A Review of EVM Analysis with Primavera

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Abstract - Earned Value Management is a project management tool that uses information based on cost, schedule and work performance to define the current status of the project. EVM helps the manager to extrapolate current trends to predict their likely final effect. This method is proved effective in cost control. The Primavera is project management software which enables users to track and analyze performance of project. The Report wizard in primavera creates customized reports that extract specific data from its database. The paper outlines the basic principles of the EVM & how it can be used successfully for particular project with help of primavera. Also some benefits and complications of EVM with reference to Indian construction sector.
Keywords – Earn Value Analysis Primavera

Introduction

Project management can be defined as a body of knowledge, a set of principles, or techniques dealing with the planning and control of projects. Project management in construction consists of a set of objectives which may be achieved by implementing a series of operations subject to resource constraints. There are always potential conflicts between the stated objectives with regard to scope, cost, time, quality, human, material and financial resources. These conflicts should be resolved at the earliest by making the necessary tradeoffs (change) or creating new alternatives.

Traditionally the budgeted cost is evaluated by computing the difference between planned cost and actual cost incurred in a project. The focus was on planned expenditure and actual costs. Earned Value reveals future opportunities and it also examines actual accomplishment. With the help of Earned Value Analysis(EVA), project managers get sufficient help to keep deep intuitive understanding into potential risk areas. With the help of clearer picture of the project cost performances, managers can create risk mitigation plans based on actual cost, schedule and technical progress of the work. It is like an alarm for the managers to identify and control problems by taking timely corrective actions before they become   too great to overcome EVM provides better understanding of the project in terms of time and cost schedule. EVA System is a set of guidelines to provide satisfactory completion of project. It has been seen that to cover cost overrun, project team undergoes cost reduction either by reducing the project scope and quality or by providing additional resources. Similarly in case of time overrun, they plan crashing of activities or fast tract programs. Therefore with the use of EVA system, project goals are achieved in better way.

The Primavera enables users to track and analyze performance. It is a multiuser, multi project system with scheduling and resource control capabilities supporting multi-tiered project hierarchies, resource scheduling with a focus on roles and skills, recording of actual data, customizable views, and user-definable data. It supports an enterprise project structure (EPS) with an unlimited number of projects, activities, baselines, resources, work breakdown structures (WBS), organizational breakdown structures (OBS), user-defined codes, and critical-path-method (CPM) scheduling and resource leveling. Primavera also provides centralized resource management. This includes resource timesheet approval and the ability to communicate with project resources who use the Progress Reporter.

In addition, Primavera provides integrated risk management, issue tracking and management by threshold. The tracking feature enables users to perform dynamic cross-project rollups of cost, schedule, and earned value. Project work products and documents can be assigned to activities and managed centrally. The Report Wizard creates customized reports that extract specific data from its database.

Relevance

The primary skills for project management are Scoping (i.e., describing and agreeing on project objectives and requirements), Scheduling, and Estimating. Other skills are Managing resources, Managing risk and uncertainty, Managing quality, Communicating and sharing information with stakeholders. It is still difficult to get the exact answer about the real progress of many construction projects with manual handling & tracking i.e. by traditional process. A construction project is perhaps one of the most complex and dynamic processes if to consider business and engineering activities. Engineers usually express the progress of works referring to the time schedule or to the cost plan. Since the changes or variation orders are normal practice in real construction projects, more integrated method is needed to describe the true status of a project.

In project management, the concept of earned value is used to measure and predict the progress of the on-going project. It has become very popular now days as a performance measuring method. 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. It is probably the only system used at present which tracks the project in terms of work, time and money. Timely performance measurement makes sure that steps can be taken to the bring project back on track before it's too late.

With EVM, one can create an effective project portfolio management process that

- Aligns the project portfolio with strategic business objectives
- Completes projects faster and more efficiently through role-based alignment

- Accurately measures both cost and schedule performance
- Analyzes and presents project performance data
- Increases program visibility through effective and streamlined communication with all stakeholders.

Project management system is directly responsible on efficient planning, monitoring and controlling of construction project with use of project management software Primavera.

