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CHAPTER 7: PROJECT COST
MANAGEMENT



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The Importance of Project Cost Management

IT projects have a poor track record in meeting budget goals. A 2011 study published in the Harvard Business Review examined IT change initiatives in almost 1,500 projects and reported an average cost overrun of 27 percent. Cost overrun is the additional percentage or dollar amount by which actual costs exceed estimates. The study was considered the largest ever to analyze IT projects. The projects ranged from enterprise resource planning to management information and customer relationship management systems. Most projects incurred high expenses, with an average cost of \$167 million; the largest project cost \$33 billion.



What Is Cost?

A popular cost accounting textbook states, “Accountants usually define cost as a resource sacrificed or foregone to achieve a specific objective.”⁶ Webster’s dictionary defines cost as “something given up in exchange.” Costs are often measured in monetary amounts, such as dollars, that must be paid to acquire goods and services. (For convenience, the examples in this chapter use dollars for monetary amounts.) Because projects cost money and consume resources that could be used elsewhere, it is very important for project managers to understand project cost management.



Many IT professionals, however, often react to cost overrun information with a smirk. They know that many of the original cost estimates for IT projects are low or based on unclear project requirements, so naturally there will be cost overruns. Not emphasizing the importance of realistic project cost estimates from the outset is only one part of the problem. In addition, many IT professionals think that preparing cost estimates is a job for accountants. On the contrary, preparing good cost estimates is a demanding, important skill that many professionals need to acquire, including project managers.





What Is Project Cost Management?

1. Planning cost management involves determining the policies, procedures, and documentation that will be used for planning, executing, and controlling project cost. The main output of this process is a cost management plan.
2. Estimating costs involves developing an approximation or estimate of the costs of the resources needed to complete a project. The main outputs of the cost estimating process are activity cost estimates, basis of estimates, and project documents updates.
3. Determining the budget involves allocating the overall cost estimate to individual work items to establish a baseline for measuring performance. The main outputs of the cost budgeting process are a cost baseline, project funding requirements, and project documents updates.



What Is Project Cost Management?

4. Controlling costs involves controlling changes to the project budget. The main outputs of the cost control process are work performance information, cost forecasts, change requests, and project management plan updates, and project documents updates.

Many IT projects are never initiated because IT professionals do not know how to develop a financial justification for them. Important concepts such as net present value analysis, return on investment, and payback analysis were discussed in Chapter 4, Project Integration Management. Likewise, many projects that are started never finish because of cost management problems.

Basic Principles of Cost Management

Opening Case

Juan Gonzales was a systems analyst and network specialist for the waterworks department of a major Mexican city. He enjoyed helping the city develop its infrastructure. His next career objective was to become a project manager so he could have even more influence. In which Juan is the most interested interesting. Project Surveyor Pro is a concept to develop a information systems including expert systems, object-oriented databases and wireless networks communications. The system will provide instant graphic information to help government surveyors do their job. For example, after a surveyor touches a map on screen of the handheld device, the system will prompt the surveyor to enter the type necessary information for that area. This system will help with planning and execution many projects, from laying fiber optic cables to installing water lines.

Planning Cost Management



To develop a cost management plan, it is necessary to identify important information, including:

- 1. Level of accuracy of cost estimates:** Cost estimates often have instructions on rounding, such as rounding to the nearest \$100. In addition, there may be instructions on the amount of contingency to include, such as 10 or 20 percent.
- 2. Unit of measure:** Each unit of measure used in cost measurement, such as labor hours or workdays, needs to be clearly defined.
- 3. Linkage to organizational procedures:** Many organizations use a work breakdown structure (WBS) component to calculate project costs, known as a control account (CA). Each control account is usually assigned a unique code used in the organization's accounting system. The project team must understand and use these codes correctly.
- 4. Control thresholds:** Like schedule variances, costs often have a degree of allowable variance before action is required, such as 10 percent above the baseline cost.
- 5. Earned Value Management (EVM) performance measurement rules:** If the project uses EVM, as described later in this chapter, the cost management plan will define the measurement rules, such as how frequently to measure actual costs and the level of detail required.

Planning Cost Management



To develop a cost management plan, it is necessary to identify important information, including:

6. Report format: This section will describe the format and frequency of cost reports required for the project.

7. Process description: The cost management plan will also describe how to perform all cost management processes.

Developing a cost management plan is an important step in project cost management, providing stakeholders with a document on how to manage costs throughout the project. To develop a cost management plan, important information needs to be identified, including the level of accuracy of cost estimates, unit of measure, linkage to organizational procedures, control thresholds, EVM performance measurement rules, report format, and process description. The cost management plan also provides stakeholders with a reference and guide for managing project costs.

