

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. One of his colleagues invited him to attend an important project review meeting for large government projects, including the Surveyor Pro project, in which Juan was most interested. The Surveyor Pro project was a concept for developing a sophisticated information system that included expert systems, object-oriented databases, and wireless communications. The system would provide instant, graphical information to help government surveyors do their jobs. For example, after a surveyor touched a map on the screen of a handheld device, the system would prompt the surveyor to enter the type of information needed for that area. This system would help in planning and implementing many projects, from laying fiber-optic cable to installing water lines.

Juan was very surprised, however, that the majority of the meeting was spent discussing cost-related issues. The government officials were reviewing many existing projects to evaluate their performance and the potential impact on the government's budget before discussing funding for any new projects. Juan did not understand many of the terms and charts being presented. What was this "earned value" they kept referring to? How were they estimating what it would cost to complete projects or how long it would take? Juan thought he would learn more about the new technologies the Surveyor Pro project would use, but he discovered that the cost estimates and projected benefits were of most interest to the government officials at the meeting. It also seemed that considerable effort would go toward detailed financial studies before any technical work could even start. Juan wished he had taken some accounting and finance courses so he could understand the acronyms and concepts people were discussing. Although Juan had a degree in electrical engineering, he had no formal education in finance and little experience with it. However, if Juan could understand information systems and networks, he was confident that he could understand financial issues on projects as well. He jotted down questions to discuss with his colleagues after the meeting.

7.1 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.¹

The most important finding in the study, however, was the discovery of a large number of gigantic overages when analyzing the project overrun data. One in six of all projects studied contained a "black swan": a high-impact event that is rare and unpredictable, but not improbable in retrospect. These IT black swan projects had an average cost overrun of 200 percent and a schedule overrun of almost 70 percent. "This highlights the true pitfall of IT change initiatives: It's not that they're particularly prone to high cost overruns on average, as management consultants and academic studies have previously suggested.

It's that an unusually large proportion of them incur massive overages—that is, there are a disproportionate number of black swans. By focusing on averages instead of the more damaging outliers, most managers and consultants have been missing the real problem.”²

Obviously, IT projects have room for improvement in meeting cost goals. This chapter describes important concepts in project cost management, particularly planning cost management, creating good estimates, and using earned value management (EVM) to assist in cost control.

WHAT WENT WRONG?

The United Kingdom's National Health Service (NHS) IT modernization program was called “the greatest IT disaster in history” by one London columnist. This 10-year program, which started in 2002, was created to provide an electronic patient records system, appointment booking, and a prescription drug system in England and Wales. Britain's Labor government estimates that the program will eventually cost more than \$55 billion, a \$26 billion overrun. The program has been plagued by technical problems due to incompatible systems, resistance from physicians who say they were not adequately consulted about system features, and arguments among contractors about who's responsible for what.³ A government audit in June 2006 found that the program, one of the largest civilian IT projects undertaken worldwide, was progressing despite high-profile problems. In an effort to reduce cost overruns, the NHS program would no longer pay for products until delivery, shifting some financial responsibility to prime contractors, including BT Group, Accenture, and Fujitsu Services.⁴ On September 22, 2011, government officials in the United Kingdom announced that they were scrapping the National Programme for Health IT. Health Secretary Andrew Lansley said that the program “let down the NHS and wasted taxpayers' money.”⁵

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7.1a 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.

Another perceived reason for cost overruns is that many IT projects involve new technology or business processes. Any new technology or business process is untested and has inherent risks. Thus, costs grow and failures are to be expected, right? Wrong. Using good project cost management can change this false perception.

7.1b What Is Project Cost Management?

Recall from Chapter 1 that the triple constraint of project management involves balancing scope, time, and cost goals. Chapters 5 and 6 discuss project scope and time management, and this chapter describes project cost management. **Project cost management** includes the processes required to ensure that a project team completes a project within an approved budget. Notice two crucial phrases in this definition: “a project” and “approved budget.” Project managers must make sure *their* projects are well defined, have accurate time and cost estimates, and have a realistic budget that *they* were involved in approving. It is the project manager’s job to satisfy project stakeholders while continuously striving to reduce and control costs. There are four processes for 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.
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, project management plan updates, project documents updates, and organizational process assets updates.

