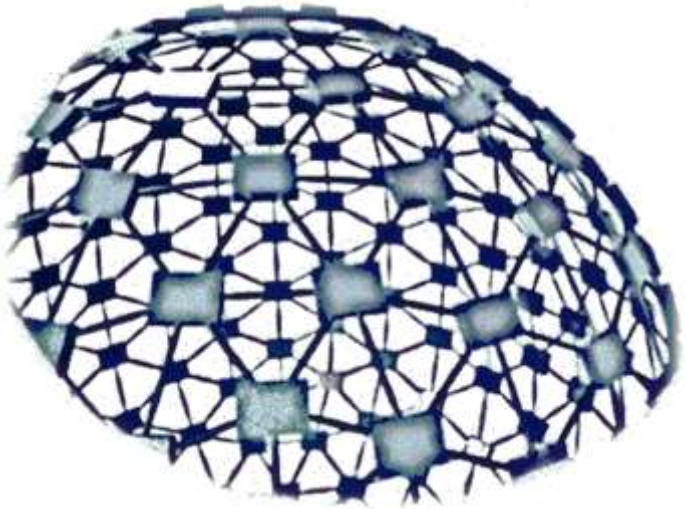

Chapter 7:
Project Cost Management

The Importance of Project Cost Management

- IT projects have a poor track record for meeting budget goals
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  - 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%
    - Most important finding was the discovery of many gigantic overages or “black swans”; a high-impact event that is rare and unpredictable, but not improbable in retrospect

What is Cost?

- Cost is a resource sacrificed 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

What is Project Cost Management? (1/2)

- Project cost management includes the processes required to ensure that the project is completed within an approved budget

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 (2/3)

- **Types of costs and benefits**

1- Tangible costs or benefits are those costs or benefits that an organization can easily measure in dollars

2- Intangible costs or benefits are costs or benefits that are difficult to measure in monetary terms (Reputation vs staff experience)

3- Direct costs are costs that can be directly related to producing the products and services of the project

4- 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 (i.e., Corp Marketing & advertising)

5- 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 (3/3)

- 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 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 متوقع تعويض بس ماعرف
    - Management reserves allow for future situations that are unpredictable (sometimes called unknown unknowns)

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1. 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:

1 – Level of accuracy
2 – Units of measure
3 – Organizational procedure links
4 – Control thresholds
5 – Rules of performance measurement
6 – Reporting formats
7 – Process descriptions

2. Estimating Costs (1 of 4)

- Project managers must take cost estimates seriously if they want to complete projects within budget constraints

1- Types of cost estimates

2- Tools and techniques for estimating costs

3- Typical problems associated with IT cost estimates

Estimating Costs (2 of 4)

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Table 7-1. Types of cost estimates

	Type of Estimate	When Done	Why Done	Typical Range
1	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%
2	Budgetary	Early, 1–2 years out	Puts dollars in the budget plans	−10% to +25%
3	Definitive	Later in the project, less than 1 year out	Provides details for purchases, estimates actual costs	−5% to +10%

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Types of Cost Estimates

a) **A rough order of magnitude (ROM) estimate** provides an estimate of what a project will cost. 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. (-50% to +100%)

b) **A budgetary estimate** is used to allocate money into an organization's budget. Many organizations develop budgets at least two years into the future. (-10% to+25%)

- For example, the actual cost for a project with a budgetary estimate of $100,000 could range from $90,000 to $125,000.

c) **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. (-5% to +10%)

- For example, if a project involves purchasing 1,000 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

Cost Estimation Tools and Techniques

1. 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
2. Bottom-up estimates
   - Involve estimating individual work items or activities and summing them to get a project total
3. Three-point estimates
   - Involve estimating the most likely, optimistic, and pessimistic costs for items
4. Parametric estimating
   - Uses project characteristics (parameters) in a mathematical model to estimate project costs

Typical Problems with IT Cost Estimates

- Reasons for inaccuracies

1– Estimates are done too quickly

2– People lack estimating experience

3– Human beings are biased toward underestimation

4– Management desires accuracy

3. Determining the Budget (1 of 2)

- 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 (2 of 2)

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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

*See the lecture slides for this chapter on the Instructor website for a larger view of this and other figures in this chapter. Numbers are rounded, so some totals appear to be off.