Purpose of earned value

The Earned Value method has been developed as a tool facilitating project progress control. It is used for determining a project's status (is it behind or ahead of schedule? is it over or under budget?) and the scale of current variances from the plan. Moreover, it allows a project manager to make inferences on the final effect of the project in terms of cost and, to some extent, in terms of duration, by extrapolating current trends.

The method is simple: it assumes a simplified model of a project, and calculations require nothing more than four basic arithmetic operations. However, the method has been recognized as a useful tool by many practitioners and government agencies and has become a standard in project management. It proved to be versatile enough to be applied to any type of a project, ranging from defense schemes worth millions and extending on many years to minor IT projects. The analysis can be conducted on any level of work breakdown structure and used by both clients and contractors. The method, if to be used efficiently, requires a disciplined approach to collection of data on project cost and progress (on weekly basis) and the findings are to be processed immediately. The purpose is to detect any deviation as soon as possible, so that there is enough time to asses if the deviation is dangerous for the project and, if necessary, to take corrective actions.

The idea of earned value analysis and interpretation of its results

1. Input data

Figure 1 presents the idea of the Earned Value project control. The analysis requires following inputs:

BCWS - Budgeted Cost of Works Scheduled - the baseline for the analysis, cumulated planned costs related to time of their incurrence;

BCWP - Budgeted Cost of Work Performed - a measure of physical progress of works expressed by cumulated planned cost of works actually done related to time, it is also called Earned Value (like the method it is used by);

ACWP – Actual Cost of Work Performed - cumulated amount payable for works done related to time;

BAC - Budget at Completion - total planned cost of the whole project, it equals BCWS at the planned finish;
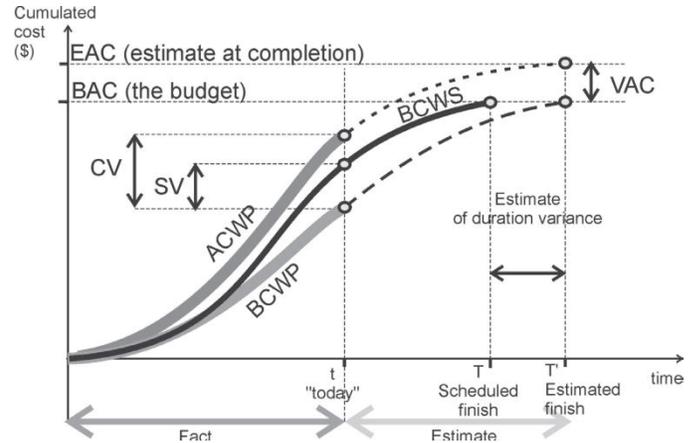
T – Planned duration of Project

Fig. 1. *Earned Value* curves; this project is currently ("today") over budget and behind schedule.

2. Project status indicators

PC - Percentage Complete:

$$PC = BCWP / BAC$$

CV - Cost Variance - a measure of deviation between planned and actual cost of works done until the date of recording progress in money units. If negative, it indicates that the project is over budget:

$$CV = ACWP - BCWP$$

To capture the scale of deviation, it is often expressed as a fraction of the budgeted cost of works performed:

$$CV\% = CV / BCWP * 100\%$$

SV - Schedule Variance - a measure of deviation between the actual progress and the planned progress. Though it is interpreted as time deviation, it is expressed in money units. In other words, it is the difference between the planned cost of works that have been done and planned cost of works that should have been done by the reporting date. If negative, it indicates a delay:

$$SV = BCWP - BCWS$$

To address any distortion caused by the relative value of activities, it is expressed as a fraction of BCWS:

$$SV\% = SV / BCWS * 100\%$$

CPI - Cost Performance Index - compares the planned and actual value of works done, if less than 1, it indicates that the project has consumed more money than planned, if greater than 1, there have been savings.

$$CPI = BCWP / ACWP$$

SPI - Schedule Performance Index - compares the planned cost

of works done with planned cost of works planned; if less than 1, it indicates a delay:

$$SPI = BCWP / BCWS$$

3. Earned Value "forecasting" parameters

EAC - Estimate at Completion - is calculated at the date of reporting progress to serve as an estimate of the effect of deviations cumulated from the project's start on the total project cost, so it informs how much the project is going to be in the end, if the cost performance index CPI stays the same:

$$EAC = BAC / CPI$$

It is clear that EAC is a simple linear extrapolation of current tendencies. It does not allow for any future risks or effects of corrective measures, so it is not a proper forecast. Nevertheless, EAC indicates the potential scale of cost problems. As the Earned Value method requires frequent progress checks from the very beginning of a project, an early EAC-based constitution that current tendencies are likely to double the cost are likely to provide a valuable warning signal and trigger rectifying actions when it is still time.