Estimating Costs

To complete projects within budget constraints, project managers need to take cost estimates seriously. After developing a good resource requirements list, they must estimate the costs for those resources and provide complete information about skill requirements, number of people, hours, special software and equipment needs.



Types of Cost Estimates

Type of Estimate	When Done	Why Done	Typical Range
Rough order of magnitude (ROM)	Very early in the project life cycle, often 3–5 years before project completion	Provides estimate of cost for selection decisions	–50% to +100%
Budgetary	Early, 1–2 years out	Puts dollars in the budget plans	–10% to +25%
Definitive	Later in the project, less than 1 year out	Provides details for purchases, estimates actual costs	–5% to +10%

The main outputs of project cost management are cost estimates and basis of estimates. Project managers normally prepare several types of cost estimates for most projects. Three basic types of estimates include the following:

1.Rough order of magnitude (ROM) estimate: done early in a project or even before it starts, used by project managers and top management for project selection decisions, and its accuracy is typically 250% to 1100%.

2.Budgetary estimate: used to allocate money into an organization's budget and made one to two years prior to project completion. The accuracy is typically 210% to 125%.

3.Definitive estimate: provides an accurate estimate of project costs, used for making many purchasing decisions for which accurate estimates are required, and made one year or less prior to project completion. The accuracy of this type of estimate is normally 25% to 110%.



Cost Estimation Tools and Techniques

Developing a good cost estimate is difficult, but tools and techniques are available to assist. These include expert judgment, analogous cost estimating, bottom-up estimating, three-point estimating, parametric estimating, cost of quality, project management estimating software, vendor bid analysis, and reserve analysis.

- Analogous estimates use the cost of a similar previous project as a basis, requiring expert judgment and are less accurate.**
- Bottom-up estimates involve estimating individual work items or activities and summing them.**
- Three-point estimates involve estimating most likely, optimistic, and pessimistic costs.**
- Parametric estimating uses project characteristics in a mathematical model to estimate costs.**
- Using a combination of these methods provides the best cost estimates.**
- Considerations include reserves, cost of quality, vendor bid analysis, and using software for cost estimating.**

Cost Estimation Tools and Techniques

Department	Year 1	Year 2	Year 3	Year 4	Year 5	Totals
Information systems	24	31	35	13	13	116
Marketing systems	3	3	3	3	3	15
Reservations	12	29	33	9	7	90
Contractors	2	3	1	0	0	6
Totals	41	66	72	25	23	227

Typical Problems with IT Cost Estimates

Although many tools and techniques can assist in creating project cost estimates, many IT project cost estimates are still very inaccurate, especially those for new technologies or software development. Tom DeMarco, a well-known author on software development, suggests four reasons for these inaccuracies and some ways to overcome them.

1. Developing estimates for large software projects is complex and requires significant effort. Many estimates must be done quickly, often before clear system requirements are produced. It is important to explain the rationale for each estimate.

2 People who develop software cost estimates often lack experience, especially for large projects. They also lack accurate, reliable project data to base estimates on. Training and mentoring can improve estimates.

3.Human beings are biased toward underestimation. Estimators might forget to allow for extra costs needed for integration and testing on large IT projects. It is important to review estimates and ask important questions to make sure the estimates are not biased.

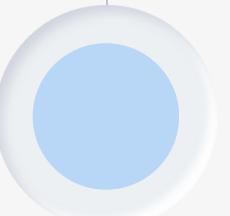
4. Management desires accuracy in estimates to help them create a bid to win a major contract or get internal funding. Project managers need to develop good cost and schedule estimates and use leadership and negotiation skills to stand by those estimates.

The importance of being cautious with initial estimates and keeping top management informed about revised cost estimates is emphasized. It is crucial to have a formal process for this, despite the possibility of it being a painful process.



Developing a cost estimate for a project involves gathering as much information as possible about the project and clarifying the ground rules and assumptions. This information should be documented in the basis of estimates, which includes the identified risks and confidence level of the final estimate. Studying sample cost estimates can also be helpful in understanding the cost estimating process.

How to Develop a Cost Estimate and Basis of Estimates



To develop a cost estimate, a step-by-step approach can be followed, using tools and techniques such as analogous estimating, parametric estimating, and bottom-up estimating. It is important to consider the purpose of the cost estimate, as it will affect the level of accuracy required.



