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1

Introducing EVM

*EVM is a completely
different method of
measuring project progress
that can add real benefits to
project management.*

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- 8** Benefits of EVM
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Earned Value Management

Earned Value Management (EVM) is a project management technique for measuring project performance and progress. It provides a way of keeping control of a project and illustrating its progress towards completion in terms of work and value (cost). Although once considered fairly esoteric and even too complex for managing simple projects, it has nevertheless grown in use and popularity in recent years, and this is in some significant part due to its inherent accuracy.

What is EVM?

EVM is more than just a unique method and technique for tracking project progress. It also includes a set of 32 guidelines that define the requirements that a project management system must meet if it is to be used on government contracts in a number of countries. Primarily developed and used extensively in the United States, it is now widely used in the United Kingdom, Canada, Australia, China, Japan and a number of European Union member states.

Objectives

The objectives of an Earned Value Management system are to:

- Develop time-phased budgets for all the work in a project, broken down through a Work Breakdown Structure, to individual Work Packages.
- Provide methods for monitoring Work Package progress against a Performance Measurement Baseline plan.
- Provide timely data to enable management to assess progress and take corrective action where necessary.
- Supply summary reporting for senior management.

Once EVM has been implemented on a project there are likely to be significant benefits to both the Project Manager (or supplier) and to the business. Supplier benefits include increased control, and the ability to respond proactively to any issues and meet the project schedule, cost and technical requirements. The business benefits include increased confidence in the contractor's ability to manage the project and identify and deal with problems swiftly. But the greatest benefit is the use of objective rather than subjective status reporting on project progress and costs.

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Why EVM?

You may be looking at using EVM for a number of reasons. You might be working for an organization or client that requires you to use it. You might be doing work for the US Department of Defense or some other similar government agency that stipulates the use of EVM. Or you may be interested in finding another way of assessing the true performance of projects. Whatever your reason for looking at EVM, this book will guide you through the methodology and how to implement it in easy steps.

Project Size

While EVM was developed for major projects and is still mostly used on medium to large projects (over \$1m budget and nine months or more duration) it can also be used on much smaller projects to great effect. There is also now a specification for a more simple form of EVM (which is introduced later in the book), which incorporates the best strengths of EVM, but tailored for smaller projects.

Who This Book is For

This book is aimed at project managers, program managers, portfolio managers, project planners, project office staff, project team members and anyone else who needs to understand and work with EVM. But whatever your reasons for looking at EVM, this book will guide you through the processes and technique of EVM in easy steps, and show you how to use it and how to implement it on a project.

- 1 The book will introduce you to the key elements of EVM
- 2 It will explain how and where EVM fits into a typical project life-cycle
- 3 It will explain how the EVM planning process works
- 4 It will show you how to use EVM to control a project and report on progress
- 5 It will explain the 32 EVM criteria and introduce the 10 criteria that make up Simple EVM

Benefits of EVM

First and foremost, EVM will help you to determine the status of a project accurately. As well as telling you how much time and money you have spent, it will show you how much you have achieved. Further, it can tell you how much you still need to do, and provides a very good indication of the final cost and the likely completion date of a project.

Good Practice

EVM builds on, and therefore enforces, good project management practice and it also underpins good corporate governance. Introducing EVM can drive the cultural and organizational change key to supporting these key objectives.

- It provides a truly objective measurement of what has been achieved on a project.
- It enables accurate forecasting of the future, based on what has been achieved to date.
- It provides project management information in a graphical format that is easy for all stakeholders to understand.
- It provides an early warning of problems, which allows the timely identification of necessary corrective actions.
- It shows stakeholders whether they're getting value for money from the project.
- It enables detailed project comparisons across programs and portfolios.
- It can be used on a wide range of projects and can be scaled to fit projects of all sizes and complexities.
- It has the ability to combine measurements of Scope, Time and Cost (the Iron Triangle) in a single integrated system.
- It is able to provide accurate forecasts of likely project performance problems.

In summary, EVM provides a set of metrics that will enable you to report accurately on real project progress to date, and provide accurate Estimates to Completion.

Let us look at a simple example of the use of EVM in a project.

