Chapter 7: Project Cost Management

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Learning Objectives

1. Understand the *importance* of project cost management

2. Explain basic project cost management *principles, concepts, and terms*

3. Describe the *process* of planning cost management

4. Discuss different types of *cost estimates and methods* for preparing them

5. Understand the processes of *determining a budget* and *preparing a cost estimate* for an IT project

Learning Objectives

6. Understand the benefits of ***earned value management*** and ***project portfolio management*** to assist in cost control

7. Describe how ***project management software*** can assist in project cost management

Opening case

　　胡安是一个系统分析师和网络专家，在一个大城市的供水系统工作，他很想帮助国家发展基础措施，他的下一个目标是成为一名项目经理，以便有更大的影响力。他的一个同事邀请他参加一个重大政府项目的评审会，其中包括"测量员助手"这个概念是开发一个复杂信息系统，该信息系统包括专家系统、面向对象数据库和无线通信系统。该系统为政府的测量员提供即时的图形信息，帮助他们工作。例如，测量员触摸手感装置上显示的地图之后，系统将提示他选择有关那个区域所需要的信息类型。该系统将对许多项目的计划和执行有帮助，从光缆的铺设到输水管线铺设。

　　然而，当项目评审会大部分时间花在讨论有关成本问题时，他非常惊奇。政府官员在讨论资助新项目之前，一直在评审许多现有的项目，评估它们到目前的执行情况及其在预算上的潜在影响。汇报人引用的很多术语和图表，胡安都不理解。他们总是谈挣值分析？胡安曾想他应当学习更多的测量员助理项目中将要应用的新技术，但现在他发现成本估算和项目收益是高级官员在会议上最感兴趣的事情。

Opening case

在任何技术工作开始之前，必须花大量的精力研究财务情况。胡安多么希望自己学过一些会计和财务方面的课程，那样他就能够理解人们正在讨论的缩写和概念。尽管胡安获得了电子工程学位，但他在财务方面没受过正规的教育，经验也特别少。他认为自己能够懂信息系统和网络，也同样能理解项目中的财务问题。他草草地记下会后需要和同事们讨论的问题。

胡安对他的同事谈了这次会议之后，他对项目成本管理的重要性有了更好理解。特别是当他了解到在项目后期纠正缺陷需要更高成本之后，他认识到了在对项目做出主要开支之前详细研究的价值。他理解了好的成本估算和成本控制的重要性。项目经理表示他们正在实施的项目管理不善，并承认他们在项目的前期计划和分析方面做得不够，政府官员于是取消了几个项目。胡安知道，如果想在自己的职业生涯中有所长进，就不能仅注重项目的技术方面。他开始怀疑本市正在考虑的几个项目是否真的对得起纳税者的钱。成本管理问题又给胡安工作增添了一个新的空间。

Main Contents

1. The importance of project cost management

2. Basic principles of cost management

3. Planning cost management

4. Estimating costs

5. Determining the budget

6. Controlling costs

1. 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 2010.

- A 2011 Harvard Business Review study reported an average cost overrun of 27 percent. The most important finding was the discovery of a large number of gigantic overages or "*black swans*".

1. The importance of project cost management

What is cost ?

- Accountants usually define cost as a *resource* sacrificed or foregone to achieve a specific objectives.

- Cost is something given up in exchange.

False perception

- Since many of the original cost estimates for IT projects are low or based on unclear project requirements, so naturally there will be cost overruns.

- IT professionals think that preparing cost estimates is a job for accountants, but it is really a skill that they need to acquire.

1. The importance of project cost management

Project cost management includes the processes required to ensure that a project team completes a project *within an approved budget.*

Reason for Cost out of Control

- Insufficient understanding of the project

- Imperfect organizational system

- Method problem

- Technical constraints

- Improper demand management

1. The importance of project cost management

It involves 4 processes:

- **Planning cost management** :determining the policies, procedures, and documentation that will be used for planning, executing, and controlling project cost.

- **Estimating costs**: developing an approximation or estimate of the costs of the resources needed to complete a project

- **Determining the budget:** allocating the overall cost estimate to individual work items to establish a baseline for measuring performance

- **Controlling costs:** controlling changes to the project budget

Cost management — 4 main processes

Planning

Process: Plan cost management

Outputs: Cost management plan

Process: Estimate costs

Outputs: Activity cost estimates, basis of estimates,
              project management plan updates

Process: Determine budget

Outputs: Cost baseline, project funding requirements,
              project management plan updates

Monitoring and controlling

Process: 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**

2. Basic principles of cost managements

- **Net present value analysis**：Calculating the expected net monetary gain or loss from a project by discounting all expected future cash inflows and out follows to the present point in time.
- **Return on investment**：is a performance measure used to evaluate the efficiency or profitability
- **Payback period**：is the amount of time it will take to recoup the total dollars invested in a project, in terms of net cash inflows.

- **Profits** are revenues minus expenditures
- **Profit margin** is the ratio of revenues to profits
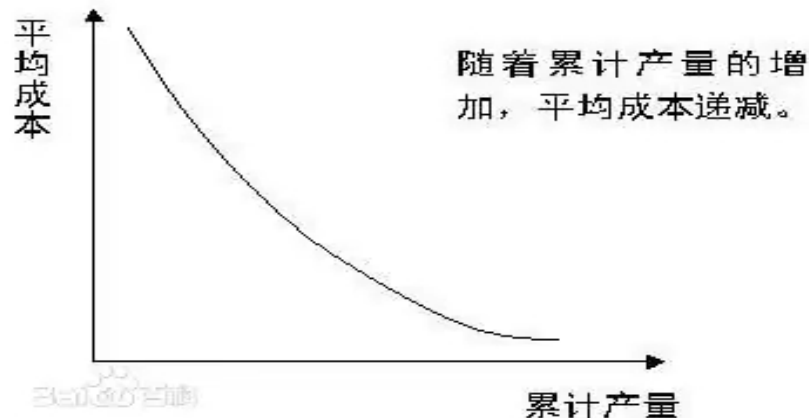
2. Basic principles of cost managements

