



MONASH University

Information Technology

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FIT2002



IT Project Management

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Lecture 6

Project Cost Management

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So Far...

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Project Management Process Group

Knowledge Areas	Project Management Process Group				
	Initiating	Planning	Executing	Monitoring & Controlling	Closing
Project Integration Management	1. Develop Project Charter	2. Define Project Scope Management 3. Plan Scope Management 4. Collect Requirements 5. Define Scope 6. Create WBS	3. Direct & manage project work 4. Manage Project Knowledge	5. Monitor & control project work	6. Close Project or Phase
Project Scope Management	Lecture 3			5. Validate Scope; 6. Control Scope	
Project Schedule Management	Lecture 4	1. Plan Schedule Management 2. Define Activities 3. Sequence Activities 4. Estimate Activity Durations 5. Develop Schedule		6. Control Schedule	
Project Cost Management	Lecture 5		Assignment Project Exam Help Email: tutorcs@163.com QQ: 749389476		
	Lecture 6	1. Plan Cost Management 2. Estimate Costs 3. Determine Budget		4. Control Costs	



Video 1:

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Learning Objectives



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

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The Importance of Project Cost Management



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

What Went Wrong?



- The United Kingdom National Health Service IT modernisation project is called the greatest IT disaster in history with an estimated **\$26 billion overrun**
- The program had **Web Chat**, **Assignment Help**, **Exam Help**, **Project Help**, **Student Help** incompatible systems, resistance from physicians, and arguments among contractors about who's responsible for what
- It was finally scrapped in 2011

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What is Cost and Project Cost Management?

- **Cost** is a resource spent 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**
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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

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Figure 7-1. Project Cost Management

Planning

Process: Plan cost management

Outputs: Cost management plan

Process: Estimate costs

Outputs: Activity cost estimates, basis of estimates, project documents updates

Process: Determine budget

Outputs: Cost baseline, project funding requirements, project documents updates

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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

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Project Start

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Project Finish



Basic Principles of Cost Management



- Most members of a project's executive board better understand and are more interested in financial terms than IT terms , so IT project managers must speak business 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



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Types of Costs and Benefits

- **Tangible costs** or  are those costs or benefits that an organisation can easily measure in dollars
- **Intangible costs** or  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  spent in the past; when deciding what projects to invest in or continue, you should *not* include sunk costs <https://tutorcs.com>



More Basic Principles of Cost Management



- **Learning curve theory** states that when many items are produced repetitively, the 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**)

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Video 2:

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Learning Obj



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

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Project Cost Management Summary



Planning

Process: Plan cost management

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Monitoring and Controlling

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Project Finish



Planning Cost Management



- The project team uses judgment, analytical techniques, and meetings to develop a 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

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Types of Cost Estimates



TYPE OF ESTIMATE	WHEN	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	Email: tutorcs@163.com QQ: 749389476	–5% to +10%

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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

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Typical Problems with IT Cost Estimates

- Estimates are done quickly
- People lack estimation experience
- Human beings are biased toward underestimation
- Management desires accuracy



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Surveyor Pro Project Cost Estimate

Surveyor Pro Project Cost Estimate Created October 5

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	# Units/Hrs.	Cost/Unit/Hr.	Subtotals	WBS Level 2 Totals	% of Total
WBS Items					
1. Project Management				\$306,300	20%
Project manager		\$100	\$96,000		
Project team members		\$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				\$644,000	40%
3.1 Licensed software	100	\$200	\$20,000		
3.2 Software development*			\$394,000		
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	

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Surveyor Pro Software Development Estimate



1. Labor Estimate	Cost/Unit/Hr.	Subtotals	Calculations
Contractor labor estimate	\$150	\$450,000	$3000 * 150$
Project team member estimate	\$75	\$144,000	$1920 * 75$
Total labor estimate		\$594,000	Sum above two values
2. Function point estimate	Quantity	Conversion Factor	Function Points
External inputs	10	4	40
External interface files	3	7	21
External outputs	4	5	20
External queries	6	4	24
Logical internal tables	7	10	70
Total function points			175
Java 2 language equivalency value			46
Source lines of code (SLOC) estimate			8,050
Productivity \times KSLOC $^{\wedge}$ Penalty (in months)			29.28
Total labor hours (27 hours/function point)*			4,725
Cost/labor hour (\$120/hour)			\$120
Total function point estimate			\$567,000

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* Based on historical data

Video 3:

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Learning Obj



- Understand the process 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

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Project Cost Management Summary



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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

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Project Start

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Project Finish



Determining the Budget



- **Cost budgeting** involves locating 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

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Surveyor



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	6,000	12,000	15,000	15,000	15,000	15,000					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	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	129,027	109,027	185,027	173,027	148,427	90,027	80,027	53,567	1,521,240

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*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.

