MONASH University

Information Technology

FIT2002
IT Project Management

Lecture 6
Project Cost Management

So Far…

Knowledge Areas	Project Management Process Group				
	Initiating	Planning	Executing	Monitoring & Controlling	Closing
Project Integration Management	1. Develop Project Charter	2. Develop Project Management Plan	3. Direct & manage project work 4. Manage Project Knowledge	5. Monitor & control project work	6. Close Project or Phaase
Project Scope Management		1. Plan Scope Management 2.. Collect requirements 3. Define Scope 4. Create WBS		5. Validate Scope; 6. Control Scope	
Project Schedule Management		1. Plan Schedule Management 2. Define Activities 3. Sequence Activities 4. Estimate Activity Durations 5. Develop Schedule		6. Control Schedule	
Project Cost Management		1. Plan Cost Management 2. Estimate Costs 3. Determine Budget		4. Control Costs	

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Video 1:
Learning Objectives

- Understand the importance of project cost management
- Discuss what project cost management involves
- Explain basic project cost management principles, concepts, and terms

The Importance of Project Cost Management

- IT projects have a poor track record for meeting budget goals
- A 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 percent.
- The most important finding was the discovery of a large number of gigantic overages or “black swans” in IT projects
- A perceived reason for cost overruns is that many IT projects involve new technology or business processes and thus pose an inherent risk.
- However, using good project cost management can change this false perception.

What Went Wrong?

- The United Kingdom's National Health Service IT modernisation program was called the greatest IT disaster in history with an estimated **$26 billion overrun**
- The program had problems due to incompatible systems, resistance from physicians, and arguments among contractors about who's responsible for what
- It was finally scrapped in 2011

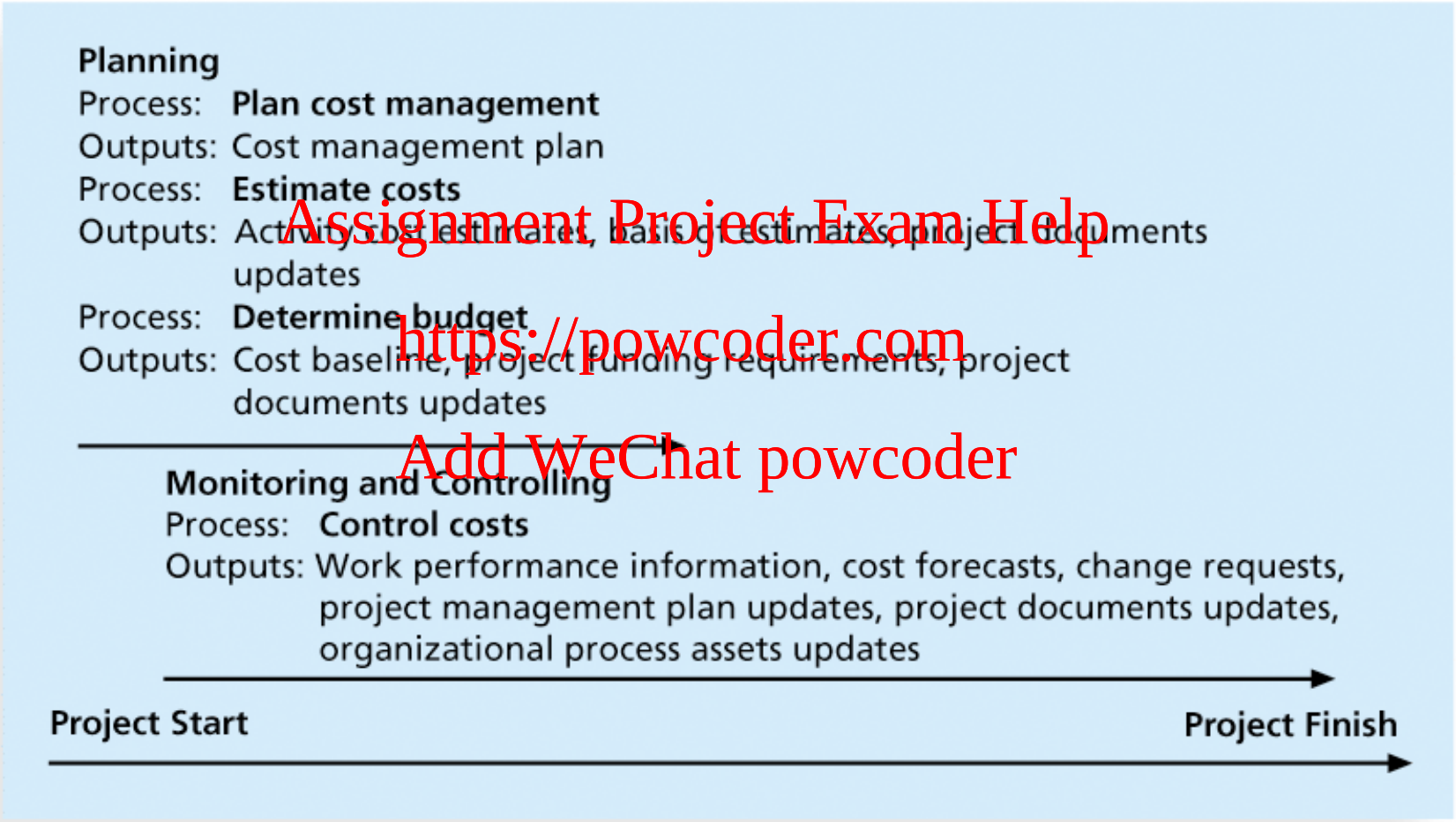
What is Cost and Project Cost Management?

