



Use of Earn Value Management in Indian Construction Industry : State of Art

Manojkumar Shukla, R.B.Magar, Abdul Razak. H

AIKTC Panvel, 410206, India

Email: manojk27031990@gmail.com, rajendramagar69@gmail.com

Abstract: Project cost and schedule are the most essential governing factor for the successful completion of a project. Earn Value Management can be used for evaluating the performance of the project. The study deals with the controlling and scheduling of a infrastructure project .EVM technique can do forecasting of duration for a project .It gives a well defined pathway of existence to the project and when to take precautionary measures for updating the project if project is behind the schedule. It can be used to identify the cost overruns and time overruns.EVM technique can be applied using certain software's like MSP, Primavera, etc.

Keywords:EVM,MSP,Primavera,Scheduling,CostControl.

1. INTRODUCTION:

1.1 In today's competitive environment, project managers' need to deliver projects on time and within the budget. They need a system that warns them about the deviations cost or time. Earned value helps them provide these warning signals. Comparison of budgeted amount with the earned value amount gives early warning about the project's health much before the actual cost over runs.

Proper analysis of a project requires four major items: Budget, earned value, actual costs and forecasts. All four are needed to obtain a true picture of the project's health.If you analyze only the budget versus actual costs, an incorrect representation often results. For example, if the project spending is 10% under budget, this might appear as if the project is doing very well. However, when the project status or earned value is added to the analysis, it may show that only half of the originally planned work has been performed. If so, we have a project that is behind schedule, and the completed work costs much more than originally planned (Bhosekar and Vyas, 2012).

1.2 Earned Value Analysis Concept:

Earned Value is a program management technique that uses "work in progress" to indicate what will happen to work in the future. EVA uses cost as the common measure of project cost and schedule performance. It allows the measurement of cost in currency, hours, worker-days, or any other similar quantity that can be used as a common measurement of the values associated with project work. EVA uses the following project parameters to evaluate project performance:

- A) Planned Value
- B) Earned Value
- C) Actual Value

As noted, there are many ways to calculate the EV, PV and AC of work packages that are in progress. Comparison of those figures can serve to identify specific work packages in which performance and progress is inadequate or advanced, which will

hopefully lead to remedial action by the project manager and team. Cost and schedule performance should be measured and analyzed as feasible with regularity and intensity consistent with project management need including the magnitude of performance risk. Analysis should be progressive and should follow the principle of management by exception. Variance thresholds should be established in the planning phase and should be used to guide the examination of performance (Bhosekar and Vyas, 2012).

1.2.1 Budgeted Cost for Work Scheduled (BCWS) – Planned value:

This is defined as the budget or plan for all work packages planned to be completed. The BCWS Curve is derived from the work breakdown structure (WBS), the project budget and the project Master schedule. The cost of each work package is calculated period to period, and the cumulative cost of work packages is shown based on the planned completion dates shown in the master schedule.

1.2.2 Budgeted Cost of Work Performed (BCWP) – Earned Value:

The planned costs of the work allocated to the completed activities are the earned value. The BCWP is calculated from the measured work complete and the budgeted costs for that work. Earned value (BCWP) = Percentage completion of project × Project budget.

1.2.3 Actual Cost of Work Performed (ACWP) – Actual Value:

This is the real cost of the work charged against the completed activities. The ACWP curve is found by actual measurement of the work completed. Actual costs are recorded from invoices and workmen's time sheets. This appears a daunting task but it can be very simple with sufficient planning and organizing.

1.3 Evm Performance Analysis And Forecasting Parameters:

EVM measures project performance for the current period and the cumulative performance till date. The important parameters like variances, indices, and forecasts that were developed using planned value, earned value, and actual cost are discussed here.

1.3.1 Schedule Variance:

Schedule variance (SV) is the difference between the work actually performed (BCWP) and the work scheduled (BCWS). SV is calculated in terms of the difference between the amount of work that should have been completed in a given time period and the work actually completed.

1.3.2 Cost Variance:

Cost variance (CV) is the difference between the planned cost of

work performed (BCWP) and actual cost incurred for the work (ACWP). This is the actual value by which a project is either overrunning or under running its estimated cost.

1.3.3 Cost Performance Index:

Cost performance index (CPI) is the ratio of cost of work performed (BCWP) to actual cost (ACWP). CPI of 1.0 implies that the actual cost matches the estimated cost. CPI greater than 1.0 indicates that the work is accomplished for less cost than what was planned or budgeted. CPI less than 1.0 indicates the project is facing cost overrun.

1.3.4 Schedule Performance Index:

Schedule performance index (SPI) is the ratio of work accomplished (BCWP) versus work planned (BCWS), for a specific time period. SPI indicates the rate at which the project is progressing.

1.3.5 Estimate at Completion:

Estimate at Completion (EAC) is a forecast of total project costs based on project performance. At the start of the project, BAC and EAC will be equal. EAC will vary from BAC when actual costs (ACWP) vary from the planned costs (BCWP).

1.3.6 Estimate to Complete:

Estimate to complete (ETC) is the difference between estimate at completion (EAC) and the actual cost (AC). It is the estimated additional cost to complete the project from any given time.

1.3.7 Variance at Completion:

Variance at Completion (VAC) is the difference between budget at completion (BAC) and estimate at completion (EAC). It is the value by which the project will be over or under budget. These variances, indices, and forecasts can be used to answer the key project management questions.

