Manajemen Proyek Sistem Informasi

Project Cost Management

PENGAMPU: MAZ, TFD, FBY, RMM,

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Learning Objectives

- Understand the importance of project cost management
- Explain basic project cost management principles, concepts, and terms
- Describe the process of planning cost management
- Discuss different types of cost estimates and methods for preparing them
- Understand the processes involved in cost budgeting and preparing a cost estimate and budget for an information technology project
- Understand the benefits of earned value management and project portfolio management to assist in cost control
- Describe how project management software can assist in project cost management

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 56 percent in 2004; other studies found overruns to be 33-34 percent

What Went Wrong?

- The U.S. government, especially the Internal Revenue Service (IRS), continues to provide examples of how not to manage costs
  - A series of project failures by the IRS in the 1990s cost taxpayers more than $50 billion a year
  - In 2006, the IRS was in the news for a botched upgrade to its fraud-detection software, costing $318 million in fraudulent refunds that didn't get caught
  - A 2008 Government Accountability Office (GAO) report stated that more than 400 U.S. government agency IT projects, worth an estimated $25 billion, suffer from poor planning and underperformance
- The United Kingdom's National Health Service IT modernization program was called the greatest IT disaster in history with an estimated $26 billion overrun

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

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

Project Cost Management Overview

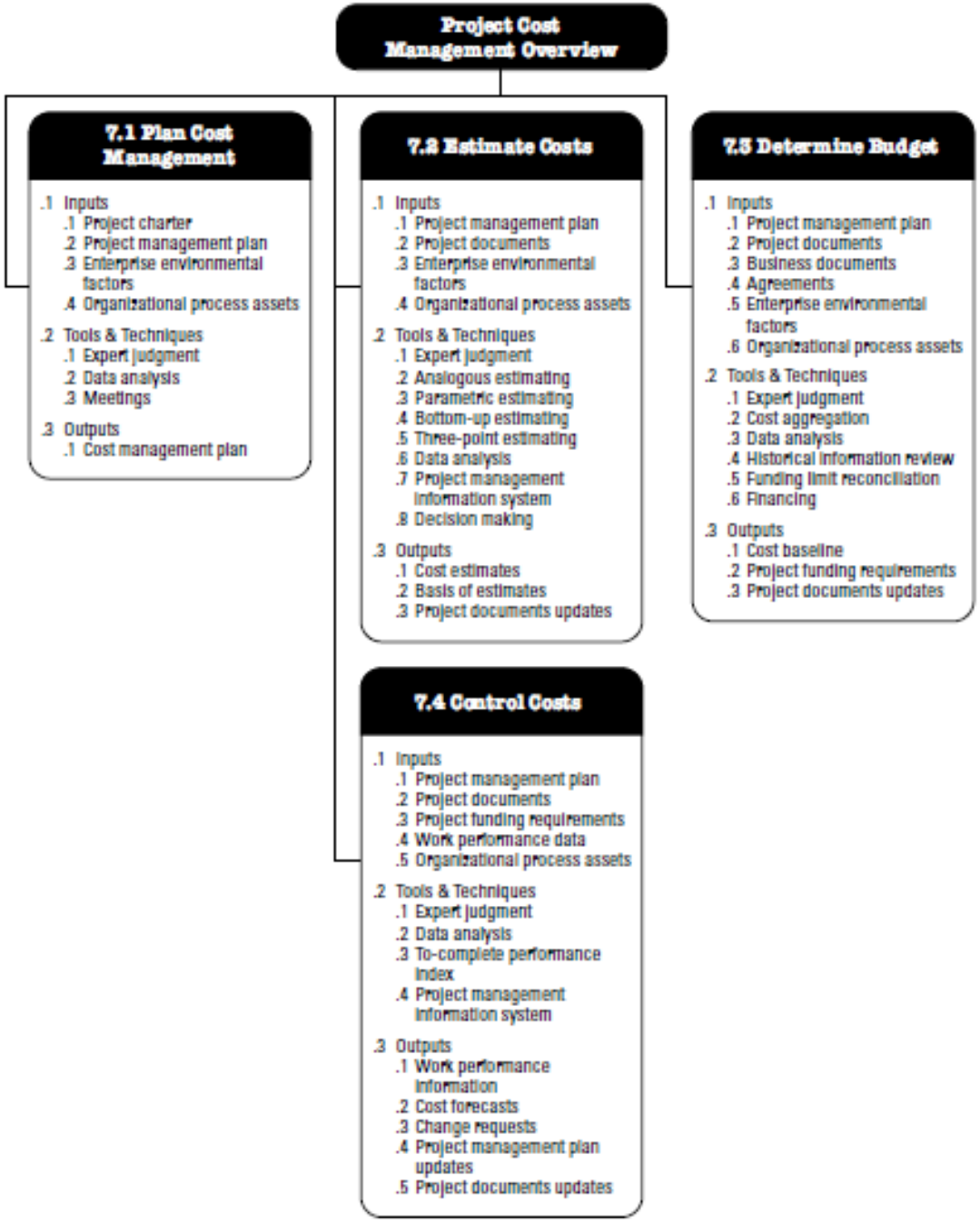

Figure 7-1. Project Cost Management Overview

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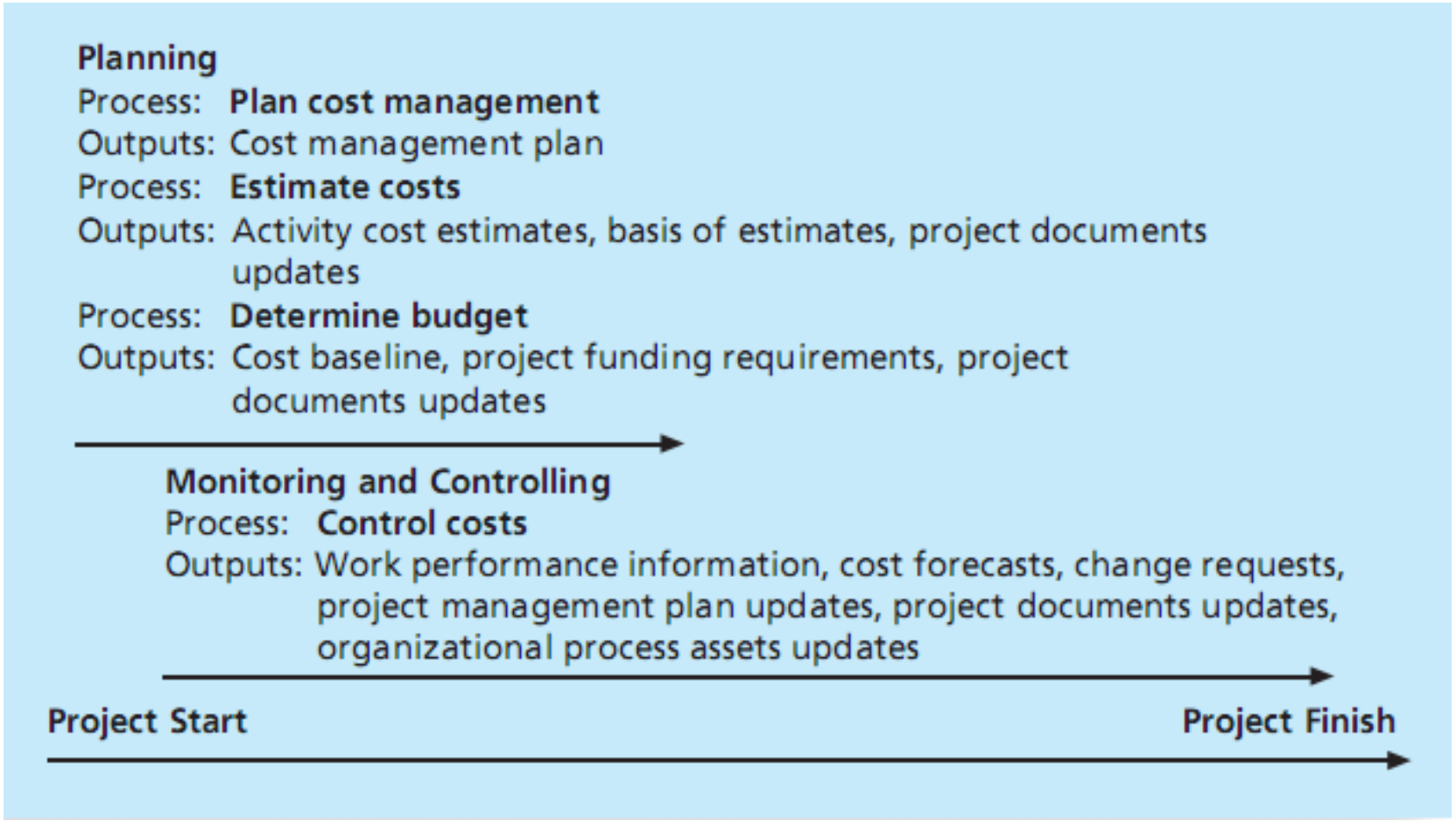
Project Cost Management Summary



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

Cost of Downtime for IT Applications

Type of IT Application	Cost/Minute
Securities trading	$73,000
Enterprise Requirements Planning (ERP)	$14,800
Order processing	$13,300
Electronic commerce	$12,600
Supply chain	$11,500
Point of sale (POS)	$ 4,700
Automated teller machine (ATM)	$ 3,600
E-mail	$ 1,900

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What Went Right?

- Many organizations use IT to reduce operational costs
- Technology has decreased the costs associated with processing an ATM transaction:
  - In 1968, the average cost was $5
  - In 1978, the cost went down to $1.50
  - In 1988, the cost was just a nickel
  - In 1998, it only cost a penny
  - In 2008, the cost was just half a penny!
- Investing in green IT and other initiatives has helped both the environment and companies' bottom lines; Michael Dell, CEO of Dell, reached his goal to make his company "carbon neutral" in 2008

Basic Principles of Cost Management

- Tangible costs or benefits are those costs or benefits that an organization 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

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)

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1. Planning Cost Management

- A cost management plan is a document that describes how the organization will manage cost variances on the project
- A large percentage of total project costs are often labor costs, so project managers must develop and track estimates for labor