- **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

- **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

Figure 7-1. Project Cost Management



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

Types of Costs and Benefits

- **Tangible costs** or **benefits** are those costs or benefits that an organisation 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

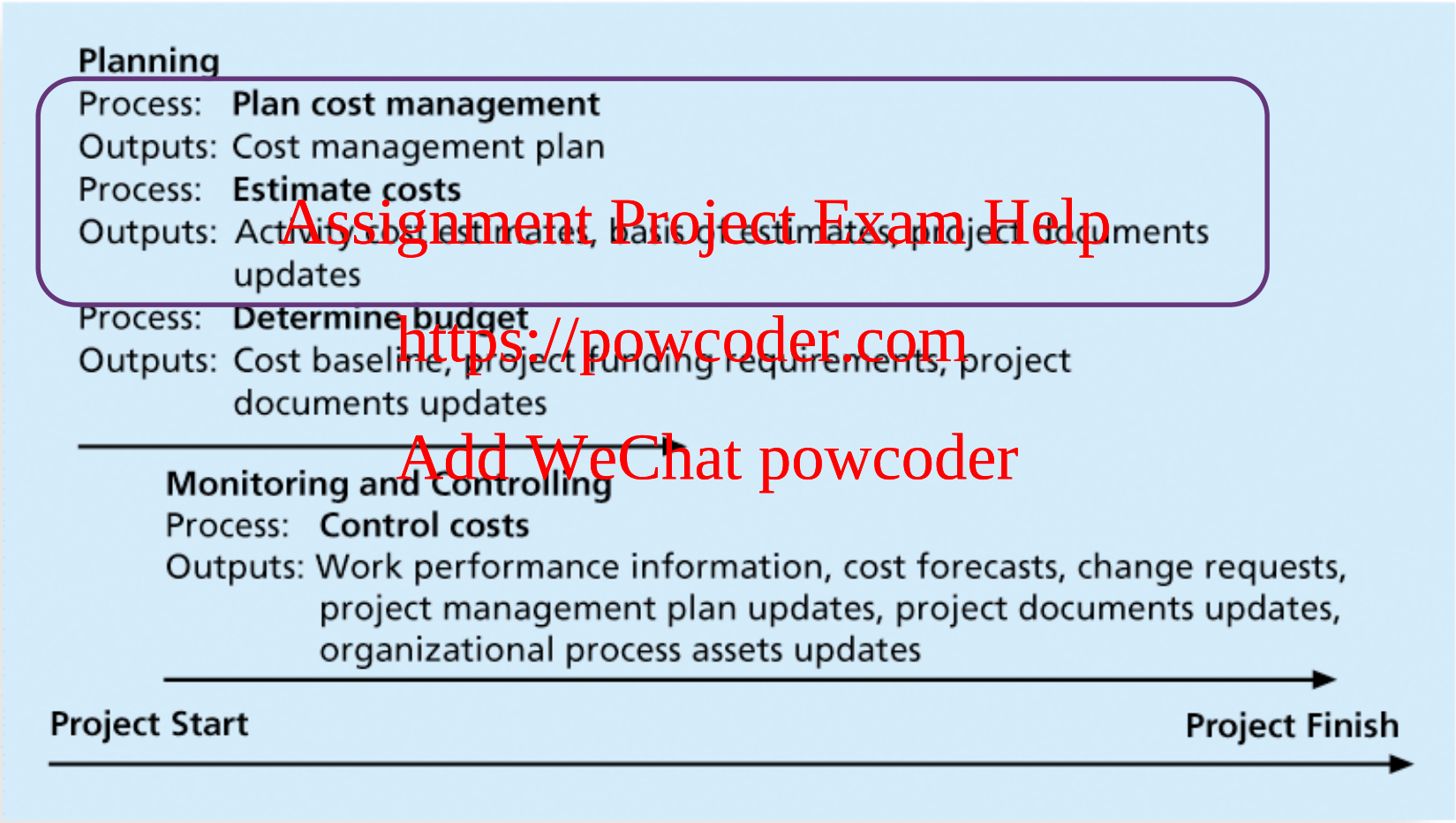
More Basic Principles of Cost Management