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Controlling Costs

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- Project cost control
 - Monitoring cost performance
 - Ensuring that only appropriate project changes are included in a revised cost baseline
- Change control system **Email: tutorcs@163.com** 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)



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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 **WeChat: cstutors**
- You must enter actual information periodically to use EVM
 - whether or not a WBS item was completed
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 - how much of the work was completed
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 - how much the completed work actually cost
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Earned Value Management Terms



- The **planned value**, formerly called the budgeted cost of work scheduled (BCS), also called the budget, is that portion of the approved total cost of a project that is allocated 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** is the ratio of actual work completed to the percentage of work planned to have been completed at any given time during 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

$$\frac{50\%}{100\%} = 50\%$$



Table 7-3. Earned Value Calculations for One Activity



ACTIVITY	WEEK 1
Earned Value (EV)	5,000
Planned Value (PV)	10,000
Actual Cost (AC)	5,000
Cost Variance (CV)	10,000
Schedule Variance (SV)	-5,000
Cost Performance Index (CPI)	0.50
Schedule Performance Index (SPI)	0.50

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Table 7-4. Earned Value Formulas



Term	Formula
Earned value (EV)	$EV = PV \text{ to date} * RP$
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

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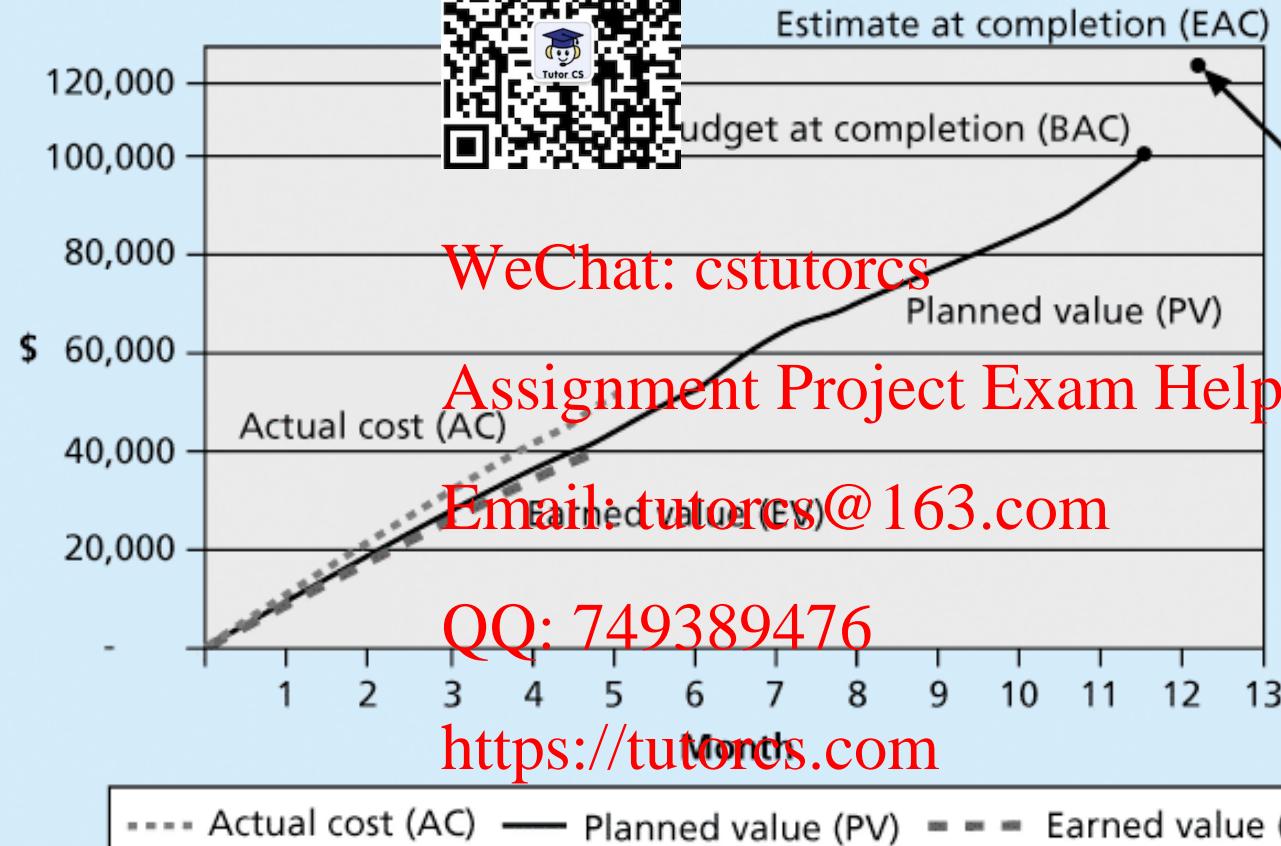


Rules of Thumb for Earned Value Numbers

- 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)
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- 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
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Earned Value Chart for Project after Five Months



An EAC point above and to the right of the BAC point means the project is projected to cost more and take longer than planned

Project Portfolio Management



- Many organisations and control an entire suite of projects or investments as one interrelated activities in a portfolio
- Five levels for project portfolio management
 1. Put all your projects in one database
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 2. Prioritize the projects in your database
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 3. Divide your projects into two or three budgets based on type of investment **Email: tutorcs@163.com**
 4. Automate the repository
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 5. Apply modern portfolio theory, including risk-return tools that map project risk on a curve
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Benefits of Portfolio Management



- Schlumberger saved \$1 billion 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): Email: tutorcs@163.com
 - “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

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

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- Explore the differences between traditional and agile cost management

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What's different between traditional and Agile Cost Management



Traditional Approach

Cost (like time), is based on fixed scope.

Agile Approach

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.

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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.

Projects cannot generate revenue until the project is complete.

Only the product features that users really need are created as agile development teams complete requirements by priority.

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Project teams can release working, revenue-generating functionality early, creating a self-funding project.

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Managing Cost in Agile



- In agile projects, cost is usually 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

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Development team velocity ~ 10 story points per sprint

Project duration = ~~60 weeks~~ Project Exam Help

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

→ Increasing velocity from 10 to 12, project duration will be shortened to 50 weeks ($300/12 \times 2$) → Total cost = \$500,000

- Lowering cost by reusing time

– Lowering the number of sprints required by not completing lower-priority requirements