

# Chapter 7: Project Cost Management

Information Technology Project  
Management, Eighth Edition

Note: See the text itself for full citations.



# Learning Objectives

- ▶ Understand the importance of project cost management
- ▶ Explain basic project cost management principles, concepts, and terms
- ▶ Describe the process of planning cost management
- ▶ Discuss different types of cost estimates and methods for preparing them

# Learning Objectives

- ▶ Understand the processes of determining a budget and preparing a cost estimate for an information technology (IT) project
- ▶ Understand the benefits of earned value management and project portfolio management to assist in cost control
- ▶ Describe how project management software can assist in project cost management

# The Importance of Project Cost Management

- ▶ IT projects have a poor track record for meeting budget goals
- ▶ A cost **overrun** is the additional percentage or dollar amount by which actual costs exceed estimates
- ▶ A 2011 Harvard Business Review study reported an average cost overrun of 27 percent. The most important finding was the discovery of a large number of gigantic overages or “black swans”

# What is Cost and Project Cost Management?

- ▶ **Cost** is a resource sacrificed or foregone to achieve a specific objective or something given up in exchange
- ▶ Costs are usually measured in monetary units like dollars
- ▶ **Project cost management** includes the processes required to ensure that the project is completed within an approved budget

# Project Cost Management Processes

- ▶ **Planning cost management** :determining the policies, procedures, and documentation that will be used for planning, executing, and controlling project cost.
- ▶ **Estimating costs:** developing an approximation or estimate of the costs of the resources needed to complete a project
- ▶ **Determining the budget:** allocating the overall cost estimate to individual work items to establish a baseline for measuring performance
- ▶ **Controlling costs:** controlling changes to the project budget

# Figure 7-1. Project Cost Management Summary

## Planning

Process: **Plan cost management**

Outputs: Cost management plan

Process: **Estimate costs**

Outputs: Activity cost estimates, basis of estimates, project documents updates

Process: **Determine budget**

Outputs: Cost baseline, project funding requirements, project documents updates

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## Monitoring and Controlling

Process: **Control costs**

Outputs: Work performance information, cost forecasts, change requests, project management plan updates, project documents updates, organizational process assets updates

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Project Start

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Project Finish

# Basic Principles of Cost Management

- ▶ Most members of an executive board better understand and are more interested in financial terms than IT terms , so IT project managers must speak their language
  - **Profits** are revenues minus expenditures
  - **Profit margin** is the ratio of revenues to profits
  - **Life cycle costing** considers the total cost of ownership, or development plus support costs, for a project
  - **Cash flow analysis** determines the estimated annual costs and benefits for a project and the resulting annual cash flow

# Types of Costs and Benefits

- ▶ **Tangible costs** or **benefits** are those costs or benefits that an organization can easily measure in dollars
- ▶ **Intangible costs** or **benefits** are costs or benefits that are difficult to measure in monetary terms
- ▶ **Direct costs** are costs that can be directly related to producing the products and services of the project
- ▶ **Indirect costs** are costs that are not directly related to the products or services of the project, but are indirectly related to performing the project
- ▶ **Sunk cost** is money that has been spent in the past; when deciding what projects to invest in or continue, you should *not* include sunk costs

# More Basic Principles of Cost Management

- ▶ **Learning curve theory** states that when many items are produced repetitively, the unit cost of those items decreases in a regular pattern as more units are produced
- ▶ **Reserves** are dollars included in a cost estimate to mitigate cost risk by allowing for future situations that are difficult to predict
  - **Contingency reserves** allow for future situations that may be partially planned for (sometimes called **known unknowns**) and are included in the project cost baseline
  - **Management reserves** allow for future situations that are unpredictable (sometimes called **unknown unknowns**)

# Planning Cost Management

- ▶ The project team uses expert judgment, analytical techniques, and meetings to develop the cost management plan
- ▶ A cost management plan includes:
  - Level of accuracy and units of measure
  - Organizational procedure links
  - Control thresholds
  - Rules of performance measurement
  - Reporting formats
  - Process descriptions

# Estimating Costs

- ▶ Project managers must take cost estimates seriously if they want to complete projects within budget constraints
- ▶ It's important to know the types of cost estimates, how to prepare cost estimates, and typical problems associated with IT cost estimates

# Table 7-1. Types of Cost Estimates

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

# Cost Estimation Tools and Techniques

- ▶ Basic tools and techniques for cost estimates:
  - **Analogous or top-down estimates:** use the actual cost of a previous, similar project as the basis for estimating the cost of the current project
  - **Bottom-up estimates:** involve estimating individual work items or activities and summing them to get a project total
  - **Parametric modeling** uses project characteristics (parameters) in a mathematical model to estimate project costs

# Typical Problems with IT Cost Estimates

- ▶ Estimates are done too quickly
- ▶ People lack estimating experience
- ▶ Human beings are biased toward underestimation
- ▶ Management desires accuracy

