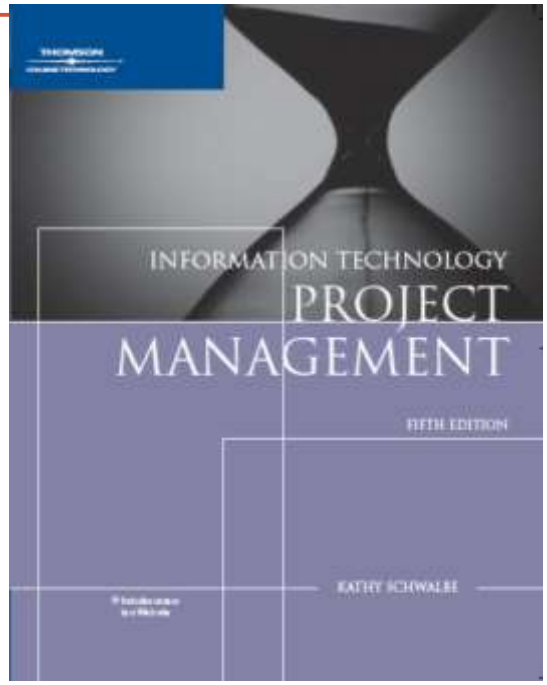
PROJECT COST MANAGEMENT

Information Technology Project Management, Fifth Edition



Learning Objectives

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

Learning Objectives (continued)

- Understand the processes involved in cost budgeting and preparing a cost estimate, and budget for an information technology 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
- The CHAOS studies found the average cost **overrun** (the additional percentage or dollar amount by which actual costs exceed estimates) ranged from 180 percent in 1994 to 43 percent in 2002; other studies found overruns to be 33-34 percent

What Went Wrong?

- The U.S. Internal Revenue Service (IRS) continues to provide examples of how not to manage costs
  - A series of project failures in the 1990s cost taxpayers more than $50 billion a year
  - In 2004, CIO Magazine reported problems with the IRS's $8 billion modernization project
  - In 2006, the IRS was in the news for a botched upgrade to its fraud-detection software, costing $318 million in fraudulent refunds that didn't get caught
- The United Kingdom's National Health Service IT modernization program was called the greatest IT disaster in history by a London columnist, with an estimated $26 billion overrun

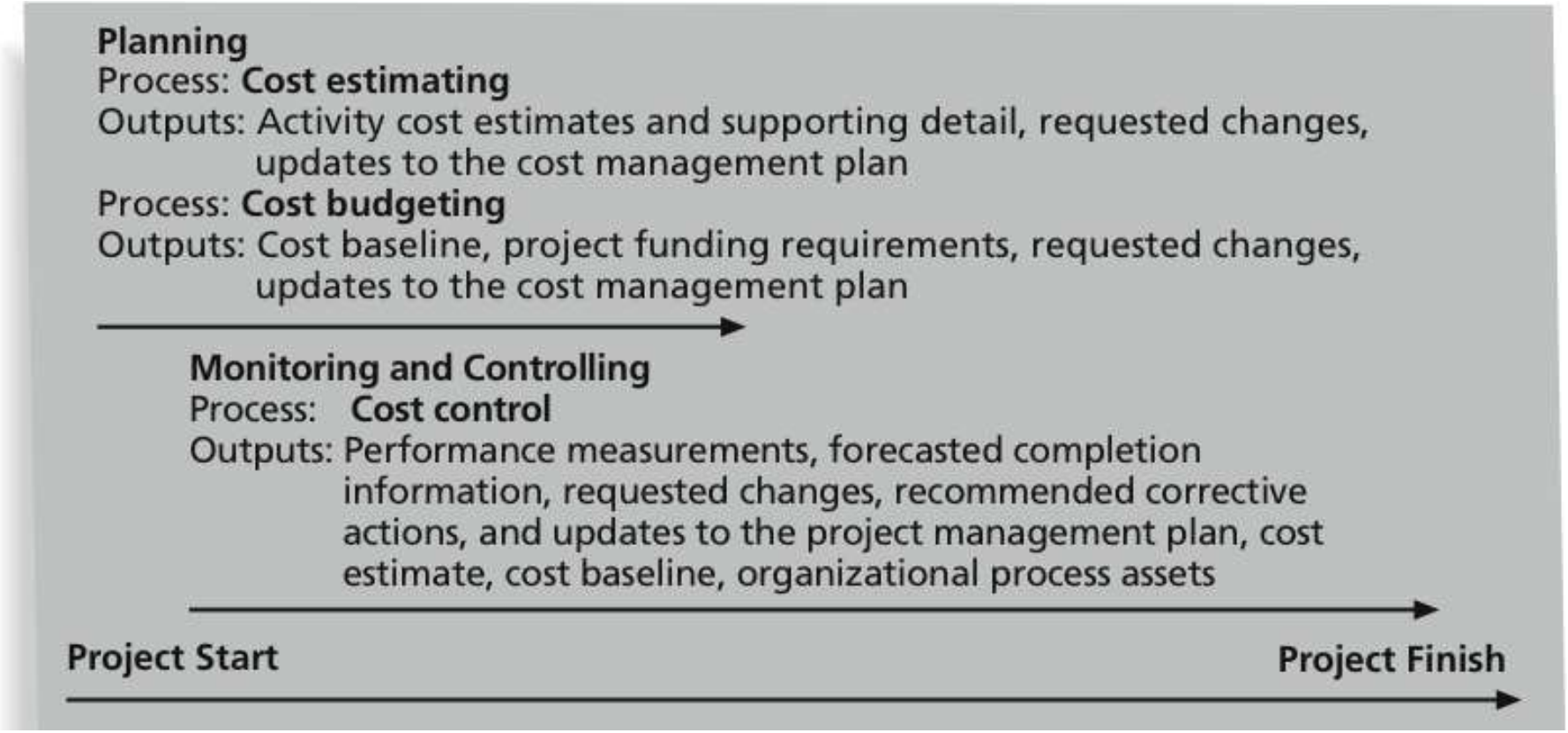
What is Cost and Project Cost Management?

