**7. Project Cost Management**

**Week 7 Topics**

- Importance of project cost management

- Basic Principles of cost management

- Cost estimating

- Cost budgeting

- Cost control

**Objectives:**

After reading this chapter, you will be able to:

1. Understand the importance of project cost management
2. Explain basic project cost management principles, concepts, and terms
3. Discuss different types of cost estimates and methods for preparing them
4. Understand the processes involved in cost budgeting and preparing a cost estimate and budget for an information technology project
5. Understand the benefits of earned value management and project portfolio management to assisting cost control
6. Describe how project management software can assisting project cost management

**Introduction**

The cost of any project is very important all stakeholders. Therefore the project manager should be good at meeting project cost. The chapter highlights the key concepts of project cost management.

**The Importance of Project Cost Management**

Just as information technology projects have a poor track record in meeting project goals, they also have a poor track record in meeting budget goals. Even though the 2003 CHAOS studies showed improved success rates for information technology projects, the average cost overrun-the additional percentage by which actual costs exceed estimates-was still 43 percent. Fortunately, the amount of cost overruns continues to decrease. This chapter describes important concepts in project cost management, particularly, creating good estimates and using earned value management (EVM) to assist in cost control.

**Definition of Cost**

Accountants usually define cost as a resource sacrificed or foregone to achieve a specific objective. 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. 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 information technology professionals think preparing cost estimates is a job for accountants. On the contrary, preparing good cost estimates is a very demanding, important skill that all information technology professionals need to acquire.

**Definition of Project Cost Management**

Recall that the triple constraint of project management involves balancing scope, time, and cost goals. We have already discussed 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.

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 three project cost management processes:

* **Cost estimating** 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 and supporting detail, requested changes, and updates to the cost management plan. The cost management plan should be created as part of the project management plan under project integration management.
* **Cost budgeting** 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, requested changes, and updates to the cost management plan.
* **Cost control** involves controlling changes to the project budget. The main outputs of the cost control process are performance measurements, forecasted completion information, requested changes, recommended corrective action, and updates to the project management plan (which includes the cost management plan), cost estimate, a cost baseline, and organizational process assets.

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.

**Basic Principles of Cost Management**

Many information technology projects are never initiated because information technology professionals do not understand the importance of basic accounting and finance principles. Most members of an executive board have a better understanding of and are more interested in financial terms than information technology terms. Therefore, information technology project managers need to be able to present and discuss project information in financial terms as well as in 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, direct costs, sunk costs, learning curve theory, and reserves. Another important topic and one of the key tools and techniques for controlling project costs-earned value management-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.

**Profit margin** is the ratio of revenues to profits.

**Life cycle costing** allows you to see 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 benefits. Life cycle costing considers the total cost of ownership, or development plus support costs, for a project.

**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 checking accounts, they cannot purchase something.

Top management must consider cash flow concerns when selecting projects in which to invest.

Tangible and intangible costs and benefits are categories for determining how definable the estimated costs and benefits are for a project. **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. Suppose

**Direct costs** are costs that can be directly related to producing the products and services of the project. You can attribute direct costs directly to a certain 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. Consider it gone, like a sunken ship that can never be returned. When deciding what projects to invest in or continue, you should not include sunk costs.

**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 money included in a cost estimate cost risk by allowing for future situations that are difficult to predict. We two types of reserves: **contingency reserves** allow for future situations that are may be partially planned for and included in the project cost baseline. **Management reserves** allow for future situations that are unpredictable.

**Cost Estimating**

Project managers must take cost estimates seriously if they want to complete projects within budget constraints. After developing a good resources requirements list, project managers and their project teams must develop several estimates of the costs for these resources. This section describes various types of cost estimates, tools and techniques for cost estimation, typical problems associated with information technology cost estimates, and a detailed example of a cost estimate for an information technology project.

