940	60835690	62378427
OCT'16	81502380	80774280	93046134
NOV'16	91565640	93257640	105693306
DEC'16	107273560	111548560	123754251
JAN'17	123234940	128904530	140887962
FEB'17	140704640	146231020	157866829
MAR'17	148718720	156712360	168111943
APR'17	166258450	172919560	184616698

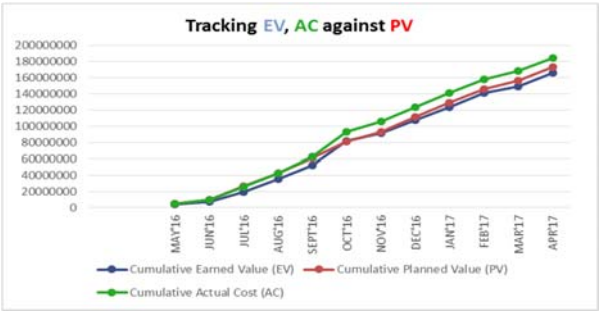

Figure 3. CUMMULATIVES OF EV, PV &AC

TABLE IV. MONTHWISE CPI & SPI

MONTH	CPI	SPI
MAY'16	0.83	0.83
JUN'16	0.77	0.77
JUL'16	0.73	0.72
AUG'16	0.83	0.83
SEPT'16	0.83	0.85
OCT'16	0.88	1.01
NOV'16	0.87	0.98
DEC'16	0.87	0.96
JAN'17	0.87	0.96
FEB'17	0.89	0.96
MAR'17	0.88	0.95
APR'17	0.90	0.96

TABLE V. MONTHWISE CV & SV

MONTH	CV	SV
MAY'16	-745706	-744850
JUN'16	-2239065	-2237550
JUL'16	-7110378	-7295550
AUG'16	-7241962	-7191800
SEPT'16	-10532487	-8989750
OCT'16	-11543754	728100
NOV'16	-14127666	-1692000
DEC'16	-16480691	-4275000
JAN'17	-17653022	-5669590
FEB'17	-17162189	-5526380
MAR'17	-19393223	-7993640
APR'17	-18358248	-6661110

Table VI FORECASTING PARAMETER

MONTH	EAC
MAY'16	260539894
JUN'16	282329083
JUL'16	298782391
AUG'16	262097786
SEPT'16	261173720
OCT'16	247820856
NOV'16	250567510
DEC'16	250424746
JAN'17	248170319
FEB'17	243552323
MAR'17	245382021
APR'17	241044408

V RESULTS

Tracking results of the project can be seen in the month-wise cumulative table and the EV, PV and AC graph. There are no much drastic differences observed. Until September 2016 AC and PV are almost overlapping, after which the actual cost is increased. From October 2016 to January 2017 PV and EV are overlapping. CPI is observed to be less than 1 and SPI is also less than 1 except for the month of Oct ’2016. Similarly all the CV values are in negative and SP value as well except for the month of Oct’2016. Estimation at complete for the month of apr’2017 is rs241044408

VI CONCLUSION

The obtained results are being shown both in the form of tables and graphs. By studying the values it can be concluded that the project is behind schedule and over budget. But studying the CPI and SPI it also can be concluded that significant improvement is seen after oct’2016 to keep the project at schedule and not to exceed the budget.

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