- **Variable cost** are those costs that changes with production volume, workload and time

- **Fixed cost** are those costs that does not change with production volume, workload and time

- **Tangible costs** are those costs that an organization can easily measure in monetary terms

- **Intangible costs** are costs 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 of the project, but are indirectly related to performing the project

2. Basic principles of cost managements

- **Normal costs** are those costs that incurred in the project according to the planned schedule
- **Accelerated costs** are those costs that incurred in the project when accelerating to the unplanned schedule
- **Recurring costs** are those costs that recurrent in the project
- **One time costs** are those costs that occur only one-time in the project
- **Opportunity costs** are those costs that giving up something else because you want to do
- **Sunk costs** are money that has been spent in the past; when deciding what projects to invest in or continue, you should not include sunk costs

2. Basic principles of cost managements

- **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

- **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

平均成本

随着累计产量的增加，平均成本递减。

累计产量

2. Basic principles of cost managements

- **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) and *are not included in the project cost baseline.*

- **Cost baseline** is an approved time-based cost expenditure plan.

3. Planning cost management

Inputs: the basic documents that initiate a project

Tools and techniques: expert judgement

analytical techniques

meetings

Outputs: cost management plan

Note !
It can be informal and broad or formal and detailed, based on the needs of the project.

3. Planning cost management

Cost management plan includes:

- Level of accuracy

- Units of measure

- Organizational procedures links

- Control thresholds

- Rules of performance measurement

- Reporting formats

- Process descriptions

基础	计量单位	准确度	精确度	组织程序链接
绩效	控制临界值	绩效测量规则	控制账户	EVM技术
跟踪汇报	跟踪方法	报告格式		
方案程序	战略筹资方案	处理汇率波动	记录项目成本	

4. Estimating costs

The basic types of estimates include the following:

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%

4. Estimating costs

Inputs:　Cost management plan, Human resource management plan,

Scope baseline, Project schedule, Risk register,

Business environmental factors,

Organizational process assets

Outputs: Activity cost estimates, Basis of estimates,

Project management plan updates
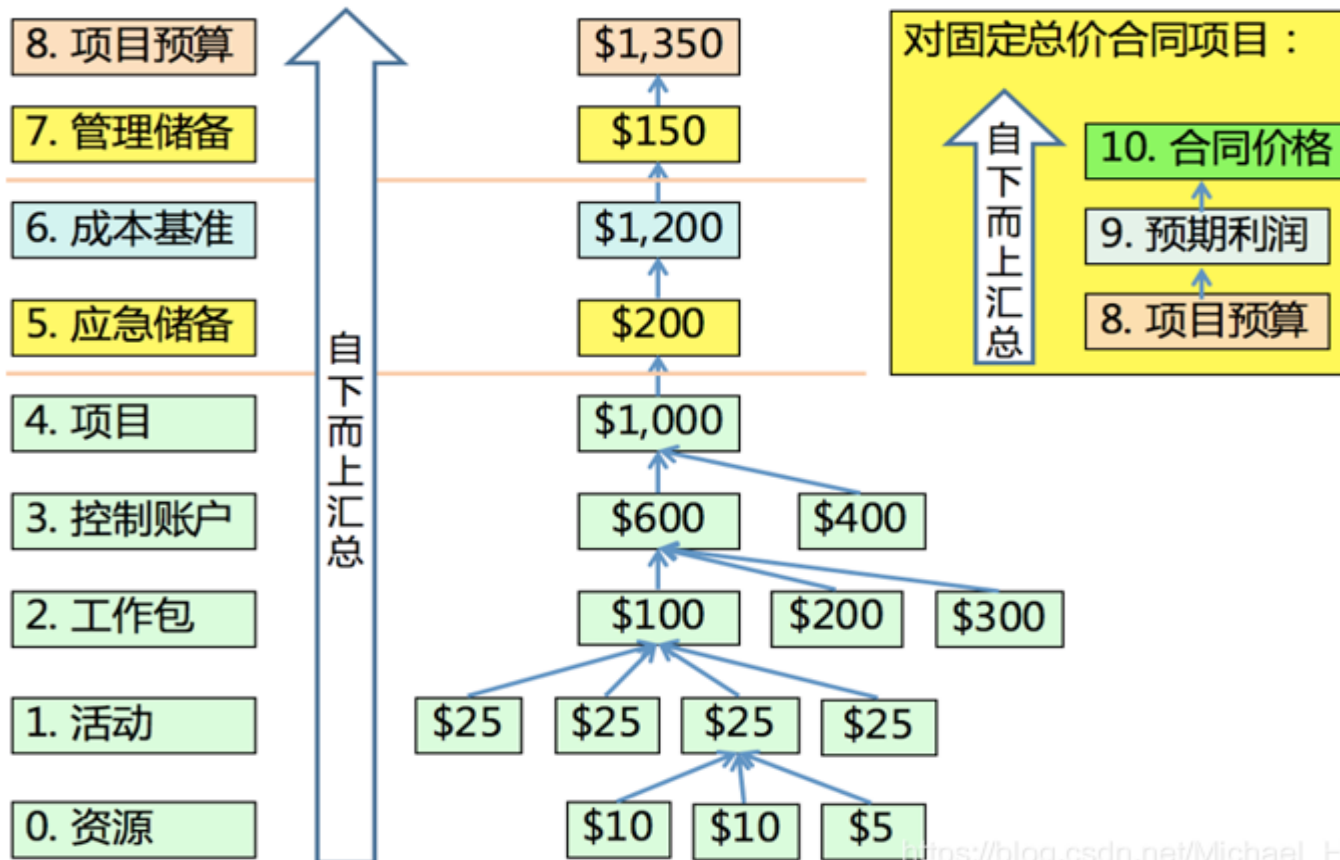
4. Estimating costs

Cost estimation tools and techniques:

- **Three-point estimates:** most likely, optimistic and pessimistic

- **Parametric estimating:** uses project characteristics (parameters) in a mathematical model to estimate project costs