**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.

* **A rough order of magnitude (ROM)** estimate provides an estimate of what a project will cost. ROM estimates can also be referred to as a ballpark estimate, a guesstimate, swag, or a broad gauge. This type of estimate is done very early in a project or even before a project is officially started. Project managers and top management use this estimate to help make project selection decisions. The timeframe for this type of estimate is often three or more years prior to project completion. A ROM estimate’s accuracy in typically-25percent to +75percent, meaning the project’s actual costs could be 25 percent below the ROM estimate or 75 percent above. For information technology project estimates, this accuracy range is often much wider. Many information technology professionals automatically double estimates for software development because of the history of cost overruns on information technology projects.
* **A budgetary estimate** is used to allocate money into an organization’s budget. Many organizations develop budgets at least two years into the future. Budgetary estimates are made one to two years prior to project completion. The accuracy of budgetary estimates is typically -10 percent to +25 percent, meaning the actual costs could be 10percent less or 25 percent more than the budgetary estimate.
* **A definitive estimate** provides an accurate estimate of project costs. Definitive estimates are used for making many purchasing decisions for which accurate estimates are required and for estimating final project costs. For example, if a project involves purchasing 1000 personal computers from an outside supplier in the next three months, a definitive estimate would be required to aid in evaluating supplier proposals and allocating the funds to pay the chosen supplier. Definitive estimates are made one year or less prior to project completion. A definitive estimate should be the most accurate of the three types of estimates. The accuracy of this type of estimate is normally-5 percent to +10 percent, meaning the actual costs could be 5 percent less or 10 percent more than the definitive estimate.

A **cost management plan** is a document that describes how the organization will manage cost variances on the project. For example, if a definitive cost estimate provides the basis for evaluating supplier cost proposals for all or part of a project, the cost management plan describes how to respond to proposals that are higher or lower than the estimates. Some organizations assume that a cost proposal within 10 percent of the estimate is acceptable and only negotiate items that are more than 10 percent higher or 20 percent lower than the estimated costs. The cost management plan is part of the overall project management plan described in Project Integration Management.

**Cost Estimation Tools and Techniques**

As you can imagine, developing a good cost estimate is difficult. Fortunately, there are several tools and techniques available to assist in creating them. Four commonly used tools and techniques are analogous cost estimating, bottom-up estimating, parametric modeling, and using computerized tools.

**Analogous estimates,** also called **top-down estimates,** use the actual cost of a previous, similar project as the basis for estimating the cost of the current project. This technique requires a good deal of expert judgment and is generally less costly than others are, but it is also less accurate. Analogous estimates are most reliable when the previous projects are similar in fact, not just in appearance.

**Bottom-up estimates** involve estimating individual work items or activities and summing them to get a project total. It is sometimes referred to as Activity Based Costing. The size-of the individual work items and the experience of the estimators drive the accuracy of the estimates. If a detailed WBS is available for a project, the project manager could have each person responsible for a work package develops his or her own cost estimate for that work package. The project manager would then add all of the cost estimates to create cost estimates for each higher-level WBS item and finally for the entire project.

**Parametric modeling** uses project characteristics (parameters) in a mathematical model to estimate project costs. A parametric model might provide an estimate of sh50 per line of code for a software development project based on the programming language the project is using, the level of expertise of the programmers, the size and complexity of the data involved, and so on. Parametric models are most reliable when the historical information that was used to create the model is accurate, the parameters are readily quantifiable, and the model is flexible in terms of the size of the project. One popular parametric model is the Constructive Cost Model (COCOMO), which is used for estimating software development costs based on parameters such as the source lines of code or function points.

**Computerized tools,** such as spreadsheets and project management software, can make working with different cost estimates and cost estimation tools easier. Computerized tools, when used properly, can also help improve the accuracy of estimates. In addition to spreadsheets and project management software, more sophisticated tools are available for estimating software project costs. Sample products include Galorath's SEERTM Suite of Tools, Cost Xpert's Cost Xpert 3.3, Owens & Minors CostTracksSM, PRICE Estimating Suite, and many more. See the fourth Suggested Reading in this chapter for information on finding computerized tools to assist in cost estimating. Another common technique for cost estimating is using resource cost rates.

**Cost Budgeting**

Project cost budgeting involves allocating the project cost estimate to individual work items over time. These work items are based on the work breakdown structure for the project. The WBS, therefore, is a required input to the cost budgeting process. Likewise, the project scope statement, WBS dictionary, activity cost estimates and 5upporting detail, project schedule, resource calendars, contracts, and cost management plan also provide useful information for cost budgeting. The main goal of the cost budgeting process is to produce a cost baseline for measuring project performance and project funding requirements. It may also result in requested changes to the project and updates to the cost management plan to help meet project cost constraints.