Figure 7-1 summarizes these processes and outputs, showing when they occur in a typical project.

To understand each of the project cost management processes, you must first understand the basic principles of cost management. Many of these principles are not unique to project management; however, project managers need to understand how these principles relate to their specific projects.

7.2 BASIC PRINCIPLES OF COST MANAGEMENT

Many IT projects are never initiated because IT professionals do not understand the importance of basic accounting and finance principles. 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. Most members of an executive board have a better understanding of financial terms than IT terms, and are more interested in finance. Therefore, IT project managers need to be able to present and discuss project information both in financial terms and technical terms. In addition to net present value analysis, return on investment, and payback analysis, project managers must understand several other cost management principles, concepts, and terms. This section describes general topics such as profits, life cycle costing, cash flow analysis, tangible and intangible costs and benefits,

PlanningProcess: **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

Monitoring and ControllingProcess: **Control costs**

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

Project Start

Project Finish

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FIGURE 7-1 Project cost management summary

direct costs, sunk costs, learning curve theory, and reserves. Another important topic—earned value management—is one of the key tools and techniques for controlling project costs; it is described in detail in the section on cost control.

Profits are revenues minus expenditures. To increase profits, a company can increase revenues, decrease expenses, or try to do both. Most executives are more concerned with profits than with other issues. When justifying investments in new information systems and technology, it is important to focus on the impact on profits, not just revenues or expenses. Consider an e-commerce application that you estimate will increase revenues for a \$100 million company by 10 percent. You cannot measure the potential benefits of the application without knowing the profit margin. **Profit margin** is the ratio of profits to revenues. If revenues of \$100 generate \$2 in profits, there is a 2 percent profit margin. If the company loses \$2 for every \$100 in revenue, there is a -2 percent profit margin.

Life cycle costing provides a big-picture view of the cost of a project throughout its life cycle. This helps you develop an accurate projection of a project's financial costs and benefits. Life cycle costing considers the total cost of ownership, or development plus support costs, for a project. For example, a company might complete a project to develop and implement a new customer service system in 1 or 2 years, but the new system could be in place for 10 years. Project managers, with assistance from financial experts in their organizations, should create estimates of the costs and benefits of the project for its entire life cycle (10 years in the preceding example). Recall from Chapter 4 that the net present value analysis for the project would include the entire 10-year period of costs and benefits. Top management and project managers need to consider the life cycle costs of projects when they make financial decisions.



MEDIA SNAPSHOT

A primary goal of many projects is to achieve some type of financial benefits, measured using life cycle costing. Project success criteria often include reaching a certain return on investment (ROI) over the life cycle. You cannot measure ROI for projects if you do not have a benefits measurement process in place. How do you know if you earned or saved a certain amount each year after the project was completed if you do not have a way to measure it? According to a 2015 report by PMI:

- Many organizations do not have a benefits measurement process at all.
- Only twenty percent of organizations report having a high level of benefits realization maturity.
- Thirty-nine percent of high-performing organizations report high benefits realization maturity compared to nine percent of low performers.

“Organizations with mature benefits realization processes can benefit from:

- Clearly identifying the strategic rewards prior to starting a project
- Effectively assessing and monitoring risks to project success
- Proactively planning for making necessary changes in the organization
- Explicitly defining accountability for project success
- Routinely extending responsibility for integration to the project team.”⁷

Organizations have a history of not spending enough money in the early phases of IT projects, which affects total cost of ownership. For example, it is much more cost-effective to spend money on defining user requirements and doing early testing on IT projects than to wait for problems to appear after implementation. Recall from Chapter 5 that correcting a software defect late in a project costs much more than fixing the defect early.