Plan Cost Management ITTO

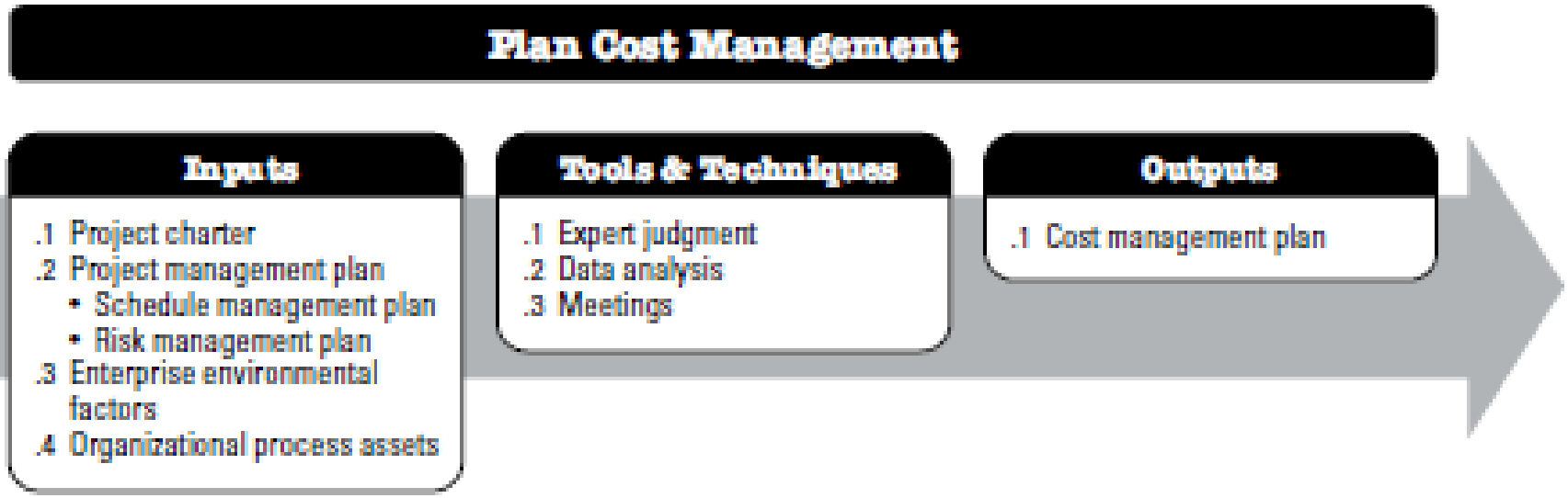

Figure 7-2. Plan Cost Management: Inputs, Tools & Techniques, and Outputs

Planning Cost Management

- In general, a cost management plan includes the following information:
  - Level of Accuracy
  - Units Of Measure
  - Organizational procedure links
  - Control threshold
  - Rules of performance measurement
  - Reporting format
  - Process descriptions

2. Estimating Costs

- Project managers must take cost estimates seriously if they want to complete projects within budget constraints
- It's important to know the types of cost estimates, how to prepare cost estimates, and typical problems associated with IT cost estimates

Estimate Costs ITTO

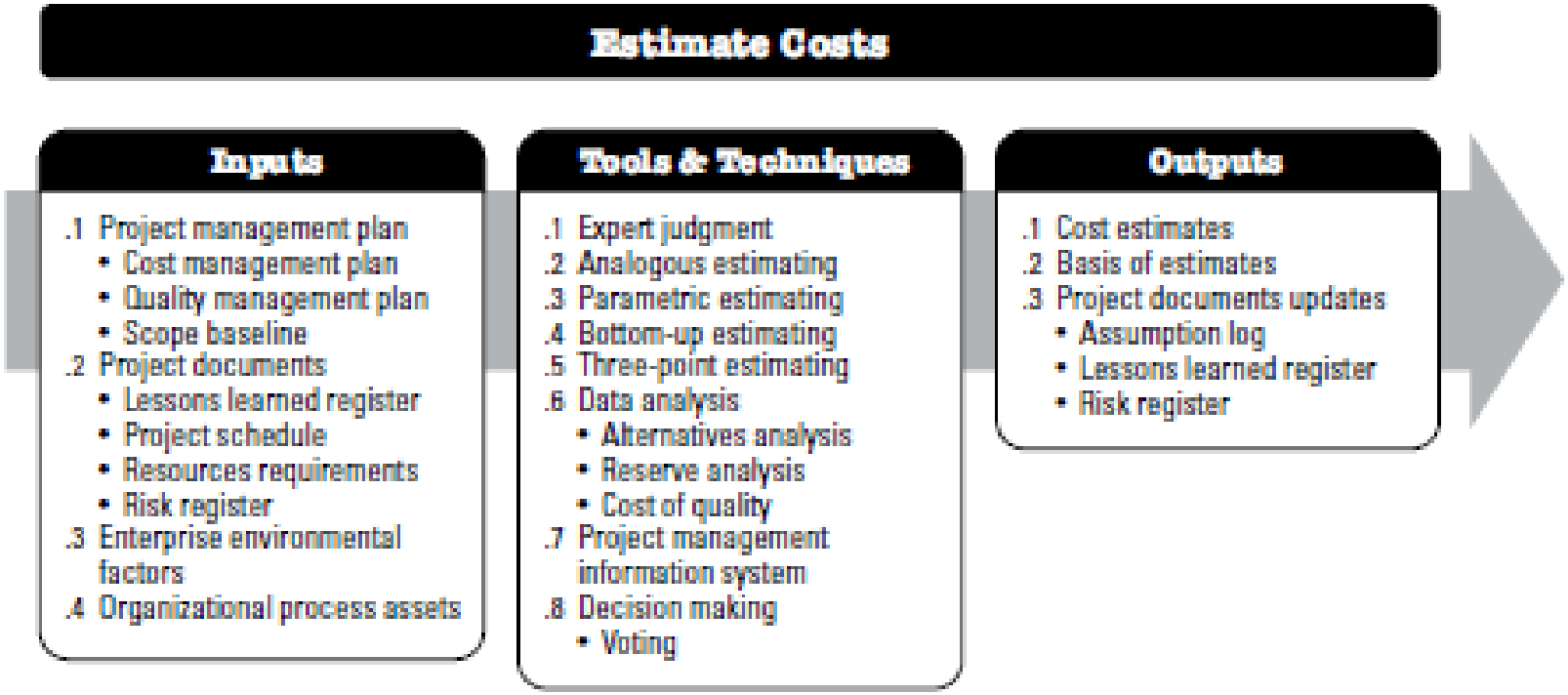

Figure 7-4. Estimate Costs: Inputs, Tools & Techniques, and Outputs

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 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%