Once the cost estimate is developed, it should be reviewed by project managers and top management to ensure accuracy and to address any biases or underestimations. Changes to the estimate should be documented and communicated to top management to keep them informed. A well-documented and accurate cost estimate can help with contract awards and performance reporting.

DETERMINING THE BUDGET

Determining the project budget is the process of allocating costs to each material or task over time. Important inputs include project documents, business documents, agreements, environmental factors, and process assets. The main goal of this process is to create a cost baseline to measure project performance and determine funding requirements for the project. Project document updates may be carried out after this process.

The Surveyor Pro project team will use cost estimates from Figure 7-2, along with the project schedule and other information, to allocate costs for each month. Figure 7-4 provides an example of a cost baseline for this project. The cost baseline is the budget for each phase that project managers use to measure and monitor cost performance. It includes contingency reserves but does not include management reserves. Remember that contingency reserves are for known unknowns while management reserves are for unknown unknowns.



DETERMINING THE BUDGET

Surveyor Pro Project Cost Baseline Created October 10*

WBS Items	Months												Totals
	1	2	3	4	5	6	7	8	9	10	11	12	
1. Project Management													
1.1 Project manager	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	96,000
1.2 Project team members	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	144,000
1.3 Contractors		6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	66,300
2. Hardware													
2.1 Handheld devices				30,000	30,000								60,000
2.2 Servers					8,000	8,000							16,000
3. Software													
3.1 Licensed software				10,000	10,000								20,000
3.2 Software development		60,000	60,000	80,000	127,000	127,000	90,000	50,000					594,000
4. Testing			6,000	8,000	12,000	15,000	15,000	13,000					69,000
5. Training and Support													
5.1 Trainee cost									50,000				50,000
5.2 Travel cost									8,400				8,400
5.3 Project team members							24,000	24,000	24,000	24,000	24,000	24,000	144,000
6. Reserves				10,000	10,000	30,000	30,000	60,000	40,000	40,000	30,000	3,540	253,540
Totals	20,000	86,027	92,027	172,027	223,027	198,027	185,027	173,027	148,427	90,027	80,027	53,567	1,521,240

*See the lecture slides for this chapter on the Instructor website for a larger view of this and other figures in this chapter. Numbers are rounded, so some totals appear to be off.