# Sample Cost Estimate

- ▶ See the text for a detailed example of creating a cost estimate for the Surveyor Pro project described in the opening case
- ▶ Before creating an estimate, know what it will be used for, gather as much information as possible, and clarify the ground rules and assumptions for the estimate
- ▶ If possible, estimate costs by major WBS categories
- ▶ Create a cost model to make it easy to make changes to and document the estimate

# Figure 7-2. Surveyor Pro Project Cost Estimate

Surveyor Pro Project Cost Estimate Created October 5

|  | # Units/Hrs. | Cost/Unit/Hr. | Subtotals | WBS Level 2 Totals | % of Total |
|--|--------------|---------------|-----------|--------------------|------------|
| <b>WBS Items</b>   |              |               |           |                    |            |
| <b>1. Project Management</b>                                 |              |               |           | <b>\$306,300</b>   | <b>20%</b> |
| Project manager  | 960          | \$100         | \$96,000  |                    |            |
| Project team members   | 1920         | \$75          | \$144,000 |                    |            |
| Contractors (10% of software development and testing)        |              |               | \$66,300  |                    |            |
| <b>2. Hardware</b>   |              |               |           | <b>\$76,000</b>    | <b>5%</b>  |
| 2.1 Handheld devices   | 100          | \$600         | \$60,000  |                    |            |
| 2.2 Servers  | 4            | \$4,000       | \$16,000  |                    |            |
| <b>3. Software</b>   |              |               |           | <b>\$614,000</b>   | <b>40%</b> |
| 3.1 Licensed software  | 100          | \$200         | \$20,000  |                    |            |
| 3.2 Software development*                                    |              |               | \$594,000 |                    |            |
| <b>4. Testing (10% of total hardware and software costs)</b> |              |               | \$69,000  | <b>\$69,000</b>    | <b>5%</b>  |
| <b>5. Training and Support</b>                               |              |               |           | <b>\$202,400</b>   | <b>13%</b> |
| Trainee cost   | 100          | \$500         | \$50,000  |                    |            |
| Travel cost  | 12           | \$700         | \$8,400   |                    |            |
| Project team members   | 1920         | \$75          | \$144,000 |                    |            |
| <b>6. Reserves (20% of total estimate)</b>                   |              |               | \$253,540 | <b>\$253,540</b>   | <b>17%</b> |
| <b>Total project cost estimate</b>                           |              |               |           | <b>\$1,521,240</b> |            |

\*See software development estimate.

# Figure 7-3. Surveyor Pro Software Development Estimate

| 1. Labor Estimate  | # Units/Hrs. | Cost/Unit/Hr.     | Subtotals        | Calculations                                   |
|--|--------------|-------------------|------------------|--|
| Contractor labor estimate  | 3000         | \$150             | \$450,000        | $3000 * 150$                                   |
| Project team member estimate   | 1920         | \$75              | \$144,000        | $1920 * 75$                                    |
| <b>Total labor estimate</b>  |              |                   | <b>\$594,000</b> | Sum above two values                           |
| 2. Function point estimate   | Quantity     | Conversion Factor | Function Points  | Calculations                                   |
| External inputs  | 10           | 4                 | 40               | $10 * 4$                                       |
| External interface files   | 3            | 7                 | 21               | $3 * 7$  |
| External outputs   | 4            | 5                 | 20               | $4 * 5$  |
| External queries   | 6            | 4                 | 24               | $6 * 4$  |
| Logical internal tables  | 7            | 10                | 70               | $7 * 10$                                       |
| <b>Total function points</b>   |              |                   | <b>175</b>       | Sum above function point values                |
| Java 2 language equivalency value  |              |                   | 46               | Assumed value from reference                   |
| Source lines of code (SLOC) estimate                                       |              |                   | 8,050            | $175 * 46$                                     |
| Productivity $\times$ K <sub>SLOC</sub> $^{\wedge}$ Penalty<br>(in months) |              |                   | 29.28            | $3.13 * 8.05^{\wedge}1.072$<br>(see reference) |
| Total labor hours<br>(27 hours/function point)*                            |              |                   | 4,725            | $27 * 175$                                     |
| Cost/labor hour (\$120/hour)   |              |                   | \$120            | Assumed value from budget expert               |
| <b>Total function point estimate</b>                                       |              |                   | <b>\$567,000</b> | $4,725 * 120$                                  |

\* Based on historical data

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# Determining the Budget

- ▶ Cost budgeting involves allocating the project cost estimate to individual work items over time
- ▶ The WBS is a required input to the cost budgeting process since it defines the work items
- ▶ Important goal is to produce a **cost baseline**
  - a time-phased budget that project managers use to measure and monitor cost performance

# Figure 7-4. Surveyor Pro Project Cost Baseline

Surveyor Pro Project Cost Baseline Created October 10\*

| WBS Items                | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       | 9       | 10     | 11     | 12     | Totals    |
|--------------------------|--------|--------|--------|---------|---------|---------|---------|---------|---------|--------|--------|--------|-----------|
| 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 companion Web site for a larger view of this and other figures in this chapter. Numbers are rounded, so some totals appear to be off.