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 modeling uses project characteristics (parameters) in a mathematical model to estimate project costs

Typical Problems with IT Cost Estimates

- Estimates are done too quickly
- Lack of estimating experience
- Human beings are biased toward underestimation
- Management desires accuracy

Sample Cost Estimate

- Before creating an estimate, know what it will be used for, gather as much information as possible, and clarify the ground rules and assumptions for the estimate
- If possible, estimate costs by major WBS categories
- Create a cost model to make it easy to make changes to and document the estimate

Surveyor Pro Project Cost Estimate

	# Units/Hrs.	Cost/Unit/Hr.	Subtotals	WBS Level 1 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

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).

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3. 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

Determine Budget ITTO

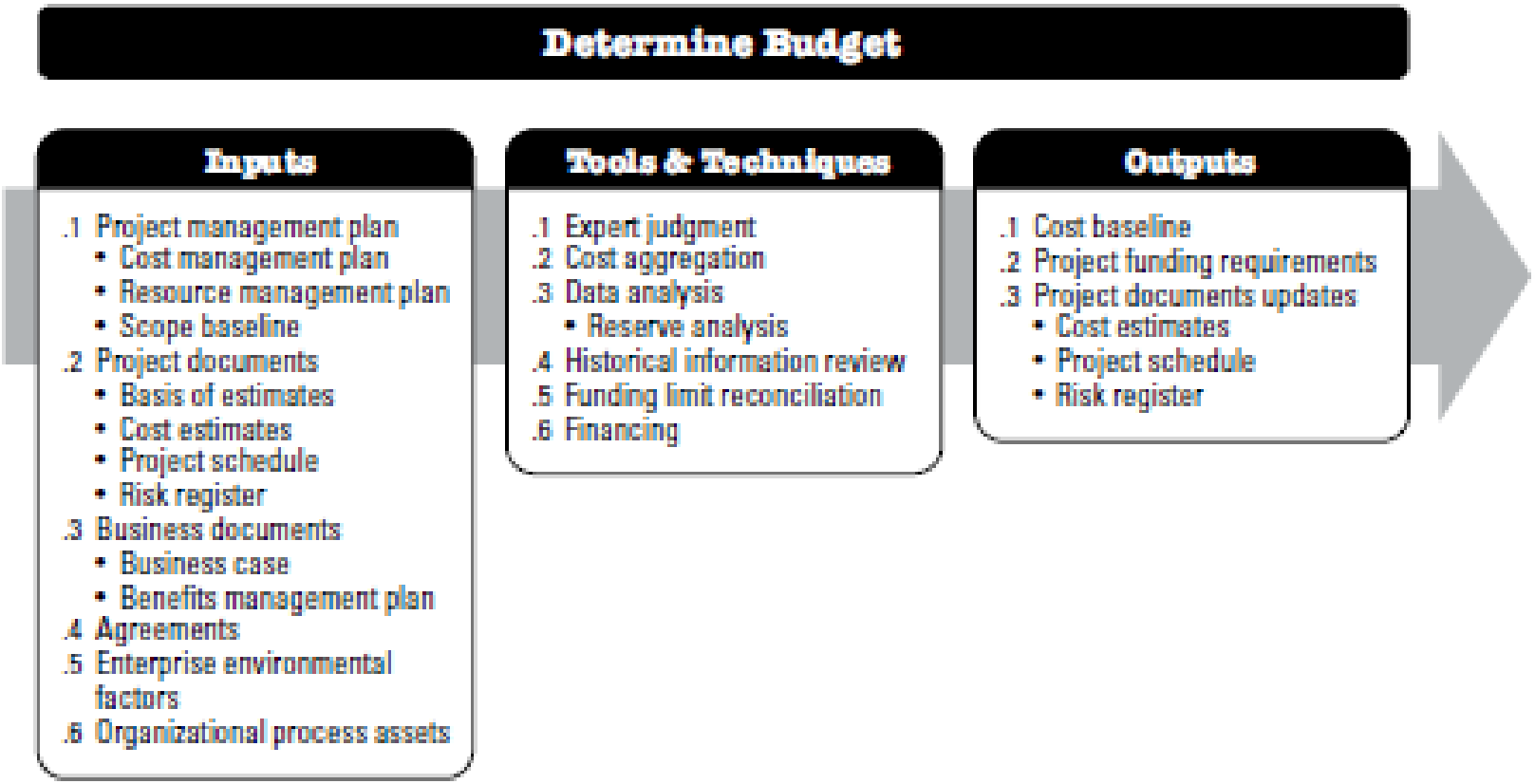


Figure 7-6. Determine Budget: Inputs, Tools & Techniques, and Outputs

Surveyor Pro Project Cost Baseline