- **The cost of quality (Chapter 8)**

- **Project management estimating software**

- **Vendor bid analysis (Chapter 12)**

- **Analogous**

4. Estimating costs

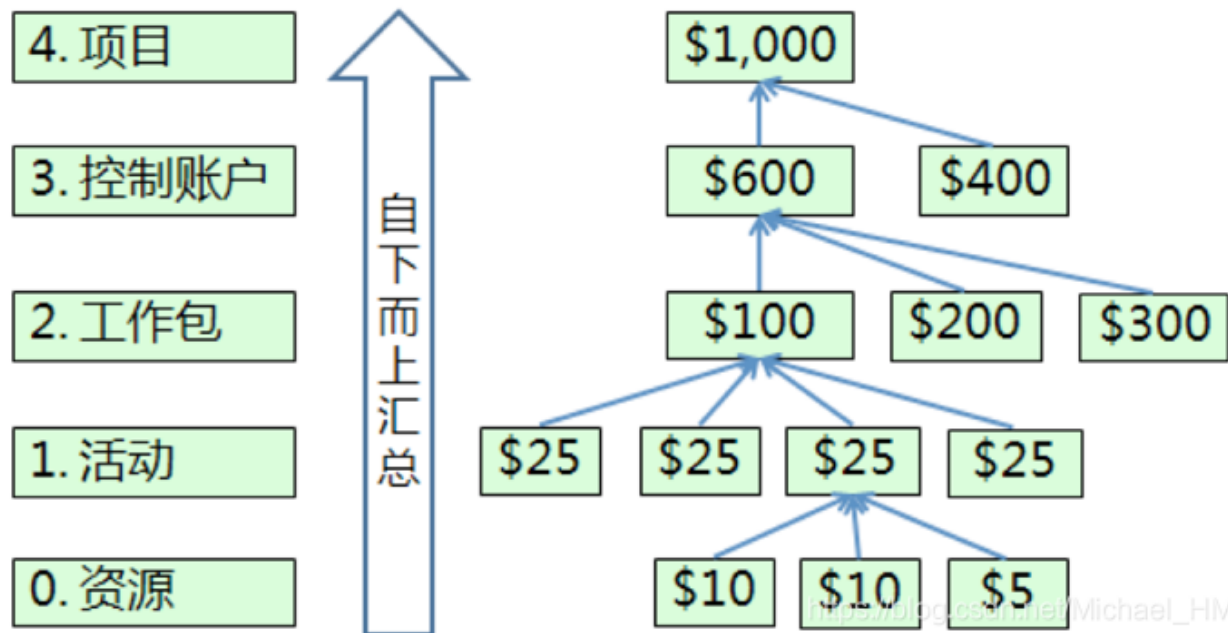**Cost estimation tools and techniques:**

- **Reserve analysis**

4. Estimating costs

Cost estimation tools and techniques:

• **Bottom-up estimates:** involve estimating individual work items or activities and summing them to get a project total.

4. Estimating costs

Typical problems with IT cost estimates:

- Estimates are done too quickly.

- People lack estimating experience.

- Human beings are biased toward underestimation.

- Management desires accuracy.

4. Estimating costs

1. Before beginning a cost estimate, you must first gather as much information as possible about the project and ask *how the organization plans to use the cost estimate*.

2. It is also important to clarify *the ground rules and assumptions* for the estimate.

3. The team decides to estimate *the cost of each WBS item* and then team reviews a draft of *the project schedule* and makes further assumptions as needed.

4. It is very important to have several people *review* the project cost estimate.

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	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.

4. Estimating costs

Surveyor Pro Software Development Estimate Created October 5

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).

4. Estimating costs

假设你的项目需要6个月时间，项目组6个人，项目经理每小时100元，2个程序员每小时75元，2个高级程序员每小时100元，1个技术支持人员每小时75元。
项目需要采购4台服务，每台2万元，培训100人，每人成本500元。留20%储备金。

XXX Project Cost Estimate					
Prepared by:	**Date:**				
Project team of 6 people, 6 months					
	# Units/Hrs.	Cost/Unit/Hr.	Subtotals	WBS Level 1 Totals	
WBS Items					
1. Project Management				**¥96,000.00**	
1.1 Project manager	960	¥100.00	¥96,000.00		
2. Hardware				**¥80,000.00**	
2.2 Servers	4	¥20,000.00	¥80,000.00		
3. Software				**¥738,000.00**	
3.1 Programmer	1920	¥75.00	¥144,000.00		
3.2 Senior Programmer	1920	¥100.00	¥594,000.00		
4. Testing (10% of total hardware and software costs)			¥81,800.00	**¥81,800.00**	
5. Training and Support				**¥122,000.00**	
5.1 Trainee cost	100	¥500.00	¥50,000.00		
5.2 Technical Support	960	¥75.00	¥72,000.00		
6. Reserves (20% of total estimate)			¥223,560.00	**¥223,560.00**	
Total project cost estimate				**¥1,341,360.00**	
* See software development estimate					

4. Estimating costs

某公司需要开发一个销售管理系统，系统需要实现产品管理、客户管理、订单管理、库存管理、报表生成等功能。为了估算该项目的开发成本和时间，该公司采用了功能点方法进行估算。