EAC is not necessarily based on the assumption that future costs are going to follow the today's pattern. Other scenarios can be considered but, as the method rests upon a simplified model of a project, linear extrapolation is a rule and it proves to be adequate. The general EAC formula allows for a number of simple scenarios:

$$EAC = ACWP + \{(BAC - BCWP) / PF\}$$

i.e. EAC is a sum of costs already committed and the reminder of the budget adjusted by a factor (PF) that reflects the relationship between the project's future and its past. This can be project-specific. Scenarios considered most often are as follows:

1. the cost of remaining task is going to be as planned, i.e. future costs are not related to current costs, PF=1, so:

$$EAC = BAC + CV$$

2. the cost of remaining tasks is going to stay in proportion to current CPI as in equation (8); it ignores the real-life time-cost relationship (if a project is to be accelerated, it usually requires more money);

3. the cost of remaining tasks will be related to current tendencies of both schedule and cost performance, so the PF is a Critical Ratio (CR), called also a Schedule Cost Ratio (SCR):

$$SCI = CPI \times SPI$$

Another measure used for forecasting (or rather for simple extrapolation) is TCPI (To Complete Performance Index) - a value of cost performance index that is to be maintained from now on if the project is to be completed to budget. In other words, TCPI is a proportion between the remaining work (expressed in terms of budgeted costs) and the money left from the budget:

$$TCPI = (BAC - BCWP) / (BAC - ACWP)$$

If it is much higher than 1 and the current CPI, it indicates the scale of effort needed for searching for economies.

Advantages of EVM

EVM keeps the management on their toes. As EVM is done periodically, management tries to make sure that all project parameter on track. It measures & predict the progress in the ongoing project in terms of work, time & money. It also allows the manager to be on time & on budget. The Cost Performance Index (CPI) and Schedule Performance Index (SPI) provides an early warning signals. It is mostly suitable for the huge construction project. EVM timely performance measurement make sure that steps can be taken to the bring project back on track before it's too late.

Application of EVM

EVM provides project managers and the organizations with triggers or early warning signals that allow them to take timely actions in response to indicators of poor performance and enhance the opportunities for project success. Such indicators have been found to be reliable as early as 15% into a project. Better planning & resource allocation associated with the early period of a project might be the cause of this reliability

EVM can be used for progress payments to contractors based on the EV of contracted or outsourced work. Because such contractual arrangements create legal & financial obligations it is important to consider the method specified for evaluating progress.

For long terms projects it may be appropriate to consider the incorporating the time value of money & time discounted cash flows into EVM. Inflation can be explicitly considered in EVM and the inflation variance can be calculated. However these considerations add complexity to the method and may be justifiable only for very long term projects or in very high inflation periods or economics.

Limitations of EVM

While doing the earn value analysis, quality is not taken into consideration. Cost of implementing Earned value management causes managers not to use it extensively. Generally software is required and coordination between different departments should be good to achieve the goal. It is required to be carried out at different stages as the uncertainty may occur any time throughout the project.

Primavera

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Methodology

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

1. Create Project
2. Define WBS
3. Create Calendars
4. Define Activities
5. Assign Durations to Activities
6. Assign Logic Links
7. Perform Scheduling
8. Assign Resources
9. Create Baseline
10. Update Schedule
11. Earn Value Analysis
12. Publishing Reports

Earned value performance reporting is intended to forewarn management of potential cost and schedule problems so that corrective action may be implemented before problems become critical. A fast turn-around from project status review to reporting the results will give management more time to devise alternate plans. Utilization of the earned value technique for project control will result in better assessment of activity time and budget requirements. Management will be better informed to distribute work load. Improved productivity can result through constant feedback to management on cost and schedule performance, thereby, providing the opportunity to concentrate on problem areas. However, the earned value technique by itself is not enough for good project control. It is a systematic procedure for performance measurement which can be effective only if it is supported by good cost and schedule control systems.

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Conclusion