1.3.8 To-Complete Performance Index (TCPI):

Helps the team determine the efficiency that must be achieved on the remaining work for a Project to meet a specified endpoint, such as BAC or the team's revised EAC $TCPI = \frac{\text{Work Remaining}}{\text{BAC} - \text{ACWP}}$

$(BCWS - BCWP) / \text{Funds Remaining} (BCWS - ACWP)$
(Prasanth and Raja, 2011).

Example for EVM :

Suppose that a 5 km length of road is to be constructed in 5 months at a budgeted cost of Rs. 500 lakh. It is proposed that 1 km of road length will be completed every month and, thus, Rs. 100 lakh is planned or budgeted for each month. At the end of 2 months, suppose that 1.5 km of road length is completed at an actual cost of Rs. 180 lakh. Is the project under-spending or overspending? Is the project behind schedule or ahead of schedule?

The project is clearly behind schedule since only 1.5 km road length has been completed against a planned progress of 2 km road length. The project appears to be 'under budget' because

the budgeted cost at the end of month 2 was supposed to be Rs. 200 lakh (Rs. 100 lakh) for month 1 and Rs. 100 lakh for month 2) and the actual cost during this period has been Rs.180 lakh. However, this seemingly 'under budget' schedule scenario is due to the project being 'behind schedule', which is why less money has been spent.

$BCWS = 200L; ACWP = 180L; BCWP = 1.5 * 100 = 150L$. In fact, according to the earned value method, there is a 'cost overrun' of Rs. 30 lakh at this point of time and a schedule overrun of Rs. 50 lakh. It may be noticed that earned value methodology has measured both schedule and cost in a common unit of measurement, which in this case is rupees, although conventionally the schedule overrun is measured in unit of time. (Construction Project Management by Kumar Neeraj Jha).

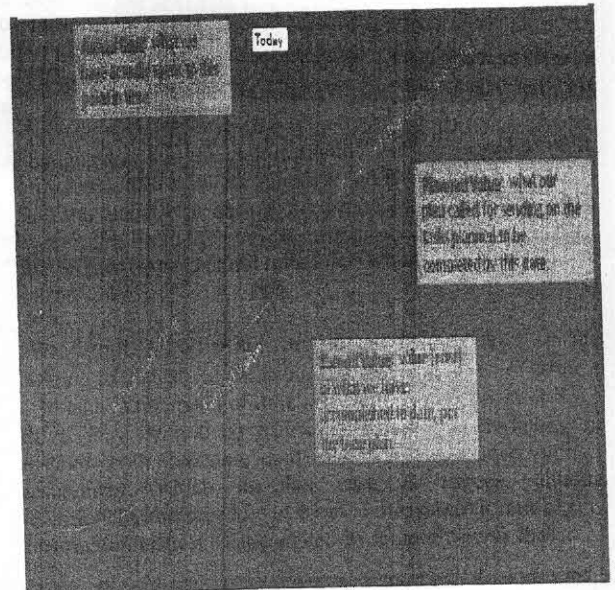


Figure 1 : Standard Earned Value Graph:
(Scale, On X axis =Time (Date), On Y axis = Cost)
(Source: Jha Construction Project Management, 2007)

2. METHODOLOGY & ANALYSIS:

Following methodology is adopted for above study.

1. Study of Earned Value Management Techniques from the published papers and books.
2. Collection of Primary Data (BOQ and MSP schedule) by studying a live Project.
3. Collection of Secondary data by making use of Primavera or MSP for preparing a revised schedule.
4. Creating a Work breakdown and cost schedule structure from which an MS Project/Primavera Schedule is prepared.
5. Analysis of Secondary and Primary Data and application of

Techniques for effective Cost and Time control.

Construction projects are so vast and complex in nature and for simplification of work, use of software's came into use. The project was scheduled and monitored using Primavera P6 software. Primavera software is the Project Management Software use for Planning, scheduling and monitoring the Construction Project. The steps involved in the work of building are as follows. mobilization of site, foundation pcc, steel erection, shuttering, concreting, curing and

for the project is created and several activities are identified. The durations of the activities are estimated on the basis of literature review, interviews with project manager and analysis of rates. The relationships are examined and linked to the activities. The following steps involved in planning and monitoring projects. (Verma et al 2014).

Table 2: Steps in Primavera

Create Project
Define WBS
Creating Calendars
Define Activities
Appoint Activity Durations
Assign Logic Links
Perform Scheduling
Allocating Resources / budgeting
Creating Baselines
Updating Schedule
Earned value analysis

CONCLUSIONS AND SUGGESTIONS:

Earned Value Management is a powerful methodology that helps project manager, program manager and other stakeholders of the project to manage the project more effectively. Earned Schedule is an important extension to EVM. EVM metrics to be transformed to time or duration to enhance the evaluation of project schedule performance. forecast the duration needed to complete the

project. It helps the project managers to understand the time estimates for the completion of the project, and provides further insights for making better decisions about the project schedule and other critical parameters.

Earned Schedule has become a powerful new dimension which gives independent estimates of time with the help of earned value data in terms of time. The application of earned value and earned schedule tools for late finishing construction projects gives better predictions.

This research shall provide early indication of performance of projects based on the schedule and cost analysis and forecasting for the estimated work to complete in a residential high rise project. Using this EVM tool to track a ongoing project is extremely beneficial and gives an immediate feel about the performance of the project.

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