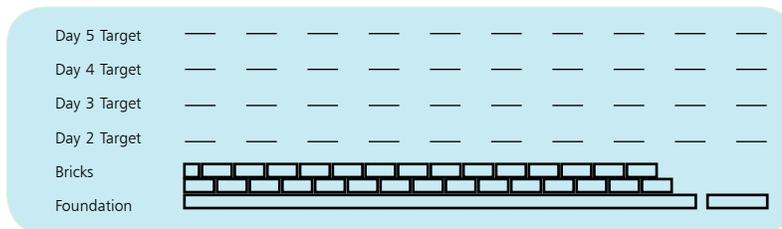
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EVM Example

Let's say we need to have a wall built and have drawn up a plan for it. After a suitable tendering process we have contracted with a builder to construct it. The contractor has estimated that it will take him five days to build at \$400 a day for a total of \$2,000 (our budget at completion) including all materials. His project schedule is: day one: prepare the site and lay the foundations; days two to four: lay bricks; day five finish wall and clean up site.

Day One: goes to plan, the client and contractor are happy.

Day two: contractor starts laying bricks but part way through he finds a problem with the foundations, which will require fixing.



Using EVM, the planned value at the end of day two was \$800 (2 days at \$400), the earned value was \$600 (75% completed as half of day two was lost). This gives a Schedule Variance of -\$200 (Earned Value - Planned Value) and a Cost Variance of -\$200 (Earned Value - Actual Cost).

If we then use this data to produce the Estimate at Completion we get a best case of \$2,200 (Actual Cost + Budget at Completion - Earned Value) which assumes that nothing else goes wrong; and a worst case of \$2,489 (if problems continue to occur at the same rate).

We can now see that the project will be between \$200 and \$489 over budget and between half and one and a quarter days late.

Research Findings

Research into the benefits of using EVM has shown that the areas of planning and control are significantly improved by the use of EVM, as well as overall project performance. Best of all, the use of EVM on a project has been found to be a positive predictor of the success of that project.



The formula for calculating the best, worst and most likely cases is explained in Forecasting on pages 66-69.



EVM is based on and still sometimes referred to (incorrectly) as Earned Value Analysis (EVA).

Brief History

Earned Value Analysis

EVM is based on and was developed from something called Earned Value Analysis (EVA), which began to be used in industrial manufacturing around the start of the 20th century. EVA was developed as a technique for tracking project progress through the value of the work completed. Although it provided a number of formulae for calculating project progress, it was not a complete project management methodology.

PERT/Cost

In the 1960s, a financial analysis technique based on earned value analysis began to be used in the United States Department of Defense (DoD). The methodology was given the title of PERT/Cost. Project Evaluation and Review Technique (PERT) being the then popular project management methodology, and Cost being the additional dimension of earned value measurement.

However, it was not popular with the contractors who were mandated to use it, as they considered it overly burdensome and not easily adaptable.

C/SCSC

In 1967, the DoD established the first criterion-based approach, using a set of 35 criteria, which they called the Cost/Schedule Control Systems Criteria (C/SCSC). This was promoted during the 1970s and early 1980s, but the technique was often ignored or even actively resisted by project managers in both government and industry.

Many of them regarded C/SCSC as just a financial control tool that could be delegated to financial specialists, and nothing to do with real project management.

EVM Arrives

In 1979, EVM finally arrived and was introduced to the engineering and architecture industry in a Public Works Magazine article by David Burstein, a project manager with a national engineering firm. It has continued to be popular in that industry ever since.

In the 1980s and early 1990s, EVM began to be recognized as a project management methodology to be understood and used by managers and executives, not just EVM specialists.

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In 1991 the then Secretary of Defense, Dick Cheney, canceled the Navy A-12 Avenger II Program because of performance problems that were detected through the use of EVM. This demonstrated conclusively that EVM mattered to senior-level leadership.

During the 1990s, many U.S. Government regulations were eliminated or streamlined. EVM, however, not only survived this reform movement but it became strongly associated with the reform movement itself. In the 1990s, ownership of the EVM criteria (then reduced to 32) was finally transferred to industry by the adoption of the ANSI EIA 748-A standard.

EVM Use Spreads

The use of EVM expanded beyond the DoD and was adopted by the National Aeronautics and Space Administration (NASA), the United States Department of Energy (DoE), and other technology-related agencies. Many other industrialized nations also began to utilize EVM in their own procurement programs.

