

Project Cost Management

Learning Objectives

- Understand the importance of project cost management.
- Explain basic project cost management principles, concepts, and terms.
- Discuss different types of cost estimates and methods for preparing them.

Learning Objectives

- 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.

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, such as Rupees/dollars.
- **Project cost management** includes the processes required to ensure that the project is completed within an approved budget.

Project Cost Management Processes

- **Cost estimating:** Developing an approximation or estimate of the costs of the resources needed to complete a project.
- **Cost budgeting:** Allocating the overall cost estimate to individual work items to establish a baseline for measuring performance.
- **Cost control:** Controlling changes to the project budget.

Basic Principles of Cost Management

- Most members of an executive board have a better understanding and are more interested in financial terms and project managers must speak their language.
 - **Profits** are revenues minus expenses.
 - **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.

Basic Principles of Cost Management

- **Tangible costs or benefits** are those costs or benefits that an organization can easily measure in Rupees/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 Rupees/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**).

Cost Estimating

- 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.

Project Cost Management

- Focused on the cost associated with the resources needed to do the project.
 - People
 - Materials
 - Equipment
 - Services, etc.
- Includes all processes needed to ensure the project is completed within the approved budget.

Purpose of Cost Management

- Develop a Budget plan based on the project scope using estimating techniques, in order to manage project cost.
 - To identify resources requiring cos.
 - To make better cost estimates.
 - To allocate the over all project cost estimate to individual work items.
 - To control budget changes.

Cost Management Fundamentals

- Sunk Costs
 - Expended costs (should not be considered when deciding whether to continue with a troubled project)
- Law of diminishing return
 - The more you put in something, the less you get out of it.