Because organizations depend on reliable IT, huge costs are associated with downtime.

- When Facebook was down for 20 minutes on September 3, 2014, they lost a little more than \$22,453 for every minute or more than \$500,000.⁸
- On August 19, 2013, Amazon.com went down for about 30 minutes, costing them \$66,240 per minute or nearly \$2 million.⁹
- For Fortune 1000 companies, the average cost of an infrastructure failure is \$100,000 per hour; the average cost of a critical application failure is \$500,000 to \$1 million per hour, or \$8,300 to \$16,600 per minute.¹⁰
- In 2014, the average annual cost of unplanned application downtime in Fortune 1000 companies was \$1.25 billion to \$2.5 billion.¹¹



WHAT WENT RIGHT?

An important cost-cutting strategy has been inspired by the global emphasis on improving the environment. Investing in green IT and other initiatives has helped both the environment and companies' bottom lines. Michael Dell, CEO of Dell, said he aimed to make

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his company "carbon neutral" in 2008. "The computer giant is looking to zero-out its carbon emissions through a number of initiatives, such as offering small businesses and consumers curbside recycling of their old computers, stuffing small recycling bags with free postage into new printer-ink cartridge boxes, and operating a 'Plant a Tree for Me' program."¹² Dell did reach his goal; as of March 2012, Dell had helped its customers save almost \$7 billion in energy costs.

Dell continues to practice corporate responsibility by helping the environment. In 2014, they reported the following progress:

- Recovered 230.9 million pounds of used electronics and are on track to reach our goal of 2 billion pounds by 2020
- Reduced the average energy intensity of our product line by 23.2 percent compared to FY12
- Decreased operational emissions by 10 percent
- Used more than 10 million pounds of post-consumer recycled plastics in our products¹³

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Cash flow analysis is a method for determining the estimated annual costs and benefits for a project and the resulting annual cash flow. Project managers must conduct cash flow analysis to determine net present value. Most consumers understand the basic concept of cash flow: If they do not have enough money in their wallets or bank accounts, they cannot purchase something. Top management must consider cash flow concerns when selecting projects in which to invest. If top management selects too many projects that have high cash flow needs in the same year, the company will not be able to support all of its projects and maintain its profitability. It is also important to clarify the year used to analyze dollar amounts. For example, if a company bases all costs on 2012 estimates, it would need to account for inflation and other factors when projecting costs and benefits in future-year dollars.

Tangible and intangible costs and benefits are categories for determining how well an organization can define the estimated costs and benefits for a project. **Tangible costs or benefits** are easy to measure in dollars. For example, suppose that the Surveyor Pro project described in the chapter's opening case included a preliminary feasibility study. If a company completed this study for \$100,000, its tangible cost is \$100,000. If a government agency estimated that it could have done the study for \$150,000, the tangible benefits of the study would be \$50,000 to the government: It could pay for the study and then assign the government workers who would have done the study to other projects.

In contrast, **intangible costs or benefits** are difficult to measure in dollars. Suppose that Juan and a few other people spent their own personal time using government-owned computers, books, and other resources to research areas related to the study. Although their hours and the government-owned materials would not be billed to the project, they could be considered intangible costs. Intangible benefits for projects often include items like goodwill, prestige, and general statements of improved productivity that an organization cannot easily translate into dollar amounts. Because intangible costs and benefits are difficult to quantify, they are often harder to justify.

Direct costs can be directly related to creating the products and services of the project. You can attribute direct costs to a particular project. For example, direct costs include

the salaries of people working full time on the project and the cost of hardware and software purchased specifically for the project. Project managers should focus on direct costs because they can be controlled.

Indirect costs are not directly related to the products or services of the project, but are indirectly related to performing work on the project. For example, indirect costs would include the cost of electricity, paper towels, and other necessities in a large building that houses 1,000 employees who work on many projects. Indirect costs are allocated to projects, and project managers have very little control over them.