Most organizations have a well-established process for preparing budgets. For example, many organizations require budget estimates to include the number of full-time equivalent (FTE) staff, often referred to as head count, for each month of the project. This number provides the basis for estimating total compensation costs each year. Many organizations also want to know the amount of money projected to be paid to suppliers for their labor costs or other from the proof of concept project, and the team can also talk to contractor personnel from the past project to help them develop the estimate. There are also some computer models available, such as a software-estimating tool based on function points.

In addition to providing input for budgetary estimates, cost budgeting provides a cost baseline. A **cost baseline** is a time-phased budget that project managers use to measure and monitor cost performance. Estimating costs for each major project activity over time provides project managers and top management: with a foundation for project cost control, as described in the next section. Cost budgeting, as well as requested changes or clarifications, may result in updates to the cost management plan, a subsidiary part of the project management plan. Cost budgeting also provides information for project funding requirements. For example, some projects have all funds available when the project begins, but others must rely on periodic funding to avoid cash flow problems.

**Cost Control**

Project cost control includes monitoring cost performance, ensuring that only appropriate project changes are included in a revised cost baseline, and informing project stakeholders of authorized changes to the project that will affect costs. The cost baseline, performance reports, change requests, and project funding requirements are inputs to the cost control process. Outputs of this process are project management plan updates, corrective action, revised estimates for project completion, requested changes, and updates to organizational process assets, such as lessons-learned documents. Several tools and techniques assist in project cost control. Earned value management (EVM) is a very powerful cost control technique that is unique to the field of project 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. A baseline is the original project plan plus approved changes. Actual information includes whether or not a WBS item was completed or approximately how much of the work was completed, when the work actually started and ended, and how much it actually cost to do the completed work.

Earned value management involves calculating three values for each activity or summary activity from a project's WBS.

1. 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.
2. The **actual cost (AC),** formerly called the actual cost of work performed (ACWP), is the total direct and indirect costs incurred in accomplishing work on an activity during a given period.
3. 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. It 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. The **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.

After you total the EV, AC, and PV data for all activities on a project, you can use the CPI and SPI to project how much it will cost and how long it will take to finish the project based on performance to date. Given the budget at completion and original time estimate, you can divide by the appropriate index to calculate the estimate at completion (EAC) and estimated time to complete, assuming performance remains the same. There are no standard acronyms for the term estimated time to complete or original time estimate.

**Cost variance (CV)** is the earned value minus the actual cost. If cost variance is a negative number, it means that performing the work cost more than planned. If cost variance is a positive number, it means that performing the work cost less than planned.

**Schedule variance (SV)** is the earned value minus the planned value. A negative schedule variance means that it took longer than planned to perform the work, and a positive schedule variance means that it took less time than planned to perform the work.

The **cost performance index (CPI)** is the ratio of earned value to actual cost and can be used to estimate the projected cost of completing the project. If the cost performance index is equal to one, or 100 percent, then the planned and actual costs are equal-the costs are exactly as budgeted. If the cost performance index is less than one or less than 100 percent, the project is over budget. If the cost performance index is greater than one or more than 100 percent, the project is under budget.

The **schedule performance index (SPI)** is the ratio of earned value to planned value and can be used to estimate the projected time to complete the project. Similar to the cost performance index, a schedule performance index of one, or 100 percent, means the project is on schedule. If the schedule performance index is greater than one or 100 percent, then the project is ahead of schedule. If the schedule performance index is less than one or 100 percent, the project is behind schedule.

**Remark:**

Note that in general, *negative numbers for cost and schedule variance indicate problems in those areas.* Negative numbers mean the project is costing more thanplanned or taking longer than planned. Likewise, *CPI and SPI less than one or less than 100 percent also indicate problems.*

**Discussion Questions**

1. Discuss why many information technology professionals may overlook project cost management and how this might affect completing projects within budget.
2. Explain some of the basic principles of cost management, such as
3. profits,
4. life cycle costs,
5. tangible and intangible costs and benefits,
6. direct and indirect costs,
7. reserves,
8. Give examples of when you would prepare rough order of magnitude, budgetary, and definitive cost estimates for an information technology project.
9. Give an example of using each of the following techniques for creating a cost estimate: analogous, parametric, bottom-up, and computerized tools.
10. Explain what happens during the cost budgeting process.
11. Explain how earned value management can be used to measure project performance and speculate as to why it is not used more often.
12. What are some general rules of thumb for deciding if cost variance, schedule variance, cost performance index, and schedule performance index numbers are good or bad?
13. What is project portfolio management? Can project managers use it with earned value management?
14. Describe several types of software that project managers can use to support