- **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

- **Cost estimating**: developing an approximation or estimate of the costs of the resources needed to complete a project
- **Cost budgeting**: allocating the overall cost estimate to individual work items to establish a baseline for measuring performance
- **Cost control**: controlling changes to the project budget

Figure 7-1: Project Cost Management Summary



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

Table 7-1: Cost of Software Defects

Phase of Software Development	Relative Cost to Repair Defects
Requirements and Analysis	1X
Coding and Unit Test	5X
Integration and System Test	10X
Beta Test	15X
Post-Product Release	30X

*Note: X is a normalized unit of cost and can be expressed in dollars, person-hours, etc.

What Went Right?

- A leading telecommunications company estimated the cost of a software bug or defect at three stages: after coding, after manual inspection, and after beta release
- The costs to correct the defect increased with each stage from $2,000 to $10,000 to $100,000
- The company estimated that when it released one million lines of new code, it had an average of 440 defects in the early stage, 250 in the middle stage, and 125 in the late stage, costing more than $15 million
- They decided to implement an automated inspection process, which reduced costs for fixing bugs by more than $11 million

Basic Principles of Cost Management

- **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

Basic Principles of Cost Management (continued)

- **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**)

Cost Estimating

- 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 7-2: Types of Cost Estimates

Type of Estimate	When Done	Why Done	How Accurate
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%

Cost Management Plan

- A **cost management plan** is a document that describes how the organization will manage cost variance on the project
- A large percentage of total project costs are often labor costs, so project managers must develop and track estimates for labor

Table 7-3: Maximum Departmental Headcounts by Year

DEPARTMENT	1994	1995	1996	1997	1998	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

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
- Lack of estimating experience
- Human beings are biased toward underestimation
- Management desires accuracy

Sample Cost Estimate

- See pp. 277-281 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, 2008

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

* See software development estimate

Figure 7-3: Surveyor Pro Software Development Estimate

Surveyor Pro Software Development Estimate Created October 5, 2008*

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
Total labor estimate			**$594,000**	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
Total function points			**175**	Sum above function point values
Java 2 languange equivalency value			46	Assumed value from reference
Source lines of code (SLOC) estimate			8,050	175*46
Productivity*KSLOC^Penalty (in months)			29.28	3.13*8.05^1.072 (see reference)
Total labor hours (160 hours/month)			4,684.65	29.28*160
Cost/labor hour ($120/hour)			$120	Assumed value from budget expert
Total function point estimate			**$562,158**	4684.65*120

*Approach based on paper by William Roetzheim, "Estimating Software Costs," Cost Xpert Group, Inc. (2003) using the COCOMO II default linear productivity factor (3.13) and penalty factor (1.072).

Cost Budgeting

- 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
- An 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, 2008*

WBS Items	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1. Project Management													
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
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
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													
Trainee cost									50,000				50,000
Travel cost									8,400				8,400
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

*Numbers are rounded, so some totals appear to be off.

Cost Control

- 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

Media Snapshot

- **Australia**: problems with the installation of an ERP system at Crane Group Ltd. led to an estimated cost overrun of $11.5 million
- **India**: as many as 274 projects currently under implementation in the Central sector are suffering serious cost and time overruns
- **Pakistan**: Pakistan has sustained a cost overrun of Rs 1.798 billion (over $30 million U.S. dollars) in the execution of the 66.5 megawatt Jagran Hydropower Project in the Neelum Valley
- **United States**: Northern California lawmakers were outraged over Governor Arnold Schwarzenegger's announcement that commuters should have to pay construction costs on Bay Area bridges…*Maybe it takes the Terminator to help control costs!*

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% complete and only 50% of that work has been completed