- **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**

Video 2:
Learning Objectives

- Describe the process of planning cost management
- Discuss different types of cost estimates

Project Cost Management Summary



Planning Cost Management

- The project team uses expert judgment, analytical techniques, and meetings to develop the cost management plan
- A cost management plan includes:
  - Level of accuracy and units of measure
  - Organisational procedure links
  - Control thresholds
  - Rules of performance measurement
  - Reporting formats
  - Process descriptions

Estimating Costs

- Project managers must take cost estimates seriously if they want to complete projects within budget constraints
- Estimates are usually done at various stages of a project and should become more accurate as time progresses
- A large percentage of total project costs are often labor costs
- It's important to know the types of cost estimates, how to prepare cost estimates, and typical problems associated with IT cost estimates

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 early go/no-go 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 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
- People lack estimating experience
- Human beings are biased toward underestimation
- Management desires accuracy

Surveyor Pro 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.

Surveyor Pro Software Development Estimate

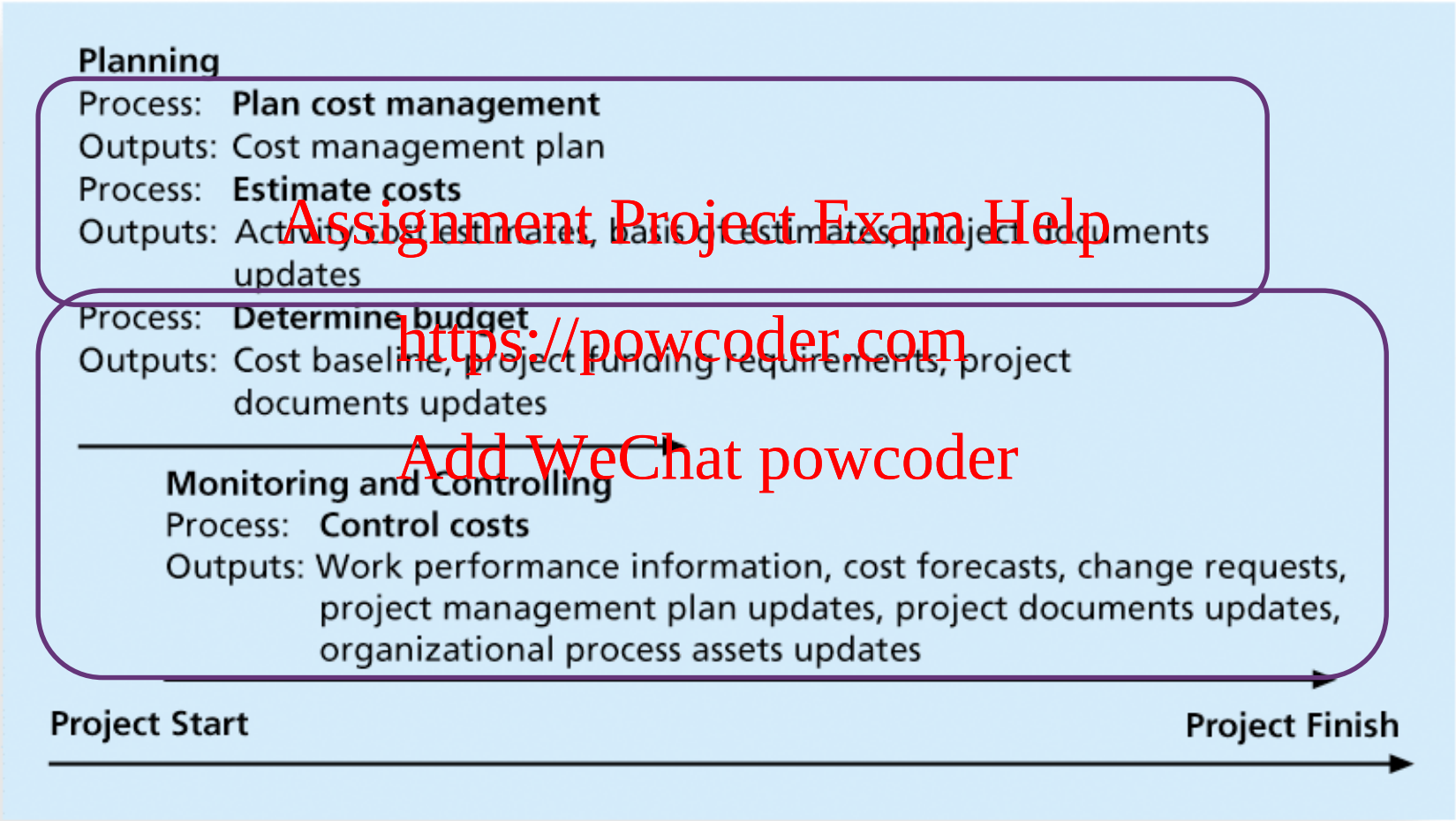
1. Labor Estimate	# Units/Hrs.	Cost/Unit/Hr.	Subtotals	Calculations
Contractor labor estimate	3000	$150	$450,000	3000 * 150
Project team member estimate	1920	$75	$144,000	1920 * 75
Total labor estimate			**$594,000**	Sum above two values
2. Function point estimate	Quantity	Conversion Factor	Function 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 language 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 (27 hours/function point)*			4,725	27*175
Cost/labor hour ($120/hour)			$120	Assumed value from budget expert
Total function point estimate			**$567,000**	4,725 * 120

* Based on historical data

Video 3:
Learning Objectives

- Understand the processes of determining a budget and preparing a cost estimate for an information technology (IT) project
- Understand the benefits of earned value management and project portfolio management to assist in cost control

Project Cost Management Summary



Determining the Budget

- **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
- Important goal is to produce a **cost baseline**
  - a time-phased budget that project managers use to measure and monitor cost performance
  - Team members should document any assumptions made when developing the cost baseline

Surveyor Pro Project Cost Baseline

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.