Surveyor Pro Project Cost Baseline Created October 10*

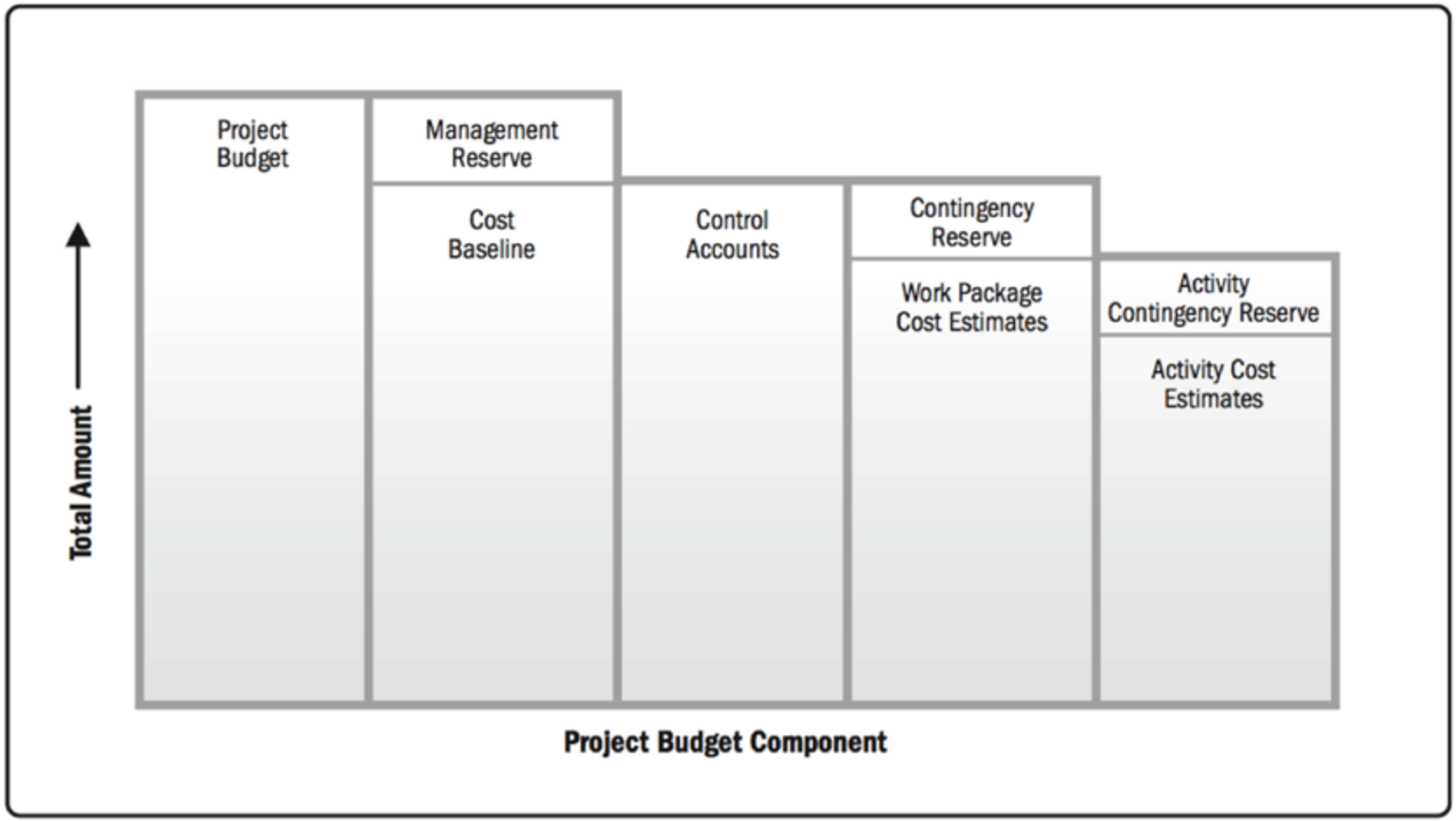
WBS Items	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1. Project Management													
1.1 Project manager	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	96,000
1.2 Project team members	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	144,000
1.3 Contractors		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.

Media Snapshot

- U.S. President Barack Obama successfully used the media and information technology in his campaign
  - The Obama campaign used 16 different online social platforms to interact with people of various backgrounds; sources say 80 percent of all contributions originated from these social networks
  - In a 60 Minutes episode shortly after the election, campaign leaders discussed some of the details of the campaign
  - The Web site My.BarackObama was created to develop an online community with more than a million members

Project Budget Components



4. 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 authorized changes to the project that will affect costs
- Many organizations around the globe have problems with cost control