FIGURE 7-4: Surveyor Pro project cost baseline

DETERMINING THE BUDGET

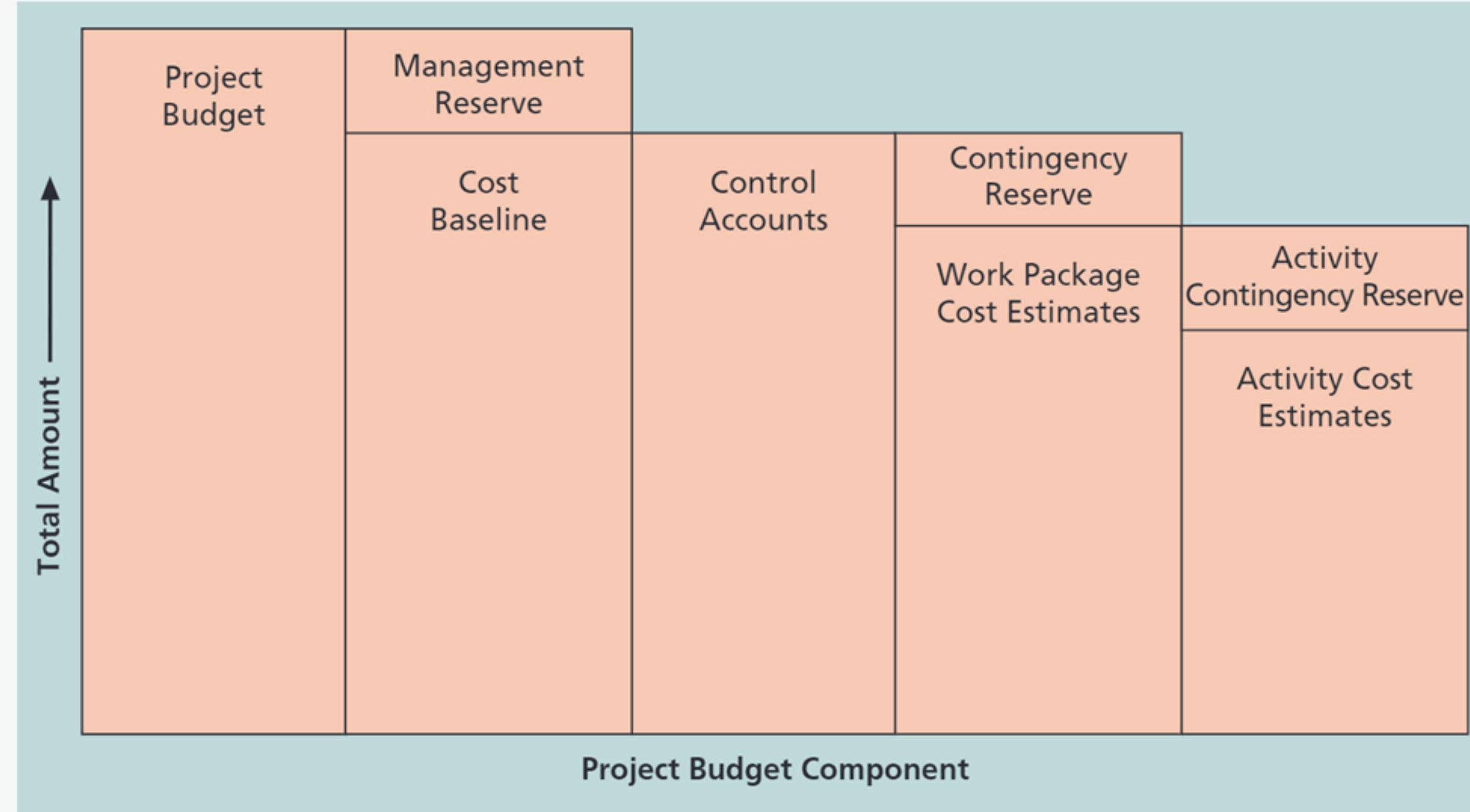


FIGURE 7-5: project budget components

Figure 7-5 illustrates the different components of a project budget. The project budget includes the baseline cost plus management reserve. The control account is the estimated total cost of the work package plus contingency reserve. The work package cost estimate is the estimated cost of the activity plus risk contingency reserve.

DETERMINING THE BUDGET



Most organizations have a well-established process for preparing budgets and other cost materials. It is important to understand these types of budgets before developing estimates to ensure that appropriate data is collected. Organizations use this information to monitor costs in projects and non-project work and to find ways to reduce costs. They also use the information for legal and tax purposes.

After determining the budget for the project, estimating the cost for each project activity over time will help project management and senior leadership control costs. Budgeting can also lead to updates to the cost management plan, and Appendix A provides guidance on using Project 2016 to control costs.

Cost budgeting also provides information for project funding requirements. Some projects have all funds available when the project begins, but others rely on periodic funding sources to avoid cash flow problems. If the cost baseline shows that more money is needed in certain months than expected, the organization must make adjustments to avoid financial problems.

Controlling Costs

Earned Value
Management

Project Portfolio
Management

Earned Value Management

Earned value management (EVM) is a project performance measurement technique that integrates scope, time, and cost data. Given a cost performance baseline, project managers and their teams can determine how well the project is meeting scope, time, and cost goals by entering actual information and then comparing it to the baseline. As defined in Chapter 4, a baseline is a starting point, a measurement, or an observation that is documented so that it can be used for future comparison. Actual information includes whether or not a WBS item was completed, approximately how much of the work was completed, when the work actually started and ended, and how much the completed work actually cost.

Earned Value Management

The basic principle of earned value management (EVM) is that the value of the piece of work is equal to the amount of funds budgeted to complete it.

Planned value: This is the approved budget for the work scheduled to be completed by a set date.

Earned value: This is the approved budget for the work actually completed by the specified date.

Actual costs: The costs actually incurred for the work completed by the specified date.

Earned Value Management

To describe your project's schedule and cost performance with EVM, you use the following indicators:

Schedule variance (SV): This is a measure of the difference between the work that was actually done against the amount of work that was planned to be done. This clearly shows if the project is on schedule or not.

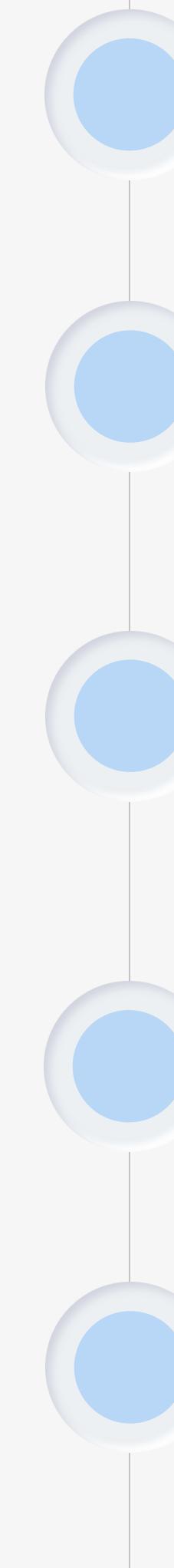
Cost variance (CV): This is the measure of the difference between the amount that was budgeted for the work meant to be done and the amount that was actually spent for the work performed. Thus this shows if the project is on budget or not.