根据该公司的经验和实际情况，输入、输出、查询、文件处理和接口等五种类型的基本功能点的权值分别为3、4、3、7和5。

对销售管理系统进行功能分解，把每一个功能分解为若干个基本功能点。对每个基本功能点进行评估，计算出其复杂度。

添加产品模块复杂度为3×3+1×4+1×3=16.
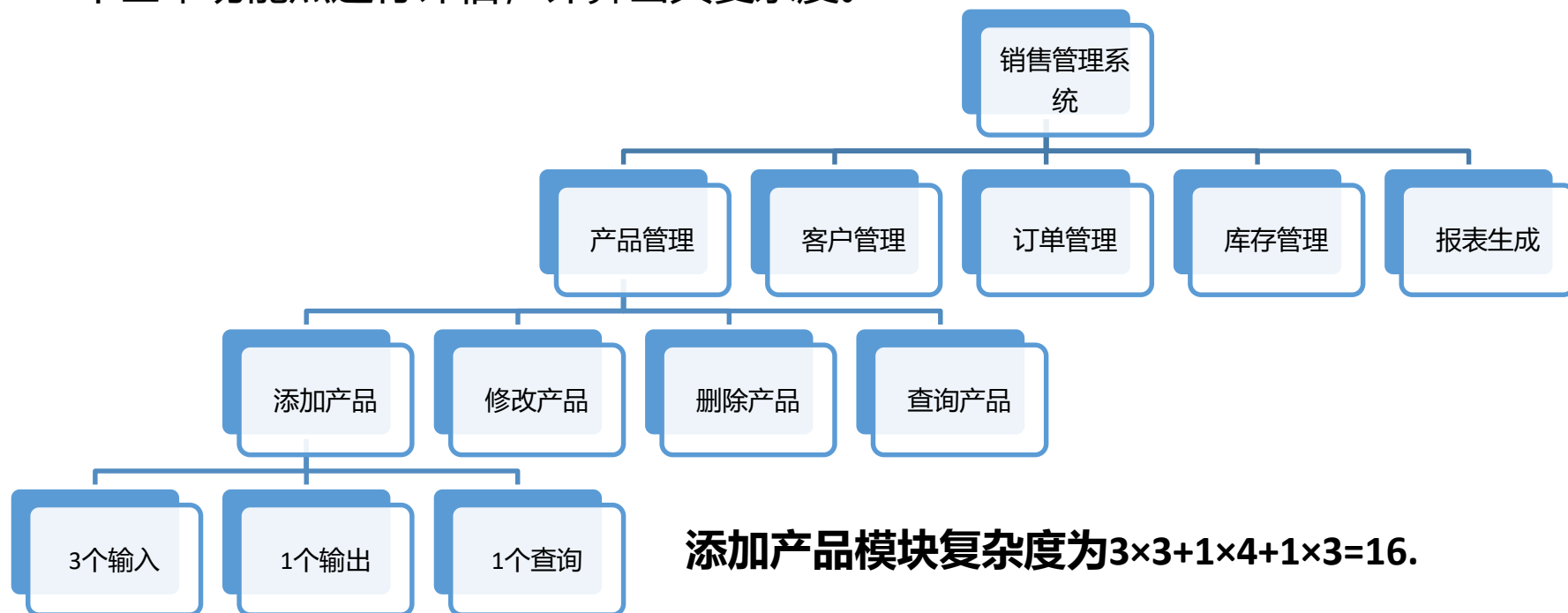
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Function point estimate	Quantity	Conversion Factor	Function Points	
External inputs	10	3	30	
External interface files	5	5	25	
External outputs	8	4	32	
External queries	7	3	21	
Logical internal tables	6	7	42	
Total function points			150	
Java 2 languange equivalency value			50	
Source lines of code (SLOC) estimate			7,500	
Productivity *KSLOC^Penalty (person months)	40.40			
Total labor hours (160 hours/month)	6,463.92			
Cost/labor hour ($150/hour)	$150			
Total software development estimate	969,588			

成本计划--估算方法

1代码行估算
- 优点：每个项目都有；易计算代码行数
- 缺点：
  - 项目初期需求不稳定的情况下难以估计代码量
  - 代码行强调编码的工作量，知识项目实现阶段的一部分

2功能点估算
- FP=UFC*TCF（UFC：未调整功能点计数；TCF：技术复杂度因子）
- UFC=每个功能计数项* 对应复杂度，TCF=0.65+0.01 *14 *（0-5之间的取值范围）
- 功能计数项
  - 外部输入：增删改
  - 外部输出：报表、统计订单等
  - 外部查询：查
  - 外部接口文件
  - 内部逻辑文件

3用例点估算
- UAW（未调整角色权值）：角色数*权值
- UUCW（未调整用例权值）：用例数*权值
- UUCP（未调整的用例点）：UUCP=UAW+UUCW
- TCF（计算技术因子）：0.6+0.01*（）
- ECF（计算环境因子）：1.4-0.03*（）
- UCP（计算调整的用例点）：UCP=UUCP * TCF * ECF

4类比（自顶向下）估算
- 以以往完成的类似的项目来推算将要开发的软件的总成本
- 估算不是非常精确

5自下而上估算
- 利用**WBS**，对每个具体工作包进行成本估算之后累加
- **相对比较准确**、花费时间少

6参数估算
- 通过项目数据进行回归分析，得出回归模型
- 使用条件
  - 具有良好的项目数据
  - 存在成熟的项目估算模型
- 特点：简单、较准确
- 整体公示：E=a+b*S^c，单位人月
  - abc经验导出的系数
  - S：主要的输入参数（LOC、FP等）
  - Walston-Felix模型：E=5.2*（KLOC）^0.91
  - COCOMO---结构化成本模型
    - 模型级别：基本、中等、高级
    - 项目类型：有机型、嵌入型、半嵌入型
    - 基本cocomo：E=a*（KLOC）^b
    - 中等cocomo：E=a*(KLOC)^b*乘法因子   乘法因子的成本驱动属性
      - 产品属性
      - 平台属性
      - 人员属性
      - 过程属性
    - 高级cocomo：将项目分解为一系列子系统或子模型

7专家估算(领域熟悉时使用)
- 每位专家的ei=（ai+4mi+bi）/6
- 最终软件规模E=E1+E2+E3...EN

5. Determining the budget

Determining the budget involves allocating the project cost estimate to individual *material resources* or *work items* over time.

The material resources or work items are based on the activities in the WBS for the project.

The main ***goal*** is to produce a cost baseline.

A cost baseline is a time-phased budget that project managers use to measure and monitor cost performance.

Cost budgeting provides a cost baseline.