Control Cost ITTO

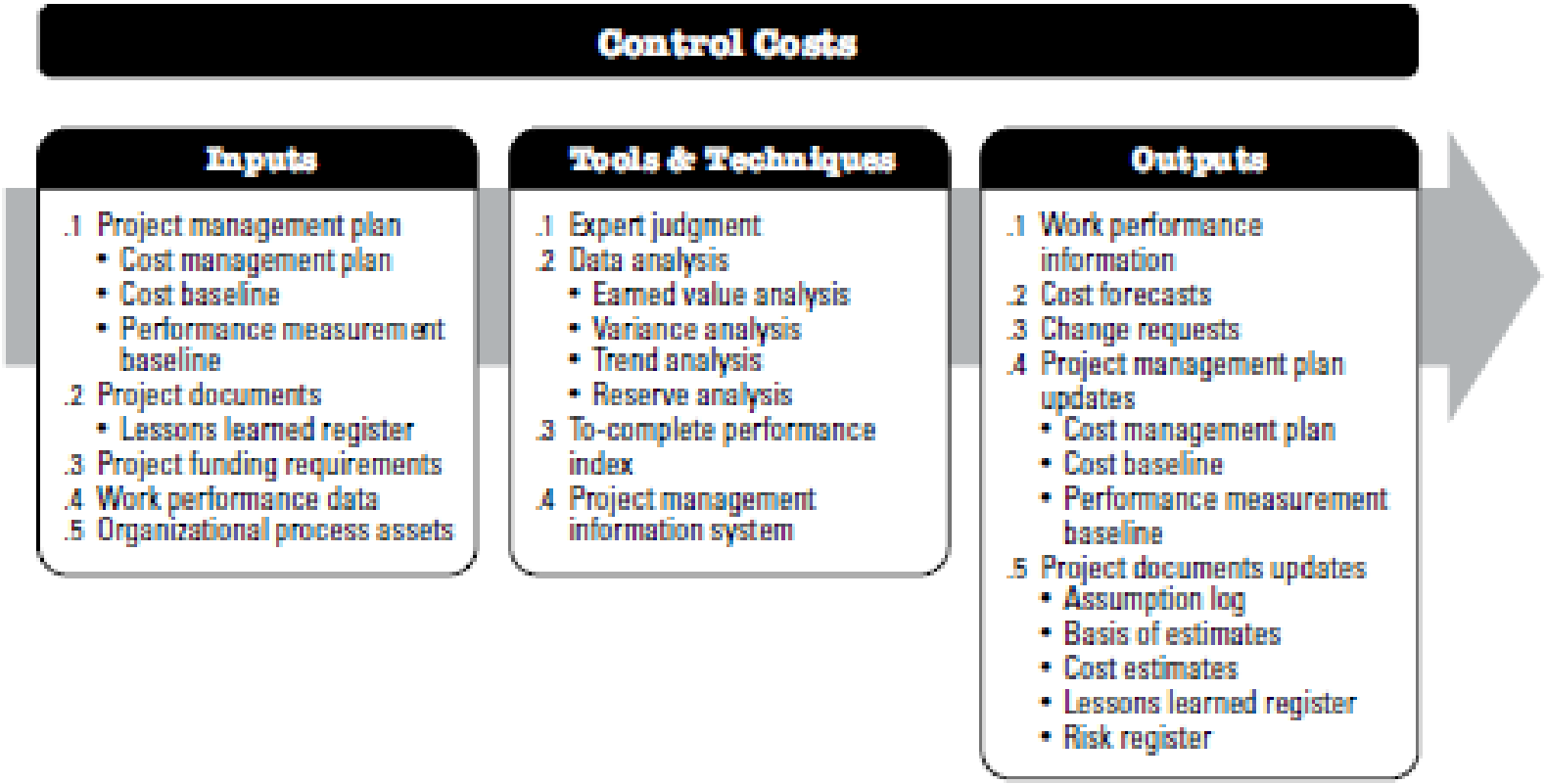


Figure 7-10. Control Costs: Inputs, Tools & Techniques, and Outputs

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), the authorized budget assigned to scheduled work
- Actual cost (AC), the realized cost incurred for the work performed on an activity during a specific time period
- The earned value (EV), a measure of work performed expressed in terms of the budget authorized for that work
- 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

Earned Value Management Terms (Cont)

- Schedule Variance (SV), a measure of schedule performance expressed as the difference between the earned value and the planned value
- Cost Variance (CV), the amount of budget deficit or surplus at a given point in time, expressed as the difference between earned value and the actual cost
- Schedule Performance Index (SPI), a measure of schedule efficiency expressed as the ratio of earned value to planned value. It measures how efficiently the project team is using its time
- Cost Performance Index (CPI), a measure of the cost efficiency of budgeted resources, expressed as a ratio of earned value to actual cost.

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 Formulas

Term	Formula
Earned Value	EV = PV to date × RP
Cost Variance	CV = EV – AC
Schedule Variance	SV = EV – PV
Cost Performance Index	CPI = EV/AC
Schedule Performance Index	SPI = EV/PV
Estimate at Completion (EAC)	EAC = BAC/CPI
Estimated Time to Complete	Original Time Estimate/SPI

Forecasting Tools

Abbreviation	Name	Lexicon Definition	How Used	Equation	Interpretation of Result
EAC	Estimate At Completion	The expected total cost of completing all work expressed as the sum of the actual cost to date and the estimate to complete.	If the CPI is expected to be the same for the remainder of the project, EAC can be calculated using: If future work will be accomplished at the planned rate, use: If the initial plan is no longer valid, use: If both the CPI and SPI influence the remaining work, use:	EAC = BAC/CPI EAC = AC + BAC – EV EAC = AC + Bottom-up ETC EAC = AC + [(BAC – EV)/ (CPI x SPI)]	
VAC	Variance at Completion	A projection of the amount of budget deficit or surplus, expressed as the difference between the budget at completion and the estimate at completion.	The estimated difference in cost at the completion of the project.	VAC = BAC – EAC	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost
ETC	Estimate to Complete	The expected cost to finish all the remaining project work.	Assuming work is proceeding on plan, the cost of completing the remaining authorized work can be calculated using: Reestimate the remaining work from the bottom up.	ETC = EAC – AC ETC = Reestimate	
TCPI	To Complete Performance Index	A measure of the cost performance that must be achieved with the remaining resources in order to meet a specified management goal, expressed as the ratio of the cost to finish the outstanding work to the budget available.	The efficiency that must be maintained in order to complete on plan. The efficiency that must be maintained in order to complete the current EAC.	TCPI = (BAC – EV)/(BAC – AC) TCPI = (BAC – EV)/(EAC – AC)	Greater than 1.0 = Harder to complete Exactly 1.0 = Same to complete Less than 1.0 = Easier to complete Greater than 1.0 = Harder to complete Exactly 1.0 = Same to complete Less than 1.0 = Easier to complete