Adoption by the PMI

An overview of EVM was included in the Project Management Institute's first PMBOK Guide in 1987, and was expanded in subsequent editions. EVM is now listed by the PMI as among the general tools and techniques for processes to control project costs.

In 1999, the Performance Management Association merged with the Project Management Institute (PMI) to become the PMI's first college: the College of Performance Management.

Government Influence

The United States Office of Management and Budget started to mandate the use of EVM across all government agencies and, for the first time, for certain internally managed projects (not just for contractors as was originally intended).

EVM also received greater attention by publicly traded companies in response to the Sarbanes-Oxley Act in 2002.

The Standard Develops

In 2007 the standard was revised and updated and issued as ANSI EIA 748-B, and in March 2013 ANSI EIA 748 revision C was released. The standards and guidelines referred to throughout this book are all based on this latest release.



ANSI is the American National Standards Institute, and EIA is the Electronic Industries Alliance.

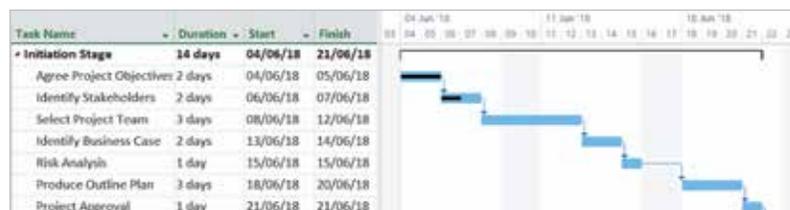
Why Use EVM

Traditionally, project success was evaluated on three counts: was the project completed on time; was it completed to budget; and did it deliver the required functionality? But as the functionality couldn't really be assessed until the project was completed, project managers traditionally evaluated project progress using the first two metrics: is the project on schedule; and is it on budget?

Let us look at what most project managers still use for controlling and reporting on the state of their projects: the Gantt or bar chart.



This Gantt chart was produced using Microsoft Project.



Gantt Chart

The Gantt chart was developed by Henry Gantt, a mechanical engineer, around 1915. Essentially, it illustrates the project by breaking it down into its constituent tasks, which are linked to their dependent tasks (predecessor and successor). It is then updated to track the progress of these tasks (using a darker color bar to indicate progress). Tasks can be in one of three states: not yet started; in progress; or completed.

Using a tracking Gantt chart we can tell if a project is on schedule by comparing the tasks we have completed at any single point in time to what we had planned to complete at this point in time. In EVM this is called the Schedule Variance.

We can more or less tell if the project is on budget by whether we have spent more or less of the total budget than we expected to have spent at this point. In EVM this is called the Cost Variance.

So using a tracking Gantt chart we can report on progress against schedule and cost against the budget at any single point in time. The problem occurs when we consider the third area of measurement: delivery of functionality. There is no way of knowing if we have delivered the functionality we have said we'd produce, as typically, it doesn't appear until the end of the project. And a project might well be on schedule and to cost but



In EVM, positive Cost and Schedule Variances are good, and negative Cost and Schedule Variances are bad.

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if it doesn't deliver what is required of it then it will be a failure. Earned Value provides us with the missing element.

Earned Value

Earned value is at the heart of the way EVM works, in that it allows us to quantify progress using its earned value. But as we can't measure delivered functionality until it has been delivered, Earned Value replaces it with a Nominal Value; the value to the business of the Work Effort expended. In fact, Earned Value is a misnomer, as what is really being measured is the planned cost to the business of the work that has been completed.

So Earned Value allows us to calculate a budget for the cost of producing the required functionality defined in the project Scope. This was originally called the Budgeted Cost of Work performed (BCWP). Now, it's simply "Earned Value" (EV). It will include the cost of manpower used by the project (the project team), the cost of other resources used by the project (facilities, IT, materials), the cost of any sub-contracted work, and the cost of any purchases (capital and revenue). In other words, the total cost of the project.