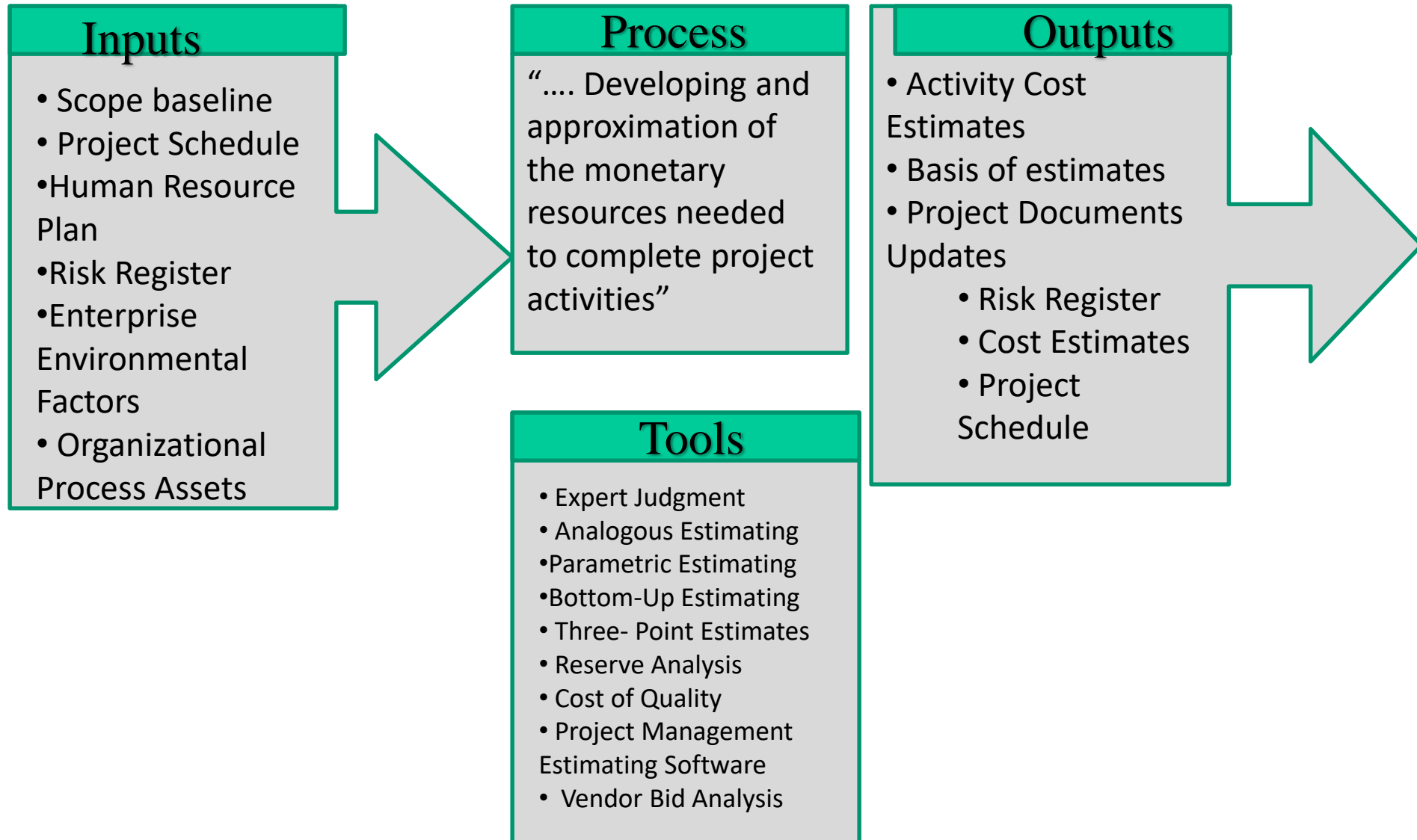
Types of Costs

- Variable
 - Changes with the amount of work (Materials)
- Fixed
 - Doesn't change as work changes (Set Up)
- Direct
 - Directly attributable to project. (Team Travel)
- Indirect
 - Incurred for the benefit of more than one project (Administrative Costs)

Depreciation

- Depreciation
 - Lost value overtime
- Straight Line Depreciation
 - Same amount of depreciation is taken each year.
- Accelerated Depreciation (Faster than Straight Line)
 - Double declining
 - Sum of the years digits.

Estimate Cost



Tools and Techniques Analogous Estimating (Top-Down)

- Based on the experience gained in the past similar projects, top managers, estimate the total project cost.
- A form of expert judgment
- Least accurate method
- Used when only limited information is available
- Requires deep expertise in the project application area.

Tools and Techniques Analogous Estimating (Bottom Up)

- People doing the work are preparing the estimates, based on the task/activity definition.
- More accurate when decomposition is done down to highly-detailed level
- Total estimate is made by rolling up the individual estimates
- Used when the team has detailed enough information about the project work.

Tools & Techniques Parametric Estimating

- Uses a mathematical model to predict project costs (e.g. cost per Linear meter, cost per unit installation)
- The complexity of mathematical models varies by domain
- Conditions to rely on parametric estimation
 - Historical info used to develop the model is accurate relevant.
 - Quantifiable parameters
 - Scalable model (works for small project, as well as for large ones)

Accuracy of Estimates

- Begins at ROM and progressively elaborated to control.
- Rough order of Magnitude (ROM)
 - -50% to +50%
 - Usually done during initiating phase or earlier
- Conceptual
- Preliminary
- Defective
 - Usually done after planning and before execution
- Control
 - -10% to +10%
 - Use if the work is well understood