Sunk cost is money that has been spent in the past. Consider it gone, like a sunken ship that can never be raised. When deciding what projects to invest in or continue, you should not include sunk costs. For example, in the chapter's opening case, suppose that Juan's office had spent \$1 million on a project over the past three years to create a geographic information system, but had never produced anything valuable. If his government were evaluating what projects to fund next year and an official suggested continuing to fund the geographic information system project because \$1 million had been spent on it already, the official would incorrectly be making sunk cost a key factor in the project selection decision. Many people fall into the trap of continuing to spend money on a failing project because so much money has been spent on it already. This trap is similar to gamblers who continue betting because they have already lost money. Sunk costs should be forgotten, even though it is often difficult to think that way.

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. For example, suppose that the Surveyor Pro project would potentially produce 1,000 handheld devices that could run the new software and access information via satellite. The cost of the first handheld unit would be much higher than the cost of the thousandth unit. Learning curve theory can help estimate costs on projects that involve the production of large quantities of items.

Learning curve theory also applies to the amount of time required to complete some tasks. For example, the first time a new employee performs a specific task, it will probably take longer than the tenth time that employee performs a very similar task. Effort estimates, therefore, should be lower for more experienced workers.

Reserves are dollar amounts 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. For example, if an organization knows it has a 20 percent rate of turnover for IT personnel, it should include contingency reserves to pay for recruiting and training costs of IT personnel. **Management reserves** allow for future situations that are unpredictable (sometimes called **unknown unknowns**). For example, if a project manager gets sick for two weeks or an important supplier goes out of business, management reserve could be set aside to cover the resulting costs. Management reserves are not included in a cost baseline, as you will learn later in this chapter.

7.3 PLANNING COST MANAGEMENT

The first step in project cost management is planning how the costs will be managed throughout the life of the project. Project costs, like project schedules, grow out of the basic documents that initiate a project, like the project charter. The project manager and

other stakeholders use expert judgment, analytical techniques, and meetings to produce the cost management plan.

The cost management plan, like the scope and schedule management plans, can be informal and broad or formal and detailed, based on the needs of the project. In general, a cost management plan includes the following information:

- *Level of accuracy:* Activity cost estimates normally have rounding guidelines, such as rounding to the nearest \$100. There may also be guidelines for the amount of contingency funds to include, such as 10 or 20 percent.
- *Units of measure:* Each unit used in cost measurements, such as labor hours or days, should be defined.
- *Organizational procedures links:* Many organizations refer to the work breakdown structure (WBS) component used for project cost accounting as the control account (CA). Each control account is often assigned a unique code that is used in the organization's accounting system. Project teams must understand and use these codes properly.
- *Control thresholds:* Similar to schedule variance, costs often have a specified amount of variation allowed before action needs to be taken, such as ± 10 percent of the baseline cost.
- *Rules of performance measurement:* If the project uses earned value management (EVM), as described later in this chapter, the cost management plan would define measurement rules, such as how often actual costs will be tracked and to what level of detail.
- *Reporting formats:* This section would describe the format and frequency of cost reports required for the project.
- *Process descriptions:* The cost management plan would also describe how to perform all of the cost management processes.

7.4 ESTIMATING COSTS

Project managers must take cost estimates seriously if they want to complete projects within budget constraints. After developing a good resource requirements list, project managers and their project teams must develop several estimates of the costs for these resources. Recall from Chapter 6 that an important process in project time management is estimating activity resources, which provides a list of activity resource requirements. For example, if an activity for a project is to perform a particular type of test, the list of activity resource requirements would describe the skill level of the people needed to perform the test, the number of people and hours suggested to perform the test, the need for special software or equipment, and other requirements. All of this information is required to develop a good cost estimate. This section describes various types of cost estimates, tools and techniques for estimating costs, typical problems associated with IT cost estimates, and a detailed example of a cost estimate for an IT project.

7.4a Types of Cost Estimates

One of the main outputs of project cost management is a cost estimate. Project managers normally prepare several types of cost estimates for most projects. Three basic types of estimates include the following: