IT Project Management(ITec5111)

Chapter 7

Project Cost Management

What is Cost?

- Cost is a resource lost or foregone to achieve a specific objective or something given up in exchange
  - Usually measured in monetary units like dollars that must be paid to acquire goods and services
- For convenience, the examples in this chapter use dollars for monetary amounts.
- Many of the **original cost estimates** for IT projects are low based on **unclear project requirements**, so naturally there will be cost overruns.
- Not emphasizing the **importance of realistic project cost estimates** from the outset or start is one part of the problem.
- 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**.
- Because projects **cost money** and **consume resources**, it is very important for project managers to understand project cost management.

What is Project Cost Management?

- Project cost management includes the processes required to ensure that the project is completed within an approved budget
- There are four processes for project cost management:
  1. **Planning cost management**: determining the policies, procedures, and documentation that will be used for planning, executing, and controlling project cost
  2. **Estimating costs**: developing an approximation or estimate of the costs of the resources needed to complete a project
  3. **Determining the budget**: allocating the overall cost estimate **to individual work items** to establish a baseline for measuring performance
  4. **Controlling costs**: controlling changes to the project budget

Basic Principles of Cost Management

- Types of costs and benefits
  - **Tangible costs or benefits:** are those costs or benefits that an organization can easily measure in monetary terms
    - paid money for who have participated in the project
  - **Intangible costs or benefits:** are costs or benefits that are difficult to measure in monetary terms
    - Suppose that Project team 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
  - **Direct costs:** are costs that can be **directly related to producing the products and services** of the project
    - Example: the **salaries** of people working full time on the project and the **cost of hardware and software** purchased specifically for 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
    - Example: indirect costs would include the **cost of electricity** and other necessities.
  - **Sunk cost:** is money that has been spent in the past **for unsuccessful project**
    - when deciding what projects to invest in or continue, you should not include sunk costs
    - many people fall into the trap/setup of continuing to spend money on a failing project because so much money has been spent on it already.

Basic Principles of Cost Management (cont'd)

- Additional concepts
  - **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/diminish 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 first step in project cost management is **planning how the costs will be managed** throughout the life of the project
  - The project team uses expert judgment, analytical techniques, and meetings to develop **the cost management plan**
- Cost management plan includes:
  - **Level of accuracy**: Activity cost estimates normally have rounding guidelines, such as rounding to the nearest $100
  - **Units of measure**: Each unit used in cost measurements, such as labor hours or days, should be defined.
  - **Organizational procedure 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**: 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**: Describe the format and frequency of cost reports required for the project.
  - **Process descriptions**: Describe how to perform all of the cost management processes.

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.
- 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.
- It is important to provide supporting details for estimates and updates to project documents
- A large percentage of total project costs are often labor costs

Estimating Costs (cont'd)

- Cost Estimation Tools and Techniques
  - 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 estimating
    - Uses project characteristics (parameters) in a mathematical model to estimate project costs
    - For example,
      - the level of expertise of the programmers,
      - the size and complexity of the data involved, and so on.

Estimating Costs (cont'd)

- Typical Problems with IT Cost Estimates
  - Reasons for inaccuracies
    - **Estimates are done too quickly**: Many estimates must be done quickly and before clear system requirements have been produced
    - **People lack estimating experience**: The people who develop software cost estimates often do not have much experience with cost estimation, especially for large projects.
    - **Human beings are biased toward underestimation:**
      - senior IT professionals or project managers might make estimates based on their own abilities and forget that many younger people will be working on a project
      - Estimators might also forget to allow for **extra costs needed for integration and testing** on large IT projects.
    - **Management desires accuracy:** Management might ask for an estimate but really want a more accurate number.
      - This problem is similar to the situation discussed in Chapter 6, Project Time Management, in which top managers or other stakeholders want project schedules to be shorter than the estimates.

Estimating Costs (cont'd)

- How to Develop a Cost Estimate and Basis of Estimates
  - Before creating an estimate ,gather as much information as possible
    - about the project
    - ask how the organization plans to use the cost estimate
    - clarify the ground rules and assumptions

Estimating Costs (cont'd): How to Develop a Cost Estimate and Basis of Estimates

Surveyor Pro Project Cost Estimate Created October 5

	# Units/Hrs.	Cost/Unit/Hr.	Subtotals	WBS Level 2 Totals	% of Total
WBS Items					
1. Project Management				**$306,300**	**20%**
Project manager	960	$100	$96,000		
Project team members	1,920	$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	1,920	$75	$144,000		
Subtotal			$1,267,700		
6. Reserves (20% of total estimate)			$253,540	**$253,540**	**17%**
Total project cost estimate				**$1,521,240**	

*See software development estimate.

FIGURE 7-2 Surveyor Pro project cost estimate

Determining the Budget

- Budgeting involves allocating the project cost estimate to individual work items over time
  - Material resources or work items are based on the activities in the WBS for the project
- Important goal is to produce a cost baseline
  - Time-phased budget that project managers use to measure and monitor cost performance

Determining the Budget (cont'd)

Surveyor Pro Project Cost Baseline Created October 10*

	Months												
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

FIGURE 7-4 Surveyor Pro Project Cost Baseline

Controlling Costs

- Activities involved in controlling project costs
  - 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
- Inputs for controlling costs:
  - The project management plan
  - Project funding requirements
  - Work performance data and organizational process assets
- Outputs of this process are work performance information, cost forecasts, change requests, project management plan updates, project documents updates, and organizational process asset updates.
- Several tools and techniques assist in project cost control
  - Expert judgment, data analysis, project management information systems, etc

Controlling Costs(cont'd): Earned Value Management (EVM)

- Project performance measurement technique: integrates scope, time, and cost data
  - Given a baseline (original plan plus approved changes), you can determine how well the project is meeting scope, time, and cost goals
- Earned value management involves calculating three values for each activity or summary activity from a project's WBS
  - **Planned value (PV):** is the portion of the approved total cost estimate planned to be spent on an activity during a given period. Also called the budget
    - Let an Activity A take one week and cost a total of $10,000 for the labor hours, hardware, and software. Therefore, the planned value (PV) for the activity that week is $10,000.
  - **Actual cost(AC):** is the total direct and indirect costs incurred in accomplishing work on an activity during a given period
    - Suppose that Activity B actually took two weeks and cost $20,000 to purchase and install the new web server.
    - Assume that $15,000 of these actual costs were incurred during Week 1 and $5,000 was incurred during Week 2.
    - AC of Activity B at week1 is $15,000 and at week2 is $5,000 for the activity each week.
  - **Earned value(EV):** is an estimate of the value of the **physical work actually completed.**
  - **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

Controlling Costs(cont'd): Earned Value Management (EVM)

- For example, suppose that the server installation was halfway completed by the end of Week 1. The rate of performance(RP) would be 50 percent by the end of Week 1

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 7-3 Earned value calculations for one activity after week 1

Controlling Costs(cont'd): Earned Value Management (EVM)

Term	Formula
Earned value (EV)	EV = PV * 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 , where BAC is budget at completion

Table 7-4 Earned value formulas

Controlling Costs(cont'd): Earned Value Management (EVM)

- Important concepts
  - **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, 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 time** than planned to perform the work
    - A positive schedule variance means that the work took **less time** than planned.
  - **Cost performance index (CPI):** is the **ratio of earned value to actual cost**
    - It can be used to estimate the projected cost of completing the project.
      - If the CPI is equal to one, or 100 percent, then the planned and actual costs are **equal**—the costs are exactly as budgeted.
      - If the CPI is less than one or less than 100 percent, the project **is over budget**.
      - If the CPI is greater than one or more than 100 percent, the project is **under budget**.
  - **Schedule performance index (SPI):** is the **ratio of earned value to planned value**
    - it can be used to estimate the projected time to complete the project.
      - if SPI of one, or 100 percent, means the project is **on schedule**.
      - If the SPI is less than one or 100 percent, the project is **behind schedule**.
      - If the SPI is greater than one or 100 percent, then the project is **ahead of schedule**.
  - **Estimate at completion (EAC):** is an estimated cost of completing a project based on performance to date. **EAC=BAC/CPI**

Controlling Costs(cont'd): Earned Value Management (EVM)

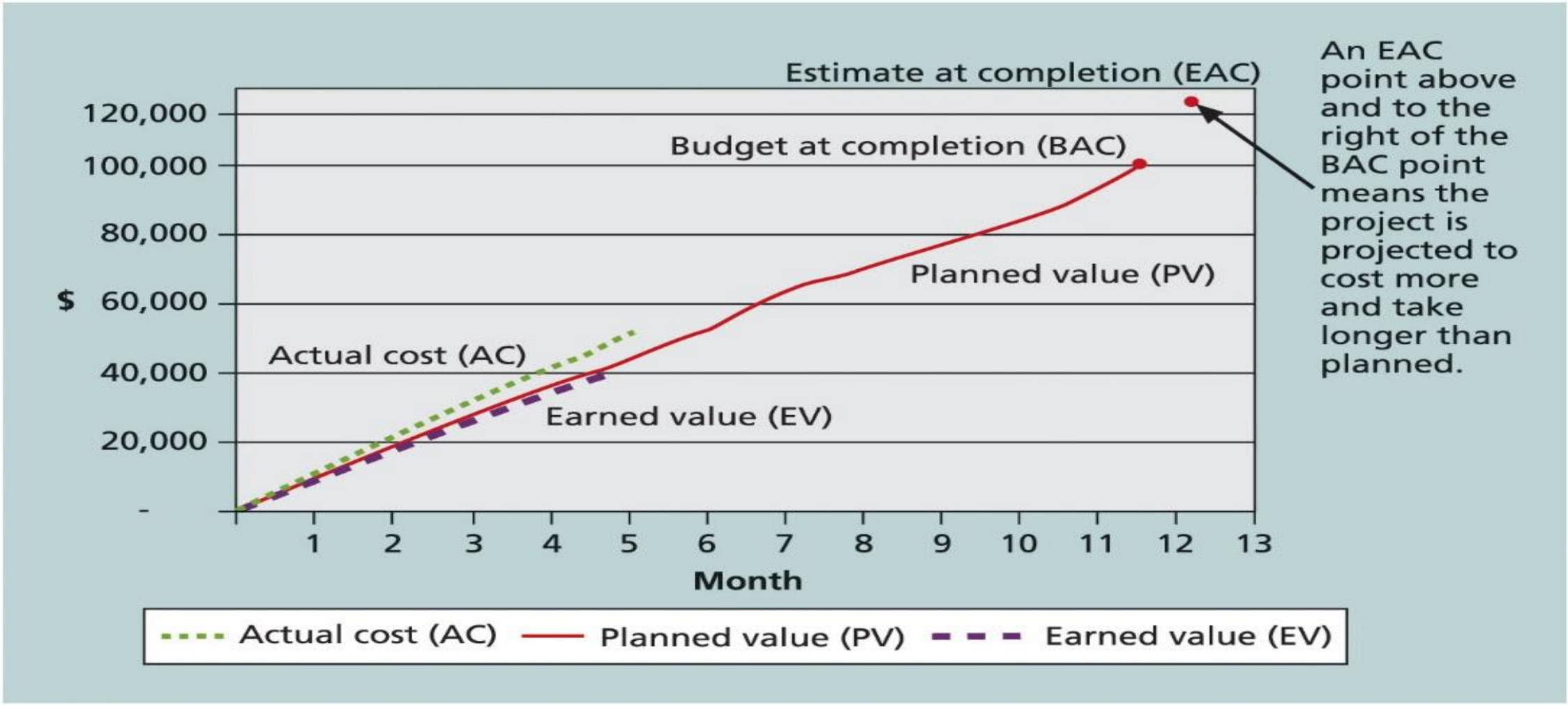

FIGURE 7-6 Earned value chart for project after five months

Using Project Management Software to Assist in Project 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 can increase a project manager's effectiveness during each process of project cost management
  - Many IT project managers use other tools to manage cost information because they do not know that they can use project management software, or they do not track costs based on a WBS, as most project management software does