5. Determining the budget

Inputs: Cost management plan, Scope baseline,

Activity cost estimates, Basis of estimates, Project schedule,

Resource calendars, Risk register, Agreements,
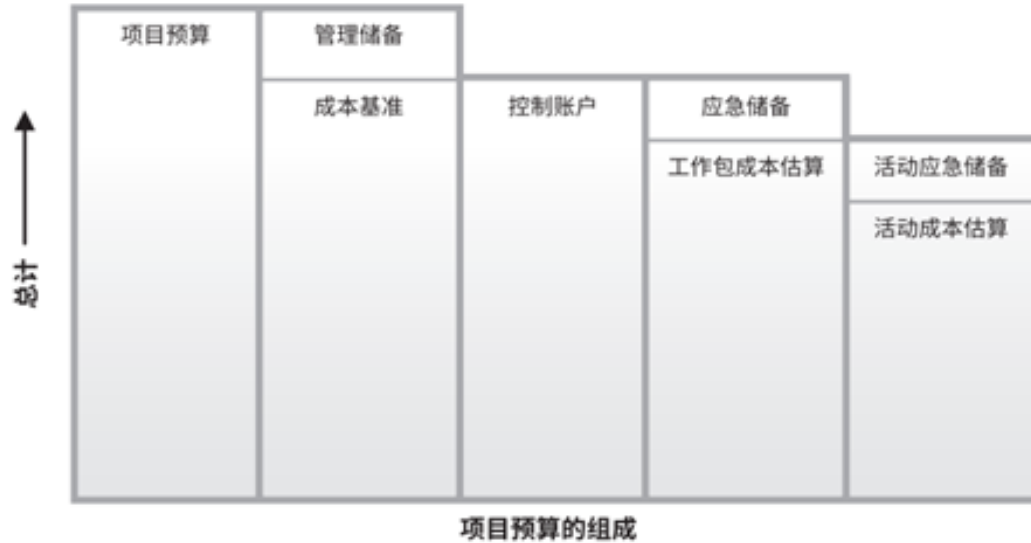
Organizational process assets

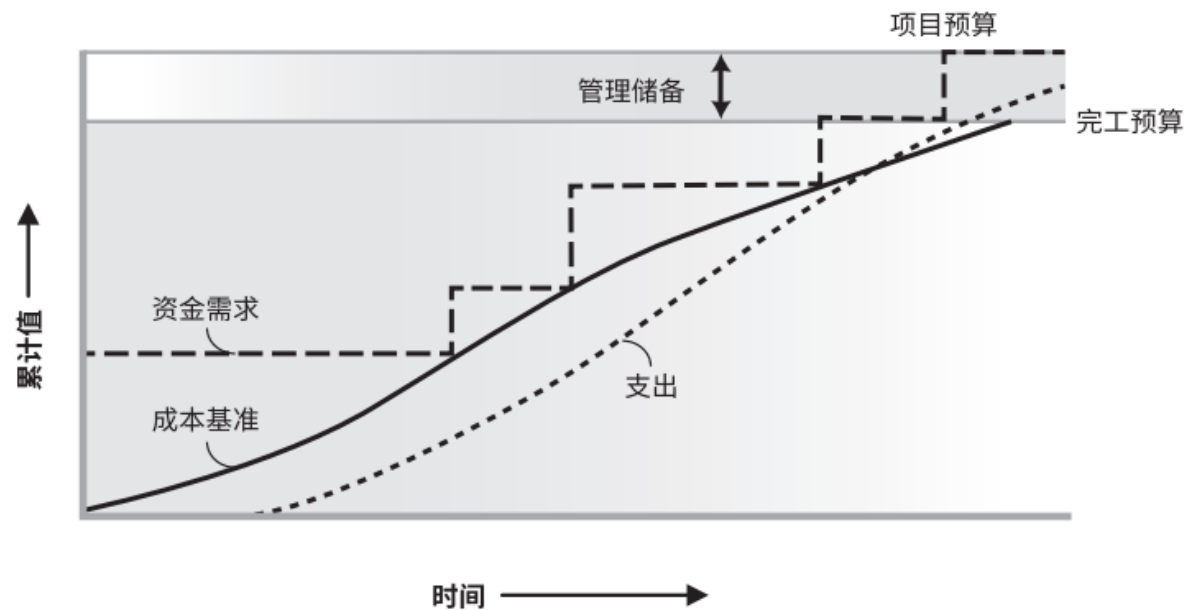**Outputs:** Cost baseline，

Project fund demand，

Project documents updates

5. Determining the budget

项目预算	管理储备			
	成本基准	控制账户	应急储备	
			工作包成本估算	活动应急储备
				活动成本估算

总计 →

项目预算的组成

估算成本	成本预算
输出活动成本估算	输出成本基准
用于成本估计	用于成本控制
通常是一个数值	通常是一条S曲线
由项目团队来做	需要管理层参与

项目预算

管理储备

完工预算

资金需求

支出

成本基准

累计值 →

时间 →

5. Determining the budget

Surveyor Pro Project Cost Baseline Created October 10*

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 companion Web site for a larger view of this and other figures in this chapter. Numbers are rounded, so some totals appear to be off.

6. Controlling costs

Controlling costs includes monitoring cost performance, ensuring that only appropriate changes are included in revised cost baseline, and informing project stakeholders of authorized changes to the project that will affect costs.