Schedule performance index (SPI): This is the ratio between the budget that is approved for the work that is performed to the budget that is approved for the work that was planned in the first place. This is a relative measure of the project's time efficiency.

Cost performance index (CPI): This is the ratio between the approved budgets for the work that is performed to the budget that was actually spent for the stipulated work. It is a relative measure of the cost efficiency of the project and can be used to estimate the cost of the remainder of the task.

Project Portfolio Management

An organization can view project portfolio management as having five levels, from simplest to most complex, as follows:



- 1. Put all your projects in one database.**
- 2. Prioritize the projects in your database.**
- 3. Divide your projects into two or three budgets based on type of investment, such as utilities or required systems to keep things running, incremental upgrades, and strategic investments.**
- 4. Automate the repository.**
- 5. Apply modern portfolio theory, including risk-return tools that map project risk on a curve.**

Project Portfolio Management

Many project managers also want to move on to manage larger projects, become program managers, then vice presidents, and eventually CEOs. Understanding project portfolio management, therefore is important for both project and organizational success.

Project portfolio managers can start by using spreadsheet software to develop and manage project portfolios, or they can use sophisticated software designed to help manage project portfolios. Several software tools available today help project portfolio managers summarize earned value and project portfolio information, as described in the following section.

The article discusses the use of software in project cost management. Many organizations use spreadsheets or centralized financial software for cost estimating, budgeting, and control. Project management software can be used to study overall project information, assign costs to resources and tasks, prepare cost estimates, develop budgets, and monitor cost performance. Some IT project managers use other tools, such as accounting or spreadsheet software, instead of project management software. However, several companies have developed methods to link data between project management and accounting software to improve cost management. The article also mentions the use of enterprise or project portfolio management (PPM) tools, which integrate information from multiple projects to show their status and health. Many organizations in various industries use PPM to achieve customer satisfaction, cost reduction, and revenue growth. The market for PPM software continues to grow, and companies are achieving high returns from their investments in such tools. Examples of successful PPM implementations include Pfizer and Ford. Overall, managers must ensure that the data is accurate and up to date when using software for project cost management or PPM, and ask pertinent questions before making decisions based on the output of such tools.

Using Project Management Software to Assist in Project Cost Management

Considerations for Agile/Adaptive Environments

A consideration in the agile/adaptive project environment is that projects subjected to various elements of ambiguity and change have an inherent need to communicate evolving and emerging details more frequently and quickly

Projects with high degrees of uncertainty or those where the scope is not yet fully defined may not benefit from detailed cost calculations due to frequent changes. Instead, lightweight estimation methods can be used to generate a fast, high-level forecast of project labor costs, which can then be easily adjusted as changes arise. Detailed estimates are reserved for short-term planning horizons in a just-in-time fashion. In cases where high-variability projects are also subject to strict budgets, the scope and schedule are more often adjusted to stay within cost constraints. Remember that projects are usually part of a program and portfolio. Senior managers in charge of the programs and portfolios are making high-level budget decisions. Most programs include projects with a variety of product life cycles (predictive, iterative, incremental, adaptive, and hybrid, as described in Chapter 2). For those projects or parts of projects using an adaptive or agile approach, the product owner secures funding, sometimes one release at a time. Agile teams, therefore, focus on completing requirements based on their priority (from the product backlog).

Considerations for Agile/Adaptive Environments

Can you use EVM on Agile projects? Yes, you can use an adaptation of EVM, as described below. Read the referenced article and other sources for more details on this topic. AgileEVM is an adapted implementation of EVM that uses the Scrum framework artifacts as inputs, uses traditional EVM calculations, and is expressed in traditional EVM metrics. AgileEVM requires a minimal set of input parameters: the actual cost of a project, an estimated product backlog, a release plan that provides information on the number of iterations in the release and the assumed velocity. All estimates can be in hours, story-points, team days or any other consistent estimate of size. The critical factor is that it must be a numerical estimate of some kind.

**THANK YOU
FOR WATCHING**