Table 7-4 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%

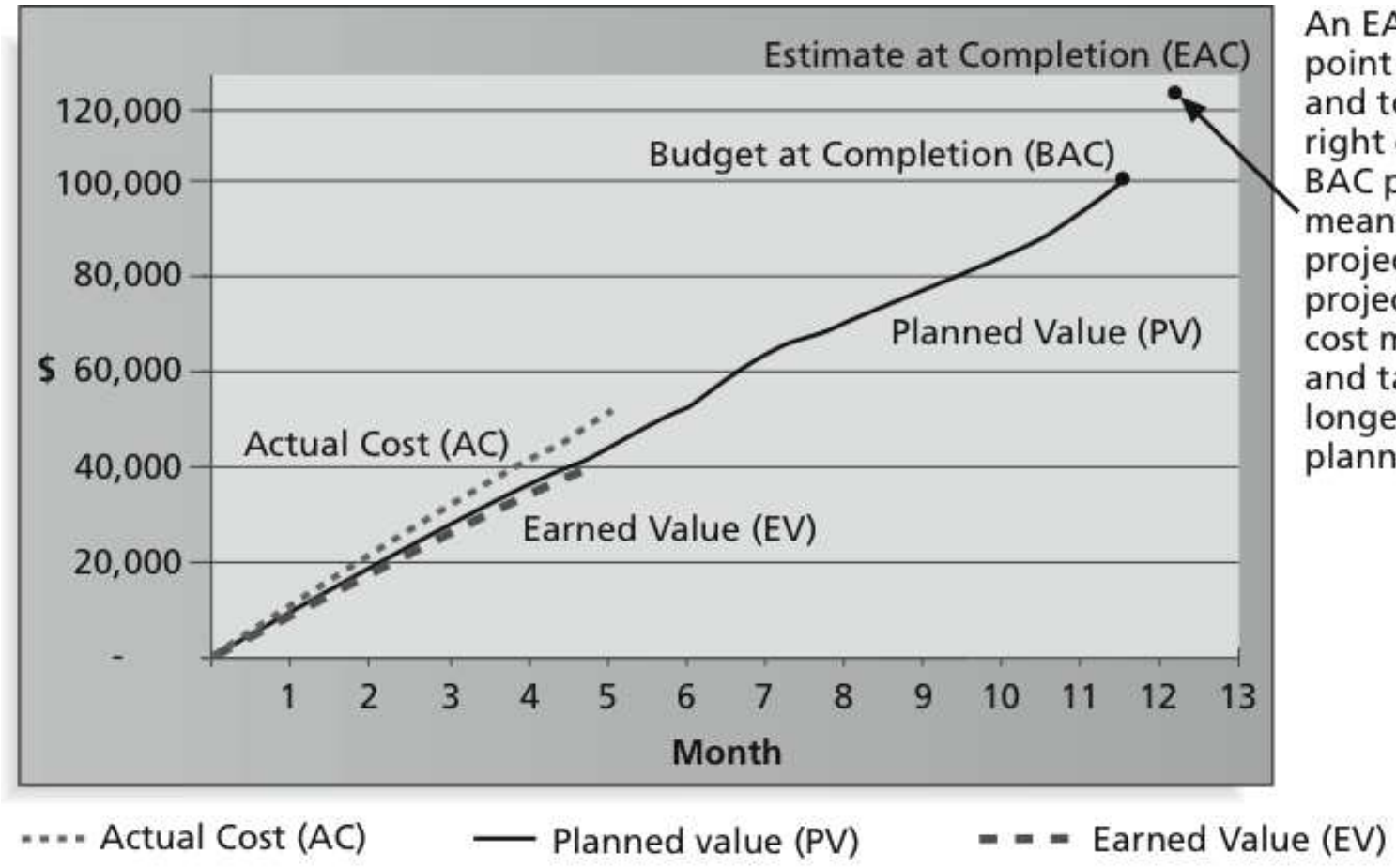
Table 7-5: Earned Value Formulas

Term	Formula
Earned Value	EV = PV to date × RP
Cost Variance	CV = EV – AC
Schedule Variance	SV = EV – PV
Cost Performance Index	CPI = EV/AC
Schedule Performance Index	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

Figure 7-5: Earned Value Chart for Project after Five Months



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
- META Group research shows that:
  - Organizations that evaluate information technology projects by what their business impacts are and what their potential business values will be implement projects that result in 25 percent more improvement to the bottom line
  - Business executives state that using project portfolio management allows managers to make decisions faster and with more confidence

Best Practice

- A global survey released by Borland Software in 2006 suggests that many organizations are still at a low level of maturity in terms of how they define project goals, allocate resources, and measure overall success of their information technology portfolios
- Some of the findings include the following:
  - Only 22 percent of survey respondents reported that their organization either effectively or very effectively uses a project plan for managing projects
  - Only 17 percent have either rigorous or very rigorous processes for project plans, which include developing a baseline and estimating schedule, cost, and business impact of projects
  - Only 20 percent agreed their organizations monitor portfolio progress and coordinate across interdependent projects

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

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:
  - Cost estimating
  - Cost budgeting
  - Cost control