Controlling Costs

- Project cost control includes
  - Monitoring cost performance
  - Ensuring that only appropriate project changes are included in a revised cost baseline
  - Informing project stakeholders of authorised changes to the project that will affect costs
- Change control system to define procedures for changing the cost baseline is necessary
- Tools and techniques to assist in project cost control:
  - Performance review meetings
  - Performance measurement – Earned value management (EVM)

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
  - whether or not a WBS item was completed
  - how much of the work was completed
  - how much the completed work actually cost

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

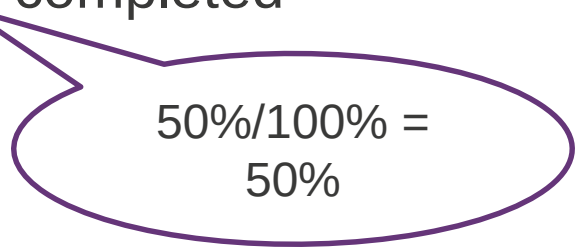


Table 7-3. Earned Value Calculations for One Activity After Week One

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%

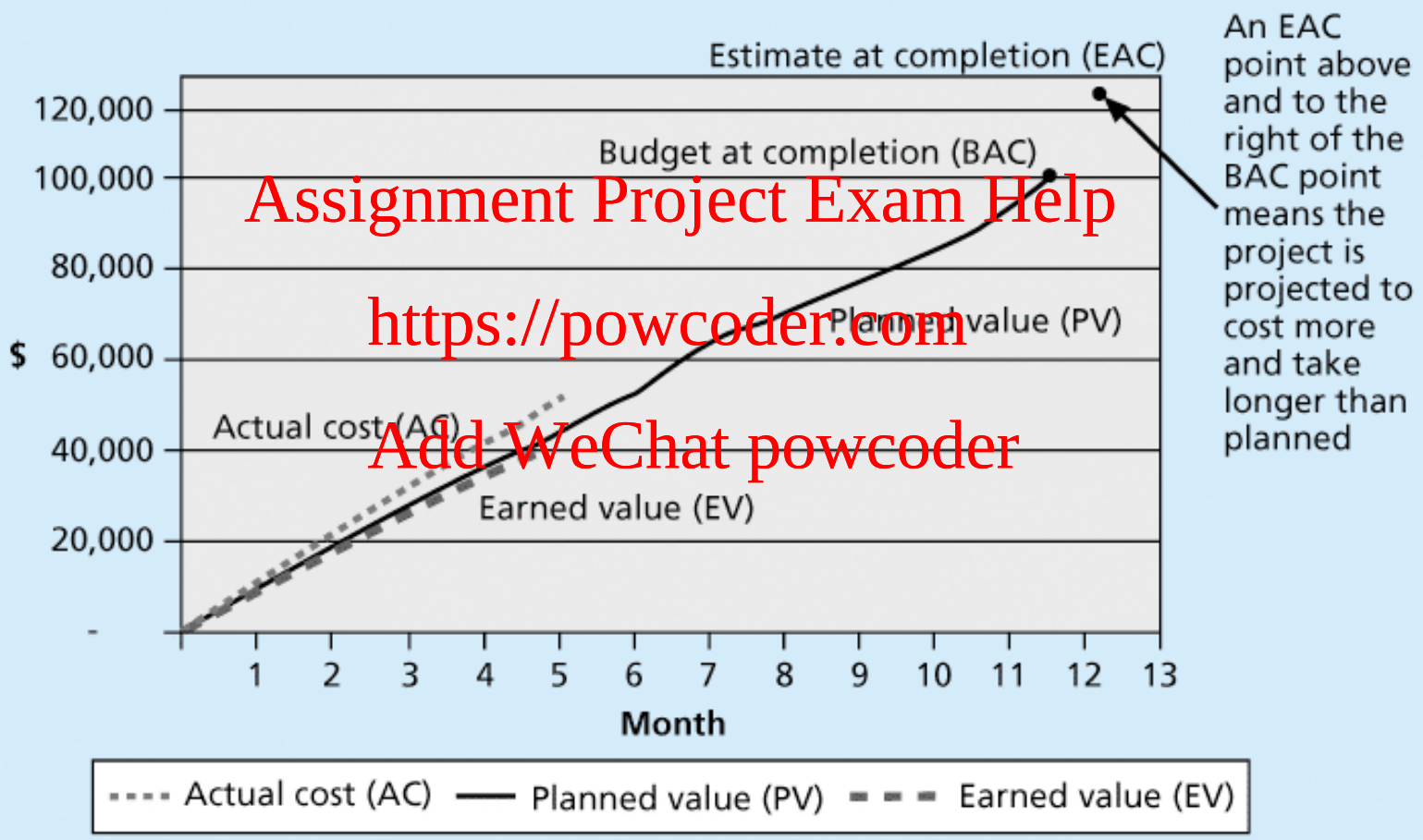
Table 7-4. Earned Value Formulas

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

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

Earned Value Chart for Project after Five Months



Project Portfolio Management

- Many organisations 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
- Reduced redundant projects and coordinated those with overlap
- IT projects can be huge investments, so it makes sense to view them as portfolios and track their progress as a whole
- Portfolio management software can help reduce costs
- Brandon Stewart (Borland):
  - “The most successful organisations are taking a holistic view of focusing, managing, and measuring their IT efforts…Portfolio management enables IT to make fact-based investment decisions in unison with business stakeholders, thus ensuring alignment, improving visibility, and shifting the burden of investment decisions from the CIO to all stakeholders.”

Best Practice

- Alvin Alexander wrote a book called *Cost Estimating in an Agile Development Environment* in 2015
- Function points are a means of measuring software size in terms that are meaningful to end users
- User stories are a common way to describe requirements in a simple, concise way
- Developers can analyse user stories to estimate function points and person-hours

Ref: Alvin Alexander, *Cost Estimating in an Agile Development Environment* (2015). alvinalexander.com/downloads/Book3-EstimatingInAnAgileDevelopmentEnvironment.pdf
David Longsteet. "Function Points?" www.softwaremetrics.com/files/OneHour.pdf, p.16