FIGURE 7-4 Surveyor Pro project cost baseline

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4. Controlling Costs

- Activities involved in controlling project costs
  1- Monitoring cost performance
  2- Ensuring that only appropriate project changes are included in a revised cost baseline
  3- Informing project stakeholders of authorized changes to the project that will affect costs
- Several tools and techniques assist in project cost control
  - Expert judgment, data analysis, project management information systems, and the to-complete performance index

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

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

Earned Value Management Terms

- **Cost variance CV:** indicates how much the project in over or under budget. Calculated by: **CV = EV-AC**
  - If CV value is positive, the project is currently under budget
  - If CV value is negative, the project is currently over budget
- **Schedule variance SV:** indicates how much ahead or behind the schedule a project is running. Calculated by: **SV = EV-PV**
  - If SV value is positive, the project is currently ahead of schedule
  - If SV value is negative, the project is currently behind schedule

Earned Value Management Terms

- **Cost performance index CPI:** is the ratio of earned value to the actual cost. It can be used to estimate the projected cost of the completing the project. If CPI is equal to 1 then the planned and actual cost are equal. If CPI is less than 1 then the project is over budget. If the CPI is greater than 1 then the project is under budget. Calculated by:

CPI = EV/AC

- **Schedule performance index SPI:** is the ratio of earned value to the planned value. It can be used to estimate the projected time to complete the project. If SPI is equal to 1 then the planned and actual time are equal. If SPI is less than 1 then the project is behind schedule. If the SPI is greater than 1 then the project is ahead of schedule. Calculated by: **SPI = EV/PV**

Earned Value Management Terms

- **BAC** – Budget at Completion, the planned budget for the total job
- **EAC** – Estimate at Completion, what is the total job expected to cost?
- **ETC** – Estimate to Complete, forecasted time to complete job
- **VAC** – Variance at Completion, how much over/under budget do we expect to be?

Rules of Thumb for Earned Value Numbers

- Negative numbers for cost and schedule variance indicate problems in those areas
- A CPI or SPI that is less than 100% indicates problems
- Problems mean the project is costing more than planned (over budget) or taking longer than planned (behind schedule)

Earned Value Formulas

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Term	Formula
Earned value (EV)	EV = PV of all completed work
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 to Complete (ETC)	ETC = EAC – AC

Example

A project includes a summary activity of purchasing and installing a new web server. According to the plan, it would take one week and cost a total of $10,000 for the labor hours, hardware, and software.

Suppose that it 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. Suppose the server installation was halfway completed by the end of week 1.

Activity	*Week 1*	*Formula*
Earned Value (EV)	*5,000*	*EV = BAC * (% complete) = 10,000 * 50%*
Planned Value (PV)	*10,000*	One Week
Actual Cost (AC)	*15,000*	One Week
Cost Variance (CV)	*-10,000*	*CV = EV – AC = 5,000 – 15,000*
Schedule variance (SV)	*-5,000*	*SV = EV – PV = 5,000 – 10,000*
Cost performance index (CPI)	*.33*	*CPI = EV /AC = 5,000 / 15,000 = 33%*
Schedule performance index (SPI)	*.50*	*SPI = EV / PV = 5,000 / 10,000 = 50%*

EVM: Example 3 (4 of 5)

Assume ABC Company invested 36 million riyals in an XY project and planned to be completed in 12 months. The project is planned to have equal spending each month. However, after 2 months, the PM found 2 M riyals was spent while work completed (WC) is 25%. Given such a scenario, What is the CV, SV, CPI, and SPI of the project?

AC = 2 M

PV to date = (36/12) *2 = 6 M

EV=PV*WC = 6*0.25=1.5 M

CV = EV- AC = 1.5 - 2 = -0.5 M

SV = EV- PV = 1.5 - 6 = - 4.5 M

CPI = EV/AC = 1.5/2 = 0.75

SPI = EV/PV = 1.5/6 = 0.25

Considerations for Agile/Adaptive Environments

- Agile EVM is an adapted implementation of EVM
  - Uses the Scrum framework artifacts as inputs, uses traditional EVM calculations, and is expressed in traditional EVM metrics
  - Requires a minimal set of input parameters
    - Actual cost of a project, an estimated product backlog, a release plan that provides information on number of iterations in the release and the assumed velocity
  - All estimates can be in hours, story-points, team days or any other consistent estimate of size
    - The critical factor is that it must be a numerical estimate of some kind

Chapter Summary

- Project cost management is a traditionally weak area of IT projects
  - Project managers must understand several basic principles of cost management to be effective in managing project costs
- Main processes
  - Plan cost management
  - Estimate costs
  - Determine the budget
  - Control costs
- Several software products can assist with project cost management