1. 对造成成本基准变更的因素施加影响；
2. 确保变更请求获得同意；
3. 当变更发生时，管理这些实际的变更；
4. 保证潜在的成本超支不超过授权的项目阶段资金和总体资金；
5. 监督成本执行，找出与成本基准的偏差；
6. 准确记录所有的与成本基准的偏差；
7. 防止错误的、不恰当的或未批准的变更被纳入成本或资源使用报告中；
8. 就审定的变更，通知项目干系人；
9. 采取措施，将预期的成本超支控制在可接受的范围内

6. Controlling costs

Inputs: project management plan, project funding requirements,

work performance data, organizational process assets

Tools and techniques: project 2010, change control system,

performance review meeting,

performance measurement

Outputs: work performance information,

cost forecasts, change requests,

project management plan updates,

project documents updates,

organizational process assets updates

6. Controlling costs

Earned value management 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

- Planned value **(PV)**
- Actual cost **(AC)**
- Earned value **(EV)**
- Rate of performance **(RP)**
- Cost variance **(CV)**

- Schedule variance **(SV)**
- Cost performance index **(CPI)**
- Schedule performance index **(SPI)**
- Budget at completion **(BAC)**
- Estimate at completion **(EAV)**

6. Controlling costs

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%

Term	Formula
Earned value (EV)	$EV = PV$ to date $* RP$
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)	$EAC = BAC/CPI$
Estimated time to complete	Original time estimate/SPI

6. Controlling costs

Cost

The planned value (PV)

The actual cost (AC)

Cost variance (CV)

Schedule variance (SV)

The earned value (EV)

0

Duration
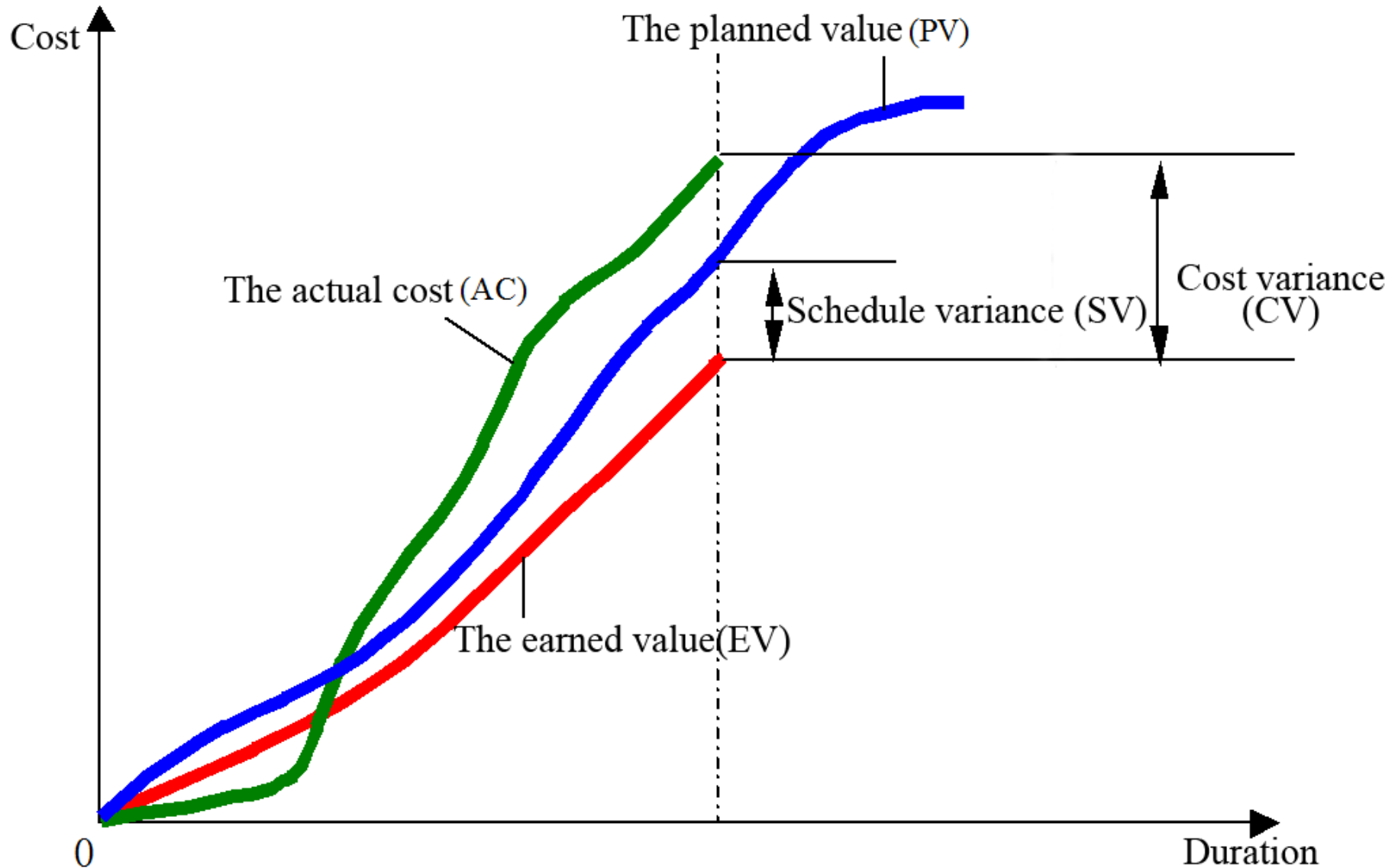
6. Controlling costs

Case 1: PV = $ 1,860

EV = $ 1,860

AC = $ 1,860

Everything is going according to the plan.

Case 2: PV = $ 1,900

AC = $ 1,700

Actual cost is less than planned cost.

Case 3: PV = $ 1,900

EV = $ 1,500

AC = $ 1,700

$$\text{SV} = \text{EV} - \text{PV} = -\$ 400$$

$$\text{SV \%} = \text{SV} / \text{PV} \times 100 = -21 \%$$

The work worth $400 was not completed as planned.

6. Controlling costs

Case 3: PV = $ 1,900

EV = $ 1,500

AC = $ 1,700

SV $= EV - PV = - \$\ 400$

SV % $= SV / PV * 100 = - 21\ \%$

CV $= EV - AC = - \$\ 200$

CV % $= CV / EV * 100 = - 13\ \%$

The actual cost has exceeded the earned value. That is to say, the work worth $1,500 has cost $1,700. Our cost has exceeded $200.

SPI $= EV / PV = \$\ 0.79$ CPI $= EV / AC = \$\ 0.88$

- The planned completion of the $1 work actually only completed the equivalent of 79 cents;
- For each dollar spent, you can only get the equivalent of 88 cents.