Video 4:
Learning Objectives

- Explore the difference between traditional and agile cost management

What's different between traditional and Agile Cost Management

Traditional Approach	Agile Approach
Cost (like time), is based on fixed scope.	Project schedule, not scope, has the biggest impact on cost.
Organisations estimate project costs and fund projects before the project starts.	Product owners often secure project funding after the product roadmap stage is complete and sometimes even fund agile projects one release at a time.
New requirements would most likely mean higher costs. Therefore, cost overruns are common.	Project teams can replace lower-priority requirements with new, equivalently-sized high-priority requirements with no impact on time or cost.

What's different between traditional and Agile Cost Management (cont…)

Traditional Approach	Agile Approach
Scope bloat may happen and so money wasted on features that is not required.	Only the product features that users really need are created as agile development teams complete requirements by priority.
Projects cannot generate revenue until the project is complete.	Project teams can release working, revenue-generating functionality early, creating a self-funding project.

Managing Cost in Agile

- In agile projects, cost is mostly a direct expression of project time
- Quite easy to determine team cost – as scrum teams consist of full-time, dedicated team members, they have a set team cost that should be the same for each sprint.
- Once we estimate the velocity (development speed), we can determine how many sprints the project will take (i.e. how long the project will be) and thus how much the scrum team will cost for the whole project.
- Other project cost includes the cost for resources like hardware, software, licenses, and other supplies needed to complete the project.

Ways to lower project costs (in Agile)

- Self-funding project
- Lowering cost by increasing velocity
  - Eg: Product backlog contains 300 story points

    Development team velocity ~ 10 story points per sprint

    Project duration = 60 weeks

    Cost: $20,000 per 2-week sprint → Total = $600,000

  → Increasing velocity from 10 to 12, project duration will be shorten to 50 weeks (300/12 x 2) → Total cost = $500,000
- Lowering cost by reducing time
  - Lowering the number of sprints required by not completing lower-priority requirements

No. of sprints = 300/10 = 30 sprints

If 2-week sprint = 30 x 2 = 60 weeks