Using Earned Value

As we can only claim the Earned Value for planned work that has been completed, we first need to plan the work. Once we have planned and scheduled the work, we can allocate the budget cost to it, along with the date when it is scheduled to be done. These together allow us to map out the Planned Value for the project, and at each project review (status date) we can report on four things:

- 1 The Planned Value: of the work we expected to be completed by this status date
- 2 The Earned Value: of the work we have actually completed by this status date
- 3 The Actual Cost: of completing the work we have actually competed by this status date
- 4 We can then use these three values to calculate the Schedule and Cost Variances, which show us exactly where the project is against the plan



Schedule Variance =
Earned Value - Planned
Value (SV = EV - PV).

Cost Variance =
Earned Value - Actual
Cost (CV = EV - AC).

About the Book

This book has been structured to take you through the EVM process and its implementation, in easy steps:

Key Elements

Chapter 2 explains the four key EVM elements:

- Planned Value (PV): the budget or what we forecast the project will cost.
- Earned Value (EV): the budgeted cost of the work we have actually completed.
- Actual Cost (AC): what it really cost to complete that work.
- Estimate to Completion (ETC): what we now think it will cost us to complete the project, and when we will do it.

Project Life Cycle

Chapter 3 takes you through a typical project life cycle and identifies which elements of EVM are used when and where.

Planning

Chapter 4 works through the steps to produce the Planned Value:

- Developing the Work Breakdown Structure (WBS).
- Defining and estimating the Work Packages.
- How contingency is dealt with in EVM.
- Scheduling the Work.
- Developing the Budget.

Using EVM

Chapter 5 explains how we use EVM during the Execution Stage:

- Control Accounts: how performance measurement is carried out on larger projects.
- Work Performance: measuring the real progress of work.
- Analyzing the Results: using the performance measurements to establish the project's Cost and Schedule Variances.
- Forecasting the Future: using the performance measurements to produce accurate estimates to completion.

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EVM Reporting

Chapter 6 looks at the critical area of how to present the data we now have on the past and likely future performance of a project:

- The problems with reports: traditional project management reports have a number of weaknesses, but these can all be overcome using EVM reporting.
- Graphic Reports: the most powerful and effective EVM reports are the use of simple graphs.
- Cost Performance Reports: the DoD has specified six formats of cost performance reports, of which two are the most used and are considered the most useful.
- Cost/Schedule Summary: the DoD has also specified a summary report for use on smaller projects.

EVM Criteria

Chapter 7 explains the 32 criteria, broken down into their five process groups:

- Organization: defining how the work should be organized.
- Planning, Scheduling and Budgeting: how the project should be planned, scheduled and the budget developed.
- Accounting Considerations: how the actual costs of the project should be captured and reconciled.
- Analysis and Management Reports: how the data should be analyzed and reported.
- Revisions and Data Maintenance: how change should be managed in a project.

The chapter also contains a specification of a simple subset of EVM criteria for use on smaller projects.

Agile EVM

Chapter 8 describes how EVM can be adapted for use on a project being run using agile development methods.

Appendix

Chapter 9 contains a glossary of all the EVM terms, and a list of the formulae used.

Summary

- Earned Value Management (EVM) embodies a technique for controlling a project by tracking the value of the work completed.
- While EVM was originally developed for use on large projects or programs, it is now flexible enough to be used on any size of project.
- EVM can help determine the real status of a project in terms of the time and cost used to date against plan.
- EVM provides proven techniques for accurately measuring the progress of work against a baseline plan.
- It can also provide the most likely forecast of how the project will end up, based on performance to date.
- It provides timely data to enable the assessment of progress, and the taking of corrective action where necessary.
- EVM has a number of summary report formats that can provide senior management with concise status reports.
- EVM in its current form was defined by the US Department of Defense, but it is now much more widely used, and is specified by the ANSI EIA 748 standard.
- While a tracking Gantt chart can illustrate if a project is on schedule based on the tasks completed, EVM can illustrate how well a project is performing against budget on cost (Cost Variance) and time (Schedule Variance).
- EVM is based around three key elements of performance:
 - Planned Value (PV): the time-based budget we have forecast for what the work of the project will cost.
 - Earned Value (EV): the budgeted cost of the work we have actually completed to the status date.
 - Actual Cost (AC): what it actually cost us to complete the work that we have completed to date.
- We can then use these three values to calculate the Schedule Variance ($SV = EV - PV$) and Cost Variance ($CV = EV - AC$) showing exactly where the project is against plan.