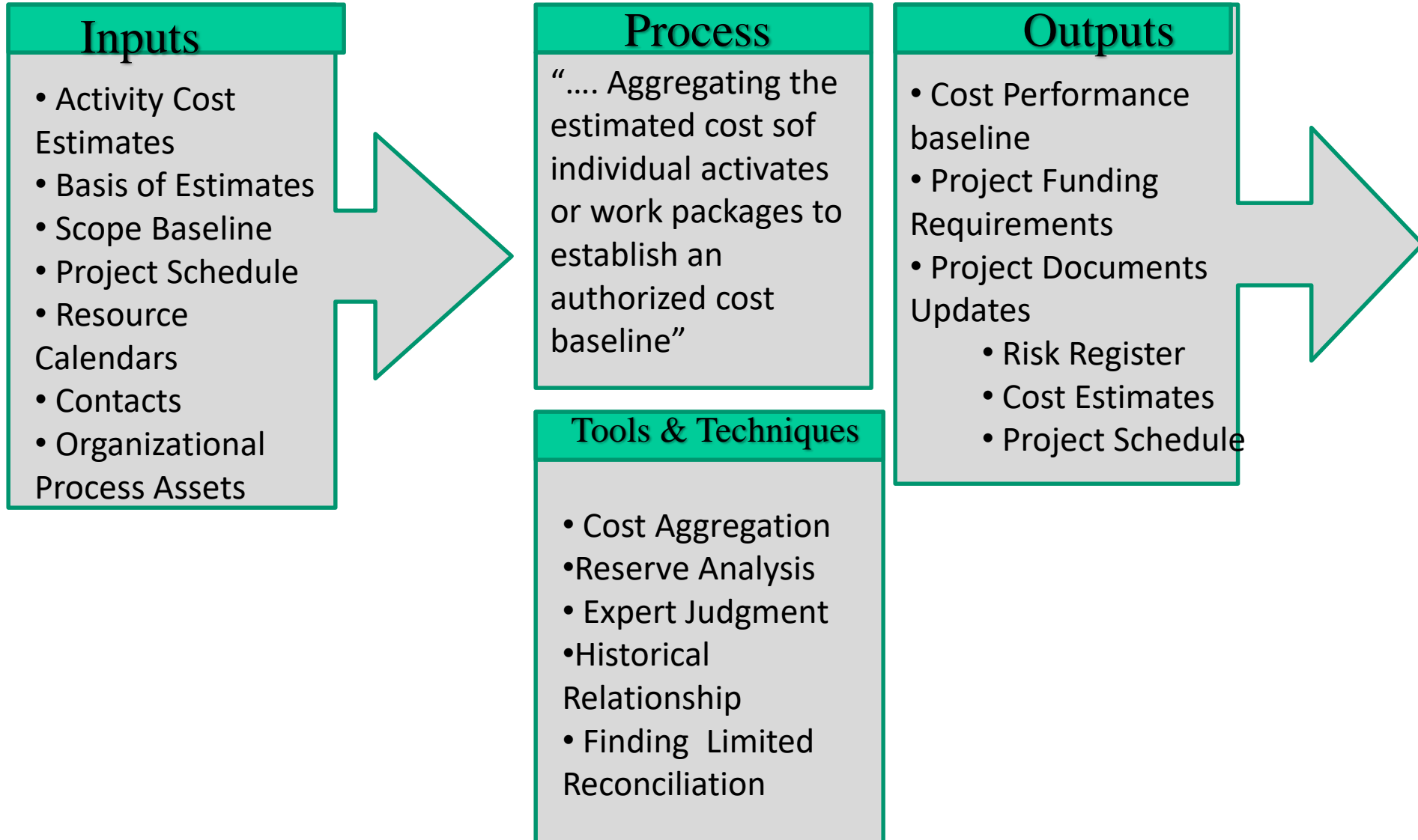
Output Activity Cost Estimates

- Expressed as amounts of monetary units
- Should include an indication of how accurate the estimation is.
- To contain all work items that require cost
- Better to have standard procedures and eliminates for activity costs Estimates.

Output bases of Estimates

- Details supporting the cost estimate.
- Provide a clear and complete understanding the hoe the cost estimate was derived.
 - Assumptions
 - How the estimate was developed
 - Confidence level of the final estimate

