Earned Value Management Explained

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Earned Value Management (EVM) helps project managers to measure project performance. It is a systematic project management process used to find variances in projects based on the comparison of worked performed and work planned. EVM is used on the cost and schedule control and can be very useful in project forecasting. The project baseline is an essential component of EVM and serves as a reference point for all EVM related activities. EVM provides quantitative data for project decision making.

EVM Rewards and Recognition

According to the NASA Headquarters Library, the first version of Earned Value Management (EVM) was developed by the Defence Department (DoD) to track its programmes during the sixties. Since 2005, EVM has been a part of general federal project risk management. Today EVM is a mandatory requirement of the US government. The Office of Management and Budget (OMB) promotes use of EVM as a preferred performance-based management system to manage software projects. EVM is also used in the private sector by companies in a variety of industries, consulting firms and educational establishments.

Some of the most well known organisations practicing EVM are:

- NASA
- Project Management Institute (PMI)
- Society of Cost Estimating and Analysis
- Defence Acquisition University
- Federal Acquisition Institute
- Acquisition Management (UK)

Based on reports of the General Accounting Office (GAO) in August 1996 a memorandum of understanding concerning common cost and schedule management for acquisitions was signed by Australia, Canada, and the United States. This gives international recognition to EVM worldwide.

EVM Measures

EVM consists of the following primary and derived data elements. Each data point value is based on the time or date an EVM measure is performed on the project.
Primary Data Points

- **Budget At Completion (BAC)**
  Total cost of the project

- **Budgeted Cost for Work Scheduled (BCWS) / Planned Value (PV)**
  The amount expressed in Pounds (or hours) of work to be performed as per the schedule plan
  \[ PV = BAC \times \% \text{ of planned work} \]

- **Budgeted Cost for Work Performed (BCWP) / Earned Value (EV)**
  The amount expressed in Pounds (or hours) on the actual worked performed
  \[ EV = BAC \times \% \text{ of Actual work} \]

- **Actual Cost of Work Performed (ACWP) / Actual Cost (AC)**
  The sum of all costs (in Pounds) actually accrued for a task to date

For example say we should have completed £800 pounds of work by today. We completed £600 worth of work. The BCWP is £600. The BCWS is £800. And if we actually paid £700 then (ACWP) = £700.

Derived Data Points

**Cost Forecasting:**

- **Estimate At Completion (EAC)**
  The expected TOTAL cost required to finish complete work
  \[ EAC = \frac{BAC}{CPI} = AC + ETC = AC + \left( \frac{(BAC - EV)}{CPI} \right) \text{ (typical case)} = AC + \left( \frac{BAC - EV}{CPI} \right) \text{ (atypical case)} \]

Here atypical means it is assumed that similar variances will not occur in the future.

- **Estimate to complete (ETC)**
  The expected cost required to finish all the REMAINING work
  \[ ETC = EAC - AC = \left( \frac{BAC}{CPI} \right) - \left( \frac{EV}{CPI} \right) = \left( \frac{BAC - EV}{CPI} \right) \]

**Variances:**

- **Cost Variances (CV)**
  How much under or over budget
  \[ CV = EV - AC \]
  NEGATIVE is over budget, POSITIVE is under budget

- **Schedule Variances (SV)**
How much ahead or behind schedule
SV = EV-PV
NEGATIVE is behind schedule, POSITIVE is ahead of schedule

- Variance At Completion (VAC)
  Variance of TOTAL cost of the work and expected cost
  VAC = BAC - EAC

Performance Indices:

- Cost Performance Index
  CPI = EV / AC
  Over (< 1) or under (> 1) budget

- Schedule Performance Index
  SPI = EV / PV
  Ahead (> 1) or behind (< 1) schedule

EVM Example
The best way to understand an EVM example is to solve it.

**Problem:** A project has a budget of £10M and schedule for 10 months. It is assumed that the total budget will be spent equally each month until the 10th month is reached. After 2 months the project manager finds that only 5% of the work is finished and a total of £1M spent.

**Solution:**
PV = £2M
EV = £10M * 0.05 = £0.5M
AV = £1M

CV = EV-AC = 0.5-1 = -0.5M
CV% = 100 * (CV/EV) = 100*(-0.5/0.5) = -100% overrun

SV = EV-PV = 0.5-2 = -1.5 months
SV% = 100 * (SV/PV) = 100*(-1.5/2) = -75% behind

CPI = EV/AC = 0.5/1 = 0.5
SPI = EV/PV = 0.5/2 = 0.25

EAC = BAC/CPI = 10/0.5 = £20M
ETC = (BAC-EV) / CPI = (10-0.5)/0.5 = £19M

Time to complete = (10-0.5)/0.25 = 38 Months

This project will take TOTAL £20M (19+1) and 40 (38+2) Months to complete.
EVM Benefits

EVM contributes to:

- Preventing scope creep
- Improving communication and visibility with stakeholders
- Reducing risk
- Profitability analysis
- Project forecasting
- Better accountability
- Performance tracking

EVM 'Gold Card'

Download and keep this useful Defense Acquisition University (DAU) Gold Card (cdn.projectsmart.co.uk/docs/evm-gold-card-8-Jan-2009.pdf), which is a single-sided reference that defines common Earned Value (EV) terminology - revised in January 2009.

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