6. Controlling costs

Case 3: PV = $ 1,900

EV = $ 1,500

AC = $ 1,700

SV = EV − PV = **- $ 400**

CV = EV − AC = **- $ 200**

- This is the worst situation since all measurements are negative.
- The plan may be too positive.

6. Controlling costs

Case 4: PV = $ 2,600

EV = $ 2,400

AC = $ 2,200

SPI = 0.92

SV = -$ 200;

SV % = -8 %

The planned completion of $1 worth of work actually only completed a job worth 92 cents.

CV = $^+$ $ 200; CV % = $^+$ 8 %

CPI = 1.09

For every dollar we spend, we get a work worth $1.09.

6. Controlling costs

Case 5: PV = $ 1,700

EV = $ 1,500

AC = $ 1,500

SV = ⁻ $ 200;   SPI = 0.88

CV = 0;   CPI=1

Case 6: PV = $ 1,400

EV = $ 1,600

AC = $ 1,400

SV = ⁺ $ 200; SV % = + 14 %

SPI = 1.14

CV = ⁺ $ 200; CV % = + 12.5 %

CPI=1.14

????   This is the best situation since all measurements are positive.

6. Controlling costs

Case 7: PV = $ 2,200

          EV = $ 2,400

          AC = $ 2,400

Case 8: PV = $ 2,000

          EV = $ 2,000

          AC = $ 2,200

Case 9: PV = $ 1,700

          EV = $ 1,500

          AC = $ 1,900

Case 10: PV = $ 1,000

          EV = $ 0.00

          AC = $ 800

**Case 11:** PV = $ 0.00

          EV = $ 700

          AC = $ 900

6. Controlling costs

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
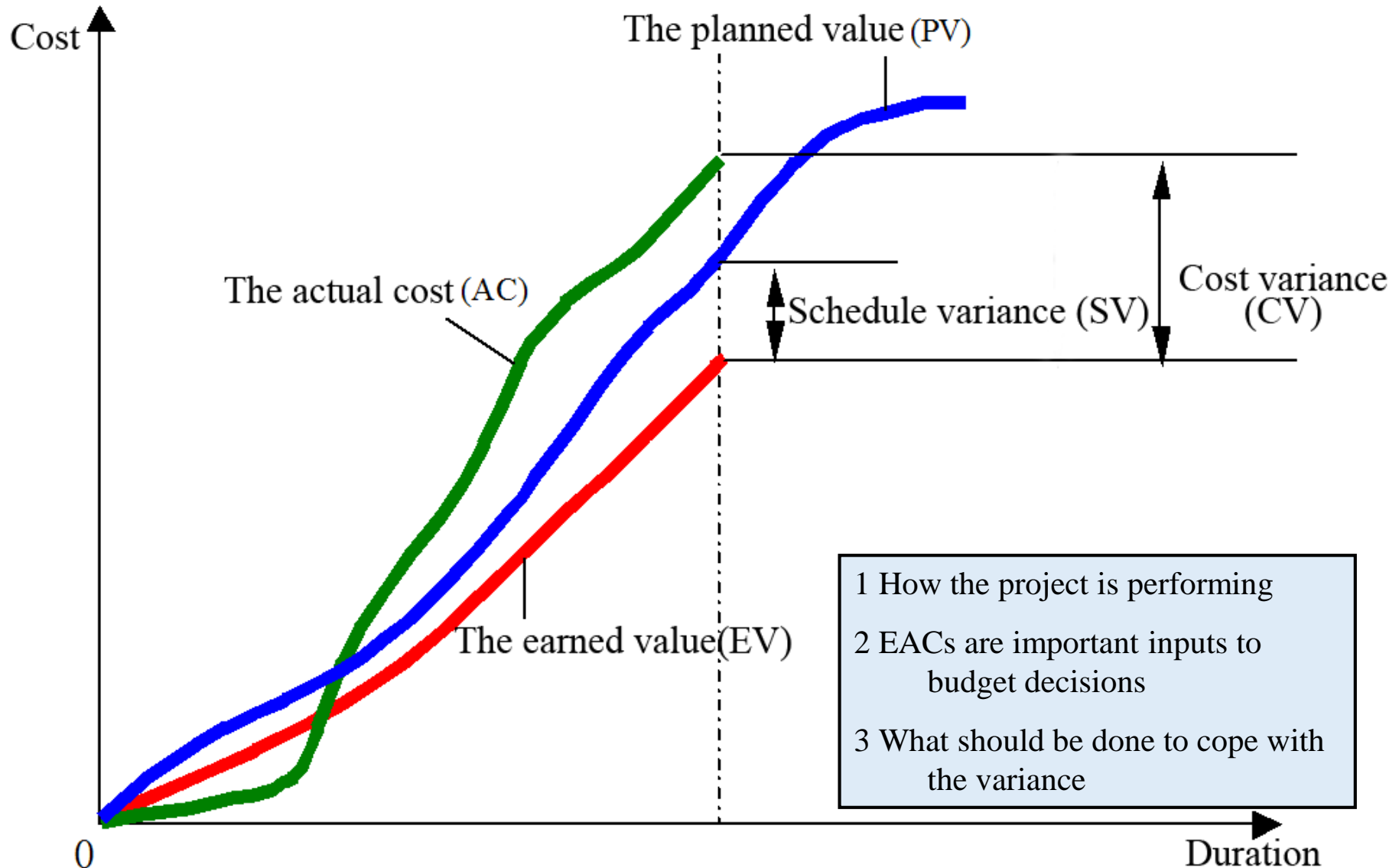
6. Controlling costs
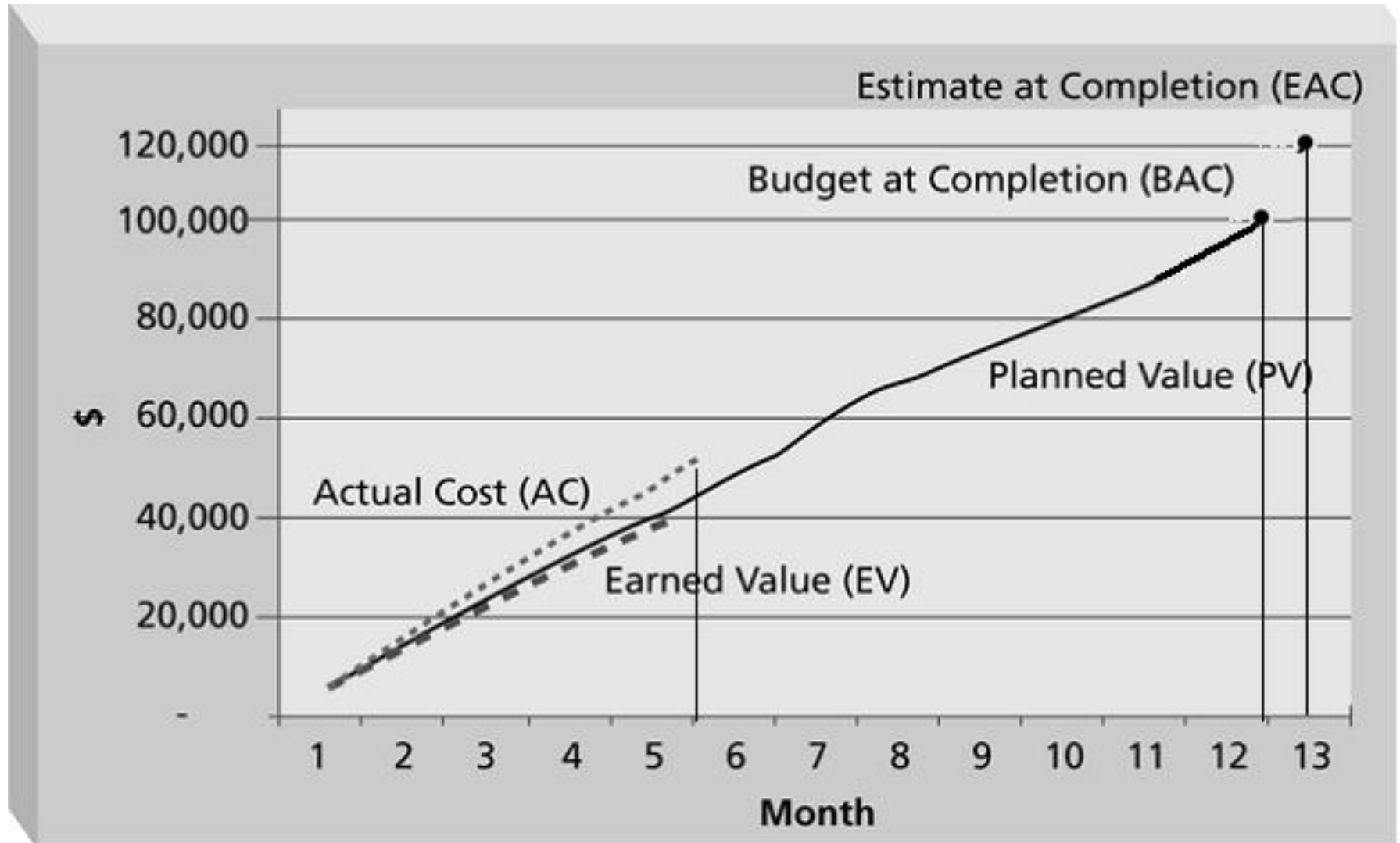
Exercise

