CDC Unified Process

Project Management

Newsletter

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Earned Value Management

Earned value (EV) is a management technique that answers the question what did we get for the money we spent? EV compares the amount of work planned with the actual work completed during a given period of time to determine if cost and schedule performance is in line with planned expectations. EV measures how much of the budget and time scheduled to complete a set amount of work has been spent regardless of the actual amount of work completed. The practice of monitoring, reviewing, and reacting to fluctuations in EV is known as Earned Value Management (EVM).

EVM is an evaluation technique that integrates performance requirements, resource planning, and schedules, while taking risk into consideration. EVM integrates these factors into a single practice approach that provides an objective measurement of performance and progress. Performance is then measured by comparing the earned value to the planned value to determine the budgeted cost of work performed. That is then compared to the actual cost of work performed to determine performance.

If implemented correctly and applied diligently throughout the life of an effort, EVM can provide a wealth of information and even provide an early warning of potential budget, schedule, and overall performance issues. EVM uses cost and schedule baselines to assess progress and any variations from those baselines. Accomplishing this involves three key values:

1. **Budget At Complete (BAC)** – The budget values established for the work to be performed. *How much should the work cost when done?*
2. **Actual Cost of Work Performed (ACWP)** – The total costs actually incurred in accomplishing the work performed during a given time period. *How much did the completed work actually cost?*
3. **Percent Complete (% Complete)** – An estimate, expressed as a percentage, of the amount of work that has been completed.

Once these three measures have been identified, the following calculations can be performed:

- Earned Value (EV) – EV is the budgeted cost of work performed (BCWP) during a given period of time (BAC x % Complete). How much work is actually done?
- Planned Value (PV) – PV is the budgeted cost of work scheduled (BCWS) to be completed up to a given point in time. How much work should be done?

Once EV and PV have been determined they can then be used to determine schedule and cost variances and to calculate overall project performance using the following formulas.

- Schedule Variance (SV) – SV is an efficiency indicator that reflects the schedule performance of the project. It measures the difference between what was planned to be completed and what has actually been accomplished. SV will ultimately equal zero when the project is completed because all of the planned values will have been earned (EV – PV = SV).
- Cost Variance (CV) – CV is an efficiency indicator that reflects the cost performance of the project. It measures the difference between the budget and the actual amount spent for the work completed (CV = EV – ACWP).
- Schedule Performance Index (SPI) – The SPI is used, in addition to schedule status, to predict the project's completion date and is sometimes used in conjunction with the CPI to forecast the project's estimate at completion. SPI is simply the ratio of the EV to the PV. An SPI below 1.0 indicates the roject is behind schedule. An SPI above 1.0 indicates the project is ahead of schedule (SPI = EV/PV).
- Cost Performance Index (CPI) – The CPI is used to monitor project cost and to predict cost overruns. The CPI is a commonly used cost-efficiency indicator and is simply the ratio of the EV to AC. A CPI below 1.0 indicates the project's cost is over the planned cost for the work performed. A CPI above 1.0 indicates the project's cost is under planned cost for the work performed (CPI =

EV/AC).

- Estimate to Complete (ETC) – ETC is the expected cost needed to complete the remaining planned work.
- Estimate at Completion (EAC) – EAC is the expected total cost of the planned work at completion of that work. EAC = ACWP + ETC

Incorporating EVM into management practices is a three step process:

1. Define the work
2. Estimate and baseline cost and schedule
3. As work is completed regularly record progress (earned value)

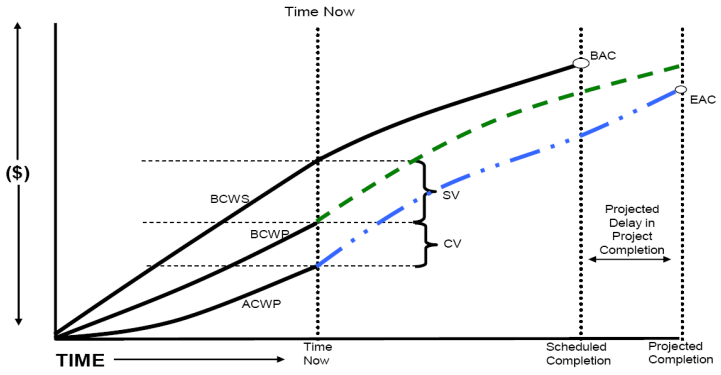
The extent to which EV is adopted determines how detailed step three will eventually become. EV analysis often reveals what is causing deviations from baselined schedule and cost. Correcting variances is easier earlier in the life cycle when small changes still have significant impact over time.

Mangers analyze EV data and compare performance indexes. Using this information in conjunction with their understanding of the remaining work and their past experiences, managers forecast EAC for cost and schedule of the effort.

For example, the image to the right illustrates how EVM can identify how an effort is performing against plan and how it can expect to finish based on its performance to date if no corrective action were to be taken. The image illustrates that the BCWP is below the BCWS. This indicates that the project is behind schedule, by how much is calculated by the manager as a SV. The ACWP is also below the BCWP. This indicates that the work completed to this point was done for less than planned. This indicates that this effort is ahead of planned budget, by how much is calculated as a CV.

To correct any variances, managers apply best practice techniques that balance cost, quality, and schedule to bring the effort back in line with baseline plans.

EVM is applied similarly in an iterative development environment as well and can provide added value for stakeholders. Once a baseline is established for a set of work, progress is measured against that baseline within predefined boundaries such as a single iteration, weekly, or monthly. At each boundary EV measures are recorded and EVM techniques applied.



For more information and tools related to earned value, the CDC Unified Process, or the Project Management Community of Practice please visit the CDC UP website at http://www.cdc.gov/cdcup/. ▮

Project Management Community of Practice

- ***September 23, 2011***
  Understanding Section 508
- ***October 28, 2011***
  Information Security 101 for Project Managers
- ***December 09, 2011***
  Enterprise Architecture

For more information on the Project Management Community of Practice visit the PMCoP website at http://www2.cdc.gov/cdcup/library/pmcop/ ▮

CDC Unified Process Presentations

The CDC UP offers a short overview presentation to any CDC FTE or Non-FTE group. Presentations are often performed at your facility, on a day of the week convenient for your group, and typically take place over lunch structured as one hour lunch-and-learn style meeting.

Contact the CDC Unified Process at cdcup@cdc.gov or visit http://www.cdc.gov/cdcup to arrange a short overview presentation for your group. ▮

Contact the CDC Unified Process

The CDC Unified Process Project Management Newsletter is authored by Daniel Vitek, MBA, PMP and published by the Office of Surveillance, Epidemiology, and Laboratory Services.

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