. THE COST CONTROLLING AND MONITORING OF CONSTRUCTION PROJECT THROUGH EARNED VALUE MANAGEMENT SYSTEM

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ABSTRACT

India is one of the most developing countries in the world; various achievements have been made in construction industry. In last few decades, the concept of project management has gained increasing demand among big construction industries. During the construction project it has been observed that certain causes may lead to delay in construction activities. This will result in time and cost overrun in the project. So it has become a major problem to complete the project on schedule and within the estimated cost. As a solution to this, the concept of construction project management by Earned Value Management System (EVMS) is evaluated. Earned Value Management is a powerful methodology used in monitoring and controlling of the project. EVMS is the project management technique developed to measure the performance and progress of the project based on the combination of schedule, cost and work performed. By using this technique, the project status can be investigated in ongoing project at any stage which detects whether the project is under or over budget and behind or ahead of the planned schedule. Also the estimate cost and time required to complete the project from current situation can be investigate.

Keywords- Construction Management, Cost Controlling, Earned Value, Performance Measurement, Monitoring.

I INTRODUCTION

In the world of construction the project manager needs strict monitoring and control over the project. Monitoring is the most important component in project management. It deals with measuring performance of project at certain time interval and reports that performance to organization for process control. After getting such monitored information, the concerned authority decides to take further action to control the project before it become insurmountable. Thus, monitoring and controlling is most important component process throughout entire life of the project.

Construction projects need significant capital investment and the most of which are used up during the execution stage of the project. All construction projects inherit a large degree of risk and may bear the loss, if

the project completion is delayed or the costs are overrun. The traditional method of project cost monitoring is based on simple parameters using two data sources that is the budget (or planned) spending and the actual spending. The comparison of budget versus actual spending merely tells what was planned to be spent versus what was actually spent at any given time. Besides, it does not relate any current performance trend to forecast future performance. Therefore, because of these limitations, the concept of Earned Value Analysis is evaluated for monitoring and controlling project cash flows.

1.1 Need of Earned Value Management System

The Earned Value Management System is needed for following reasons,

1. To check whether we are ahead or behind the schedule of the project.
2. To check whether we are currently under or over budget of the project.
3. To check how efficiently we are working with the project.
4. To know when the project is likely to be complete.
5. To know what is the remaining or entire project is likely to cost.

1.2 Concept of Earned Value Management System

The Earned Value Management system is "a technique developed by a project manager to measure the project performance that integrates scope, schedule and resources of the project. EVMS is a valuable technique to determine real gains and losses on projects and provides a means to balance gains/losses and maximize the gains and also a powerful tool to control simultaneously physical and cost performance. Performance is measured by determining the budgeted cost of work performed (i.e., earned value) and comparing it to the actual cost of work performed (i.e., actual cost). Progress is measured by comparing the earned value to the planned value.

To determine cost performance, EVM compares how much we have spent to what we planned to have spent to do the work we have done. To determine time performance, it compares the amount of work done to the amount of work scheduled to be done. It requires the continues monitoring of actual expenditures and the amount of work done (expressed in cost units). To make these comparisons, EVM calculates cost and schedule variances, along with performance indices for project performance management. Based on these results, it forecasts the date and cost of the project at completion and highlights the possible need for corrective action.It is an effective and useful project tool that helps the client and as well as contractor to assess the project performance.

1.3 Elements of Earned Value Management System

The elements of earned value management system which helps to track the status of project are-

Planned Value (PV)

It is also called as Budgeted Cost of Work Schedule (BCWS). Planned value is defined as, "The authorized budget assigned to the scheduled work to be accomplished for a schedule activity or work breakdown structure elements." The planned value can be calculated by using following formula,

$$P.V = \% \text{ Planned work completed} \times BAC$$

BAC = Budgeted cost at completion

Earned Value (EV)

It is also called as Budgeted Cost of Work Performed (BCWP). Earned Value is defined as, "The value of work performed expressed in terms of the budget assigned to that work for a schedule activity or work breakdown structure element." Earned value is total cost of work completed / performed as of reporting time. Earned Value can be calculated by using following formula,

$$E.V = \% \text{ complete work} \times BAC$$

Where, BAC = Budget at completion

Actual Cost (AC)

It is also called as Actual Cost of Work Performed (ACWP). Actual cost is defined as, "The total costs actually incurred and recorded in accomplishing work performed for a schedule activity or work breakdown structure element." Actual cost is the total cost taken to complete the work as of reporting date. The actual cost can be calculated by using following formula,

$$A.C = \text{Hourly Rate} \times \text{Total hour spent}$$

Cost Variance (CV)

Cost variance is the algebraic difference between the worth of the work that has been carried out and to the amount of money that was spent to do it. Mathematically it is represented by,

$$CV = EV - AC$$

A positive value of CV shows the project is spending less than the planned budget means it is favorable while the negative value shows that actual cost is exceeded than the budgeted amount which is unfavorable condition.