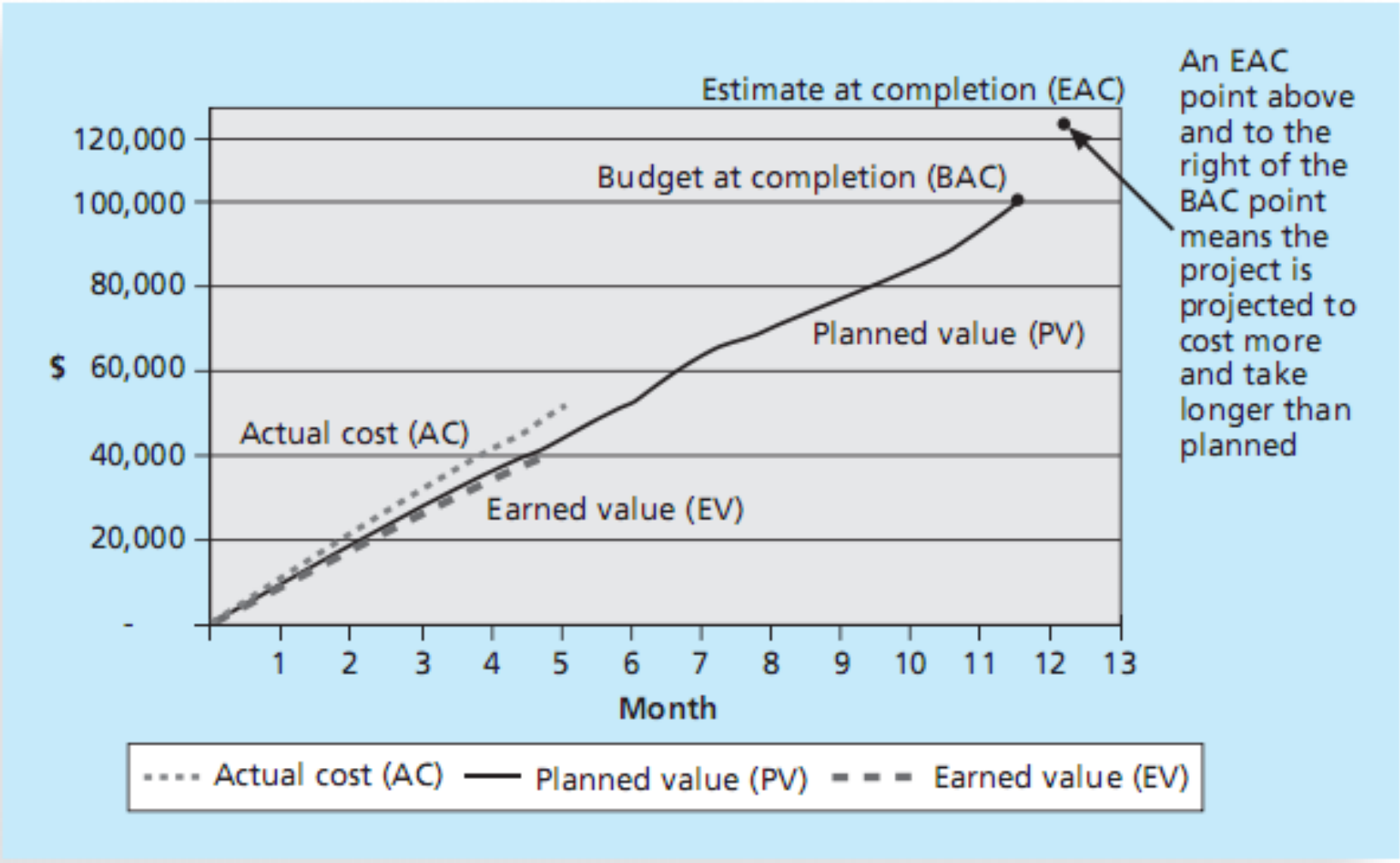
Earned Value Calculations for One Activity after Week One