# Controlling Costs

- ▶ Project cost control includes
  - Monitoring cost performance
  - Ensuring that only appropriate project changes are included in a revised cost baseline
  - Informing project stakeholders of authorized changes to the project that will affect costs
- ▶ Many organizations around the globe have problems with cost control

# Earned Value Management (EVM)

- ▶ EVM is a project performance measurement technique that integrates scope, time, and cost data
- ▶ Given a **baseline** (original plan plus approved changes), you can determine how well the project is meeting its goals
- ▶ You must enter actual information periodically to use EVM
- ▶ More and more organizations around the world are using EVM to help control project costs

# Earned Value Management Terms

- ▶ The **planned value (PV)**, formerly called the budgeted cost of work scheduled (BCWS), also called the budget, is that portion of the approved total cost estimate planned to be spent on an activity during a given period
- ▶ **Actual cost (AC)**, formerly called actual cost of work performed (ACWP), is the total of direct and indirect costs incurred in accomplishing work on an activity during a given period
- ▶ The **earned value (EV)**, formerly called the budgeted cost of work performed (BCWP), is an estimate of the value of the physical work actually completed
- ▶ EV is based on the original planned costs for the project or activity and the rate at which the team is completing work on the project or activity to date

# Rate of Performance

- ▶ **Rate of performance (RP)** is the ratio of actual work completed to the percentage of work planned to have been completed at any given time during the life of the project or activity
- ▶ Brenda Taylor, Senior Project Manager in South Africa, suggests this term and approach for estimating earned value
- ▶ For example, suppose the server installation was halfway completed by the end of week 1. The rate of performance would be 50% because by the end of week 1, the planned schedule reflects that the task should be 100 percent complete and only 50 percent of that work has been completed

# Table 7-3. Earned Value Calculations for One Activity After Week One

| ACTIVITY                         | WEEK 1  |
|----------------------------------|---------|
| Earned Value (EV)                | 5,000   |
| Planned Value (PV)               | 10,000  |
| Actual Cost (AC)                 | 15,000  |
| Cost Variance (CV)               | -10,000 |
| Schedule Variance (SV)           | -5,000  |
| Cost Performance Index (CPI)     | 33%     |
| Schedule Performance Index (SPI) | 50%     |

# Table 7-4. Earned Value Formulas

| Term                             | Formula                        |
|----------------------------------|--------------------------------|
| Earned value (EV)                | $EV = PV \text{ to date} * RP$ |
| Cost variance (CV)               | $CV = EV - AC$                 |
| Schedule variance (SV)           | $SV = EV - PV$                 |
| Cost performance index (CPI)     | $CPI = EV/AC$                  |
| Schedule performance index (SPI) | $SPI = EV/PV$                  |
| Estimate at completion (EAC)     | $EAC = BAC/CPI$                |
| Estimated time to complete       | Original time estimate/SPI     |

# Rules of Thumb for Earned Value Numbers

- ▶ Negative numbers for cost and schedule variance indicate problems in those areas
- ▶ CPI and SPI less than 100% indicate problems
- ▶ Problems mean the project is costing more than planned (over budget) or taking longer than planned (behind schedule)
- ▶ The CPI can be used to calculate the **estimate at completion** (EAC)—an estimate of what it will cost to complete the project based on performance to date. The **budget at completion** (BAC) is the original total budget for the project

# Project Portfolio Management

- ▶ Many organizations collect and control an entire suite of projects or investments as one set of interrelated activities in a portfolio
- ▶ Five levels for project portfolio management
  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
  4. Automate the repository
  5. Apply modern portfolio theory, including risk-return tools that map project risk on a curve

# Benefits of Portfolio Management

- ▶ Schlumberger saved \$3 million in one year by organizing 120 information technology projects into a portfolio
- ▶ Reduced redundant projects and coordinated those with overlap
- ▶ IT projects can be huge investments, so it makes sense to view them as portfolios and track their progress as a whole

# Using Software to Assist in Cost Management

- ▶ Spreadsheets are a common tool for resource planning, cost estimating, cost budgeting, and cost control
- ▶ Many companies use more sophisticated and centralized financial applications software for cost information
- ▶ Project management software has many cost-related features, especially enterprise PM software
- ▶ Portfolio management software can help reduce costs

# Chapter Summary

- ▶ Project cost management is a traditionally weak area of IT projects, and project managers must work to improve their ability to deliver projects within approved budgets
- ▶ Main processes include
  - Plan cost management
  - Estimate costs
  - Determine the budget
  - Control costs