Schedule Variance (SV)

Schedule Variance is the algebraic difference between the worth of the work that has been carried out and to the amount of money that has to be spent according to the planning to do it. Mathematically it is represented by,

$$SV = EV - PV.$$

It determines whether the project is ahead or behind the schedule. Positive value of SV shows the project is ahead of the planned schedule which is a favourable condition and negative value shows it is behind which is an unfavourable condition.

Cost Performance Index (CPI)

Cost Performance Index is the ratio of earned value (EV) to actual costs (AC). It indicates the efficiency of resource use and measures the worth of the work that is achieved by spending every single unit cost. CPI is represented mathematically as,

$$CPI = EV / AC$$

A ratio less than 1 is an unfavourable and suggests the value of the work that has been accomplished is less than the amount of money spent and the cost is overrun. Whereas, the ratio more than 1 indicates favourable condition n tells more amount of work is achieved as that of the corresponding cost.

Schedule Performance Index (SPI)

Schedule Performance Index is the ratio of earned value (EV) to planned value (PV). It indicates the efficiency of time use and measures the worth of the work that is achieved by spending every single unit time. SPI is represented mathematically as,

$$SPI = EV / PV$$

A ratio less than 1 is an unfavourable and suggests the value of the work that has been accomplished is less than the amount of time spent and the cost is overrun. Whereas, the ratio more than 1 indicates favourable condition n tells more amount of work is achieved as that of the corresponding time.

Budget at Completion (BAC)

Budget at Completion is the total amount of money expected to be spent on the project.The "Fig.1" indicates the ideal graph of EVM elements.

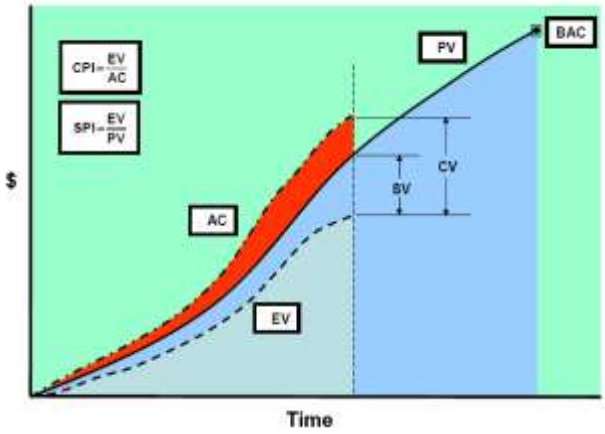

Figure 1 – Elements of EVMS

1.4 Advantages / Benefits of EVMS

1. EVM keeps the management on their toes. As EVA is done periodically, management tries to make sure that all the project parameters are on track.
2. It is used to measure and predict the progress in the ongoing project.
3. It is the only system used at present which track the project in terms of work, time and money.
4. It allows the project manager to be on time and on budget.
5. The cost performance index (CPI) and schedule performance index (SPI) provides an early warning signal.
6. It can be applied to any construction project and is mainly useful for huge construction project.
7. Timely performance measurement makes sure that steps can be taken to the bring project back on track before it's too late.

1.5 Disadvantage / Drawbacks of EVMS

1. While doing Earned Value analysis, we don't take quality into consideration..
2. Cost of implementing Earned value management causes managers to not use it extensively. Generally, software is required and coordination between different departments should be good to achieve the goal.

3. It is required to be carried out at different stages as the uncertainty may occur any time throughout the project.

II METHODOLOGY

The construction projects are so vast and complex in nature and therefore for simplification of work, use of software's came into existence. The WBS for the project is created and several activities are identified. The following recommended steps for the successful implementation of earned value analysis –

1	Create Project
2	Define WBS
3	Creating Calendars
4	Define Activities
5	Appoint Activity Durations
6	Assign Logic Links
7	Perform Scheduling
8	Allocating Resources / budgeting
9	Creating Baselines
10	Updating Schedule
11	Earned value analysis
12	Publishing Reports

III CONCLUSION

On the basis of concept of EVMS, and it's methodology, we have concluded the following points,

1. On comparing Earned Value Management method to traditional management, traditional management does not allow for analysis of physical amount of work performed. Earn value management allows both schedule cost analysis against physical work performed.
2. Earned Value provides an early warning signal to managers to take the corrective action.
3. It helps the project manager to understand time estimate for the completion of the project and provide further insight for making better decision about the project schedule.
4. Where the traditional method focuses on planned accomplishment, the Earned Value Management goes one step ahead and examines actual accomplishment.
5. Timely performance measurement makes sure that steps can be taken to bring project back on track before it's too late.
6. Earned Value Management gives executives, project manager and other stakeholder's ability to visualize project status throughout the project life cycle and helps to manage the project more effectively.

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