Given the following information for a one-year project, answer the following questions.

$$PV = 23000 \quad EV = 20000$$

$$AC = 25000 \quad BAC = 120000$$

a. What is the cost variance, schedule variance, cost performance index, and schedule performance index for the project.

b. How is the project doing? Is it ahead of schedule or behind schedule? Is it under budget or over budget.

c. Use the CPI to calculate the estimate at completion for this project. Is the project performing better or worse than planned?

d. Use the SPI to estimate how long it will take to finish this project.

e. Sketch the earned value chart for this project, using Figure 7-5 as a guide.

6. Controlling costs

Cost

The planned value (PV)

The actual cost (AC)

Schedule variance (SV)

Cost variance (CV)

The earned value (EV)

1 How the project is performing

2 EACs are important inputs to budget decisions

3 What should be done to cope with the variance

0

Duration

6. Controlling costs

某项目共有十项工作，预计每项花费10元，共花费100元，10个月的时间。

现状：第4个月底只完成了3项工作，花费了35元，计算项目情况；

- PV：现阶段应该完成多少工作，这些工作预计花费多少钱；
- AC：完工部分内容的实际花费，按现在完成的工作每一件实际花费多少预算的总和；
- EV：完工部分内容的预计花费；按现在完成的工作每一件应该花费多少预算的总和；
- SV：进度偏差，实际完工工作预计花费 - 计划此时完成多少工作花的钱；
- SPI：进度绩效指数，实际完工工作预计花费/计划此时完成多少工作花的钱；
- CV：成本偏差，实际完工工作预计花费 - 完工部分内容的实际花费；
- CPI：成本绩效指数：CPI=EV/AC；
- BAC：按原计划完成所有工作需要花费的预算；
- EAC：全部工作的成本，根据目前的效率和工作方式，完工的花费。
- ETC：完工尚需估算，剩下的工作当前估算花多少钱；
- VAC：完工偏差=BAC-EAC；计划完工成本-按现状完工的成本；
- TCPI：完工尚需绩效指数 = 剩余工作 / 剩余资金。

6. Controlling costs

- EVM is used worldwide, and it is particularly popular in the Middle East, South Asia, Canada, and Europe

- Most countries require EVM for large defense or government projects

- EVM is also used in such private-industry sectors as IT, construction, energy, and manufacturing.

- However, most private companies have not yet applied EVM to their projects because management does not require it, feeling it is *too complex and not cost effective*

6. Controlling costs

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

- *Portfolio management software* can help reduce costs

Summary

- What is cost ?

- Earned value management / Earned value analysis

- A cost baseline

- Project cost management processes

  ➢ Plan cost management

  ➢ Estimate costs

  ➢ Determine budget

  ➢ Control costs