Using Earned Value Management for Improving Processes

By Cynthia K. West

Summary:
This article explains earned value management and explores how the metric can be used to improve project and business processes.

Article Categorization: Measurement and Reporting, People Metrics, Process Metrics, Product Metrics

Experienced project managers utilize a technique called earned value management (EVM) to assess a project’s progress over time and allow project teams to understand the health and performance of their projects. EVM is also a good metric to share with management. According to the Project Management Body of Knowledge:

Earned Value Management (EVM) is a method for integrating scope, schedule, and resources for measuring project performance. It compares the amount of work or effort that was planned with what was actually earned and spent to determine if cost and schedule performance are as planned.

By comparing planned value (the ideal progress of the project) to the earned value (the value of the project to date based on work or effort expended), a project manager can detect early if the project is going awry. If the schedule performance index (explained later in this article) is less than 1.0, then the project is in danger of going over schedule. If the cost performance index (also explained later in this article) is less than 1.0, then the project is in danger of going over budget. By monitoring and reviewing these metrics, a project manager can report these statistics to management so they can determine whether to continue with the project. The process may be revised for similar projects by learning from the statistics and modifying expectations.

Earned Value Technique
Earned value is a technique for monitoring project performance based on a project’s percentage complete. In most organizations, projects are measured against a budget by looking at actual dollars spent and the project’s percentage complete. In most cases, this percentage complete is a guess and does not take into consideration re-estimates on what it will take to complete the project. Earned value will give project managers a more accurate measurement of a project’s status.

Using Percentage Complete
There are two constants in project management—people will take all of the time given to them to complete their task, and people are terrible estimators. Understanding these two constants will assist a project manager in determining how to measure performance on the project.

Measuring performance solely as a percentage complete has inherent risks. For example, if a task has a planned duration of ten days with thirty hours of work effort,
and five days have passed, typically the performer will state that he is 50 percent complete. The problem is that the project manager cannot tell from this estimate if the duration or the work effort is 50 percent complete.

As a best practice, several variables need to be considered—work effort expended, remaining work left to perform, and a re-assessment of remaining duration. By providing these variables, a more accurate percentage complete and an assessment of the schedule impact can be derived.

In our example above, after five days, only ten hours of work have been performed. The re-estimate determines that an additional thirty hours is needed in order to complete the task, but the performer feels confident he will be able to finish the task in the remaining five days. Instead of 50 percent complete, the task is actually only 25 percent complete and the schedule, at present, is not going to be impacted.

A project schedule and resource plan is only as good as an organization’s ability to adjust to changes and obtain an accurate assessment of completed work. A work authorization system and accurate time-tracking system can facilitate the collection of work performance and flow of information to the project manager so she can respond quickly to changes.

**Key Terms in Earned Value Technique**

**Planned Value**

The planned value (PV) is the baseline value for the task. So if the project manager planned to spend ten hours on task X, at a rate of $50 per hour, the PV is $500. In addition, any material expenditure or fixed cost planned should be included, so if the project manager expects to purchase Z for $100, the PV on task X is now $600.

<table>
<thead>
<tr>
<th>5 hours x $50/hour</th>
<th>$250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed costs</td>
<td>$100</td>
</tr>
<tr>
<td>Total actual cost</td>
<td>$350</td>
</tr>
</tbody>
</table>

**Actual Cost**

The actual cost (AC) is the actual expenditure to date, including labor and materials. For task X, five hours were spent, plus you purchased Z for $100, so the AC to date would be $350.

**Earned Value**

Earned value (EV) is defined as the physical work accomplished plus the authorized budget for this work. The sum of the approved cost estimates (which may include overhead) for tasks completed during a given period.

EV is a measurement of what has been completed against the plan. For example, if the task owner spent five hours working on task X, the project manager may want to assume the task is 50 percent complete. However, what is missing is the assessment of any remaining work on the task, which gives the project manager an adjustment to the original plan. If the task owner spent five hours working on task X and estimated that there are only five hours of remaining work, then one can effectively...
state that the task is 50 percent complete. However, if it was determined that the
task owner originally estimated poorly and that he still had ten hours of remaining
work, the performance on that task would be different. So in this case, the task
owner only completed 33 percent of the original estimated plan of ten hours, or 3.33
hours, multiplied by $50 per hour or $166.50, plus the $100 for the material. The EV
on task X would be $266.50.

Now, assume that the original plan of ten hours was supposed to be spread out over
ten days, where the task owner was expected to spend one hour per day on task X
and the task owner was expected to purchase Z on day two. After day five, the PV of
task X would be $350 ($250 labor & $100 material). Your AC is $350 as stated above
and your EV is $266.50. Where does task X stand? By utilizing the earned value
technique, we will calculate two additional values—cost variance and schedule
variance.

Without calculating earned value on task X, the project manager may be deceived
into thinking that everything is just fine. The planned value equals the actual costs,
so the project must be on target.

Cost Variance
Cost variance (CV) is a measure of cost performance. CV is calculated as EV minus
AC. For the example above, the CV would be $266.50 - $350 or -$83.35. A negative
number represents an over budget situation.

Schedule Variance
Schedule variance (SV) is a measure of schedule performance. SV is calculated as EV
minus PV. For our example above, the SV would be $266.50 - $350 or -$83.50. A
negative number represents a behind schedule situation.

After applying earned value analysis, the project manager now knows that the
project is not fine. It is both behind schedule and over budget.