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%

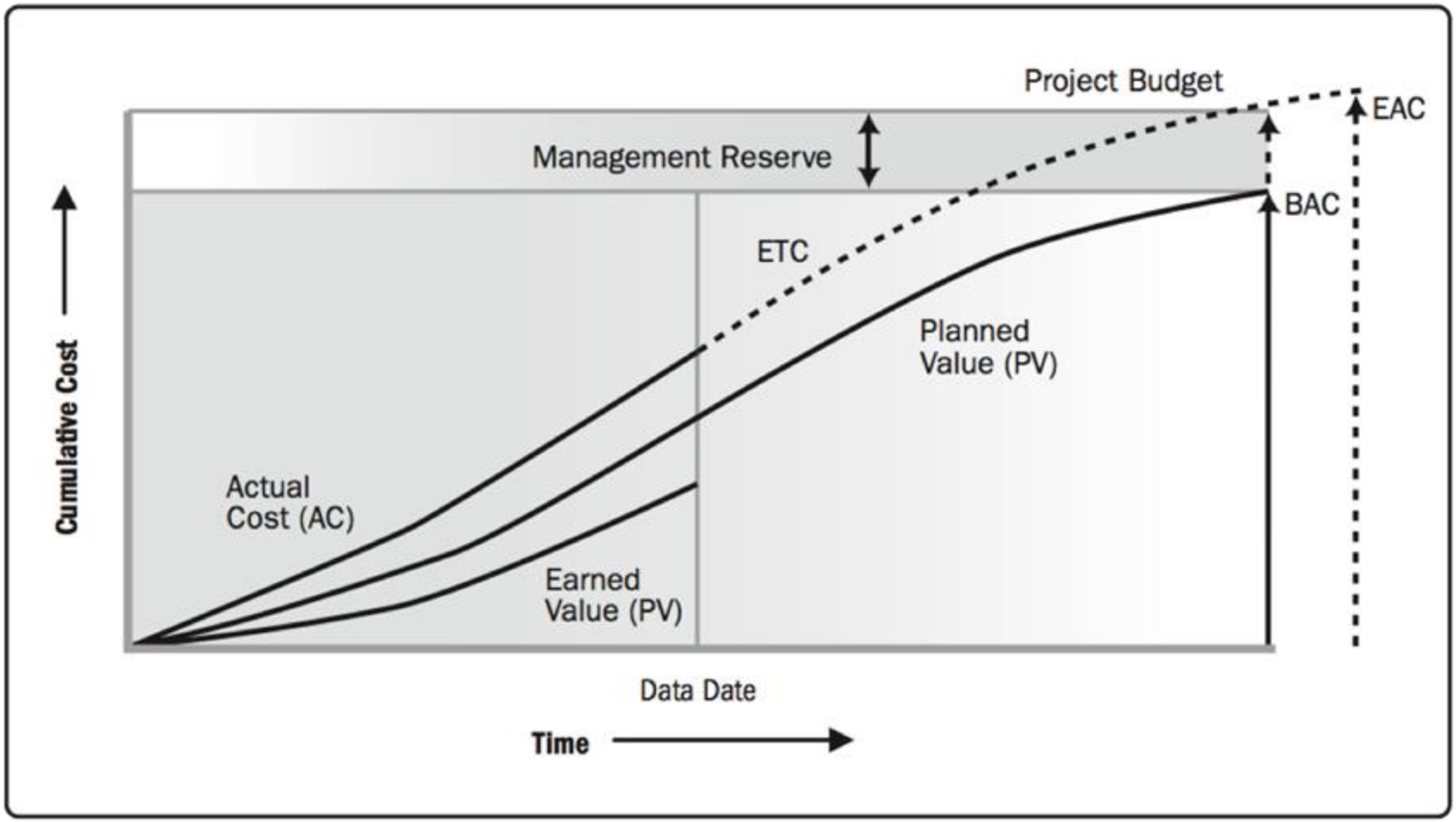
Rules of Thumb for Earned Value Numbers

- 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



EV, PV, and AC Chart (PMBOK)



Project Portfolio Management

- Many organizations 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
- ROI of implementing portfolio management software by IT departments:
  - Savings of 6.5 percent of the average annual IT budget by the end of year one
  - Improved annual average project timeliness by 45.2 percent
  - Reduced IT management time spent on project status reporting by 43 percent and IT labor capitalization reporting by 55 percent
  - Decreased the time to achieve financial sign-off for new IT projects by 20.4 percent, or 8.4 days

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

Best Practice

- A global survey released by Borland Software in 2006 suggests that many organizations are still at a low level of maturity in terms of how they define project goals, allocate resources, and measure overall success of their information technology portfolios
- Some of the findings include the following:
  - Only 22 percent of survey respondents reported that their organization either effectively or very effectively uses a project plan for managing projects
  - Only 17 percent have either rigorous or very rigorous processes for project plans, which include developing a baseline and estimating schedule, cost, and business impact of projects
  - Only 20 percent agreed their organizations monitor portfolio progress and coordinate across inter-dependent projects

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Excercise

You are managing a project laying underwater fiber optic cable. The total cost of the project is $52/ meter to lay 4 km of cable across a lake. It's scheduled to take 8 weeks to complete, with an equal amount of cable laid in each week. It's currently week 5, your team has laid 1,800 meters of cable, and already spend $ 90.000 so far

1. Using EVM, Determine BAC, PV, EV, AC, SV, CV, SPI, and CPI
2. Determine the project is late or not
3. Determine the project is under or over budget

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Unique Identifier	Activity	Predecessor	Duration (Day)	Planned Value (million)	Progress (%)
Start	Kick off Meeting	-	0	5	100%
A	Requirement Analysis	Start	5	25	100%
B	System Design	Start	10	30	100%
C	Story Board	A, B	5	25	100%
D	Programming	C	10	75	100%
E	Telecoms Infrastructure	B	5	150	100%
F	Hardware Installation	D, E	5	80	50%
G	Software Mock Up	D	10	50	25%
M	Ready for Integration	F, G	0	0	
H	Integration	M	15	75	
I	System Testing	H	5	50	
J	Training Support	H	35	50	
K	Handover and Go-Live	I	30	30	
L	User Acceptance Test	J, K	10	15	
End	Closing Project	L	0	5	

Mengacu kapada table diatas dan didapatkan data bahwa menjelang “Ready for Integration” biaya yang sudah digunakan adalah sebesar 650 juta, serta **project direncanakan selesai sesuai dengan jawaban di soal nomor 2 diatas**, maka lakukanlah perhitungan Earn Value Management dan jelaskan hasil dari setiap angka tsb: à **2 POINT MASING-MASING**

1. BAC
2. Total PV
3. Total EV
4. Total AC
5. Schedule Variance
6. Cost Variance
7. Schedule Performance Index
8. Cost Performance Index
9. EAC serta estimasi kapan project akan selesai
10. Dengan asumsi management menyetujui angka EAC di soal nomor 19, bagaimanakah seharusnya performa project kedepannya (TCPI dan jelaskan).

Summary

- Project cost management is a traditionally weak area of IT projects, and project managers must work to improve their ability to deliver projects within approved budgets
- Main processes include:
  1. Plan Cost Management
  2. Estimate costs
  3. Determine the budget
  4. Control costs

References

1. Kathy Schwalbe, Managing Information Technology Projects 7th Edition, *Course Technology, Cengage Learning*, 2014
2. A Guide to the Project Management Body of Knowledge: PMBOK Guide 6th Edition, *Project Management Institute*, 2017