Project XYZ – Performance as of today

<table>
<thead>
<tr>
<th>Task</th>
<th>Total PV</th>
<th>PV</th>
<th>AC</th>
<th>EV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task X</td>
<td>$ 600</td>
<td>$ 350</td>
<td>$ 350</td>
<td>$ 266.50</td>
</tr>
<tr>
<td>Task Y</td>
<td>$ 400</td>
<td>$ 400</td>
<td>$ 450</td>
<td>$ 400</td>
</tr>
<tr>
<td>Task Z</td>
<td>$1200</td>
<td>$ 600</td>
<td>$1200</td>
<td>$1200</td>
</tr>
<tr>
<td>Task AA</td>
<td>$1000</td>
<td>$1000</td>
<td>$1200</td>
<td>$ 900</td>
</tr>
<tr>
<td>Total</td>
<td>$3200</td>
<td>$2350</td>
<td>$3200</td>
<td>$2766.50</td>
</tr>
</tbody>
</table>

In the table above, the total budget for the project is $3,200. As of today, the
project should have spent $2,350, but the actual costs are $3,200 and the EV on the
project is $2,766.50. In total, the SV is $416.50, which means, in total, the project is
ahead of schedule, while the CV is -$850.00 or over budget.

There are two additional tools that earned value provides that help project managers
reforecast project costs. They are cost performance index and schedule performance
index.
**Cost Performance Index**

Cost performance index (CPI) is a measure of cost efficiency. CPI is calculated as EV divided by AC. In the example above, the CPI would be $266.50/$350 or 0.76. Basically this means that for every dollar spent, you received $0.76 worth of cost performance. This is an indication of a cost issue on the project.

**Schedule Performance Index**

Schedule performance index (SPI) is a measure of schedule efficiency. SPI is calculated as EV divided by PV. For our example above, the SPI would be $266.50/$350 or 0.76 again. This also means that for every dollar spent you are only receiving $0.76 of schedule performance. A SPI that is less than one is an indication of a schedule issue on the project.

Consider a project that has a CPI of 0.76, as stated above. If the project manager considers the performance of the project to date to be representative of the future performance on the project, a $100,000 budgeted project with a current accumulated EV of $20,000 and a current AC of $26,316 can be reforecasted using the following formula:

\[
\text{Estimate to complete (ETC)} = (\text{AC} - \text{EV})/\text{CPI} \text{ or } $105,263
\]

The reforecasted budget for the project is $26,316 + $105,263, or $131,578.

**Reporting Progress**

In many cases, project managers will provide earned value management metrics to their sponsors in order for them to view and assess project progress. Project managers may calculate earned value manually, however, many portfolio and project management solutions provide comprehensive earned value assessment in real-time. If the project team members enter in their actual hours against tasks, then the project manager can view project progress and earned value in real-time. The keys to using earned value successfully are:

- Realize that each task is measured independently
- Tasks must be defined clearly and budgeted

By tracking these values, the project manager can more readily identify projects in danger of running behind schedule and over budget and can make adjustments along the way. Sponsors may more easily determine if a project will succeed or need to be quashed.
### New Toy (5-9 year olds) Product Development - Project Summary

#### 5. Schedule

**Schedule: Behind Schedule**

- **Red**
  - **Scheduled Dates**: 5/29/09 9 AM - 8/2/09 5 PM
  - **Duration**: 564 Days
  - **Actual Total Time**: 665.44
  - **Total Duration**: 720 Days
  - **Duration % Complete**: 84.4%
  - **Actual Work Time**: 720.00
  - **Work % Complete**: 5.63
  - **Actual Hours To Finish**: 108.00

**Forward Progress**

- **5/29/09 9:49 AM**
  - **Current Critical Tasks**: None. No critical tasks.
  - **Current Resources**: None. No resources.

#### 6. Budget Overview

**Earned Value** is calculated through 10/27/2005

<table>
<thead>
<tr>
<th>Work Cost</th>
<th>DB Work Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>$65,740.00</td>
<td>$72,000.00</td>
</tr>
</tbody>
</table>

**Budgeted Costs**

<table>
<thead>
<tr>
<th>Work Total Cost</th>
<th>Total Total Cost for ALL TASKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$499,900.00</td>
<td>$459,200.00</td>
</tr>
</tbody>
</table>

**Estimated Total Cost for ALL TASKS that should have been performed through the date above.**

**Actual Total Time** for ALL TASKS

### Performance

#### Earned/Planned values calculated through 10/27/2005

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Earned Value</th>
<th>Planned Value</th>
<th>Actual Value</th>
<th>Re-forecast of Labor &amp; Fix Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>$65,740.00</td>
<td>$72,000.00</td>
<td>$65,740.00</td>
<td>$15,160.00</td>
</tr>
<tr>
<td>Billable Work</td>
<td>$72,000.00</td>
<td>$65,740.00</td>
<td>$65,740.00</td>
<td></td>
</tr>
</tbody>
</table>

#### Date Earned Value is calculated through ALL TASKS

### Resources

- **Project Manager(s)**: [Template Creator](mailto:temp@template.com)
- **Resources**: [Resource Type/Role]

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**Sample Project Summary from Project Insight**

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Project Insight by Metafuse, Inc., 17320 Red Hill Avenue, Suite 270, Irvine, CA 92614, 949-476-6499

http://www.projectinsight.net

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