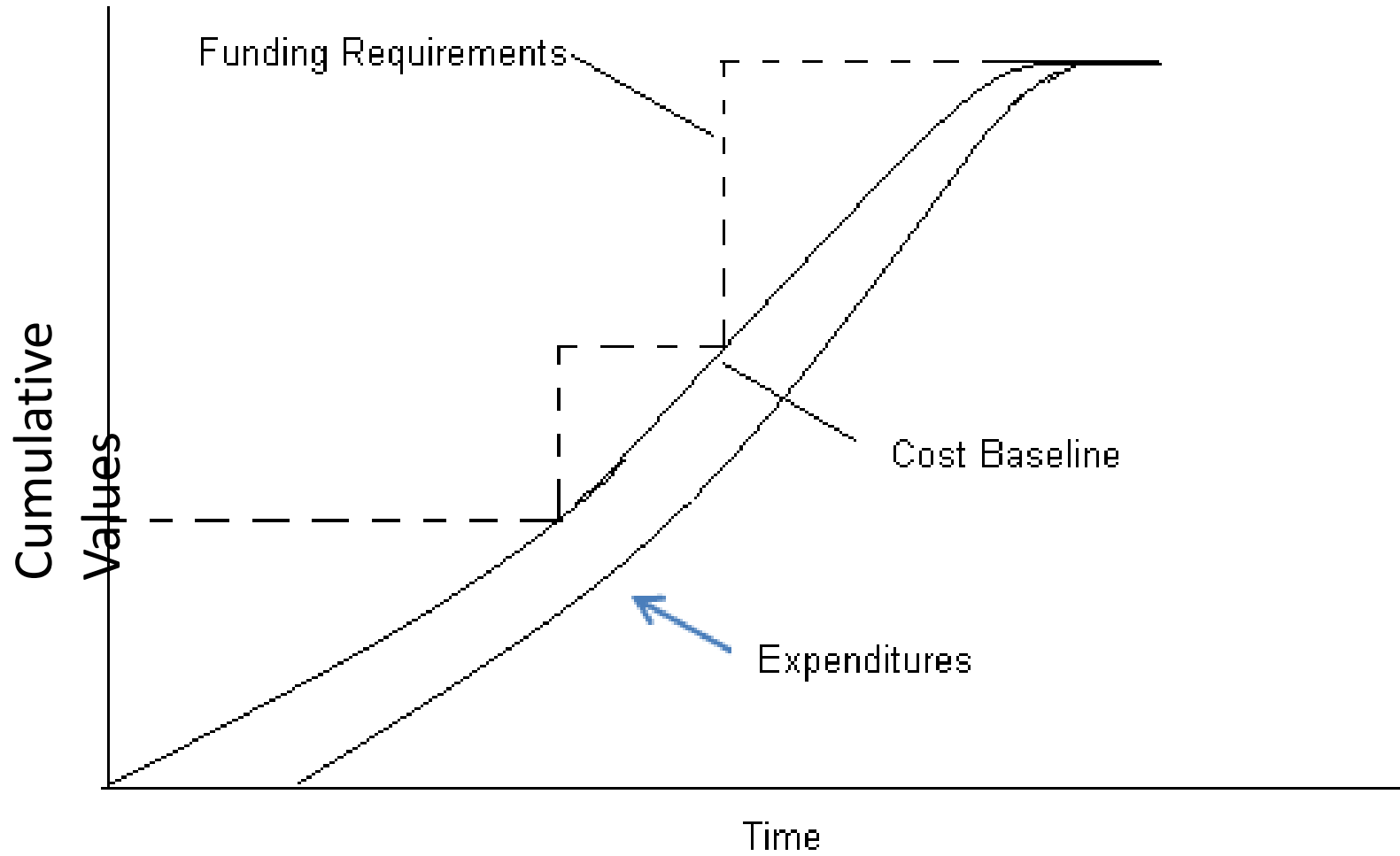
7.2 Determine Budget



Outputs

- Cost Performance Baseline
 - The project budget allocated by project phases
 - Summarization of the estimated cost by period
 - Usually display as an “ S-Curve”
- Project Funding Requirements
 - Derived from the Cost Baseline
 - Funding provided in incremental amounts (vs. Continuously)
 - Includes Cost Baseline plus any management reserves.

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	–25% to +75%
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 Management Plan

- 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.

Cost Estimation Tools & 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.
 - **Computerized tools:** Tools, such as spreadsheets and project management software, that can make working with different cost estimates and cost estimation tools easier.

Typical Problems with IT Cost Estimates

- Developing an estimate for a large software project is a complex task that requires a significant amount of effort.
- People who develop estimates often do not have much experience.
- Human beings are biased toward underestimation.
- Management might ask for an estimate, but really desire a bid to win a major contract or get internal funding.

Sample Cost Estimate

- Before creating an estimate, know what it will be used for, gather as much information about the project 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 change and document the estimate.

Surveyor Pro Project Cost Estimate

Surveyor Pro Project Cost Estimate Created October 5, 2006

	# 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, 2006

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 (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).

Cost Budgeting

- Cost budgeting involves allocating the project cost estimate to individual work items over time.
- The WBS is a required input for the cost budgeting process because 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.

Cost Control

- 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.

Earned Value Management (EVM)

- **EVM** is a project performance measurement technique that integrates scope, time, and cost data.
- Given a **baseline** (original plan plus approved changes), you can determine how well the project is meeting its goals.
- You must enter actual information periodically to use EVM.
- More and more organizations around the world are using EVM to help control project costs.

Earned Value Management Terms

- The **planned value (PV)**, formerly called the budgeted cost of work scheduled (BCWS), also called the budget, is that portion of the approved total cost estimate planned to be spent on an activity during a given period.
- **Actual cost (AC)**, formerly called actual cost of work performed (ACWP), is the total of direct and indirect costs incurred in accomplishing work on an activity during a given period.
- The **earned value (EV)**, formerly called the budgeted cost of work performed (BCWP), is an estimate of the value of the physical work actually completed.
- 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.

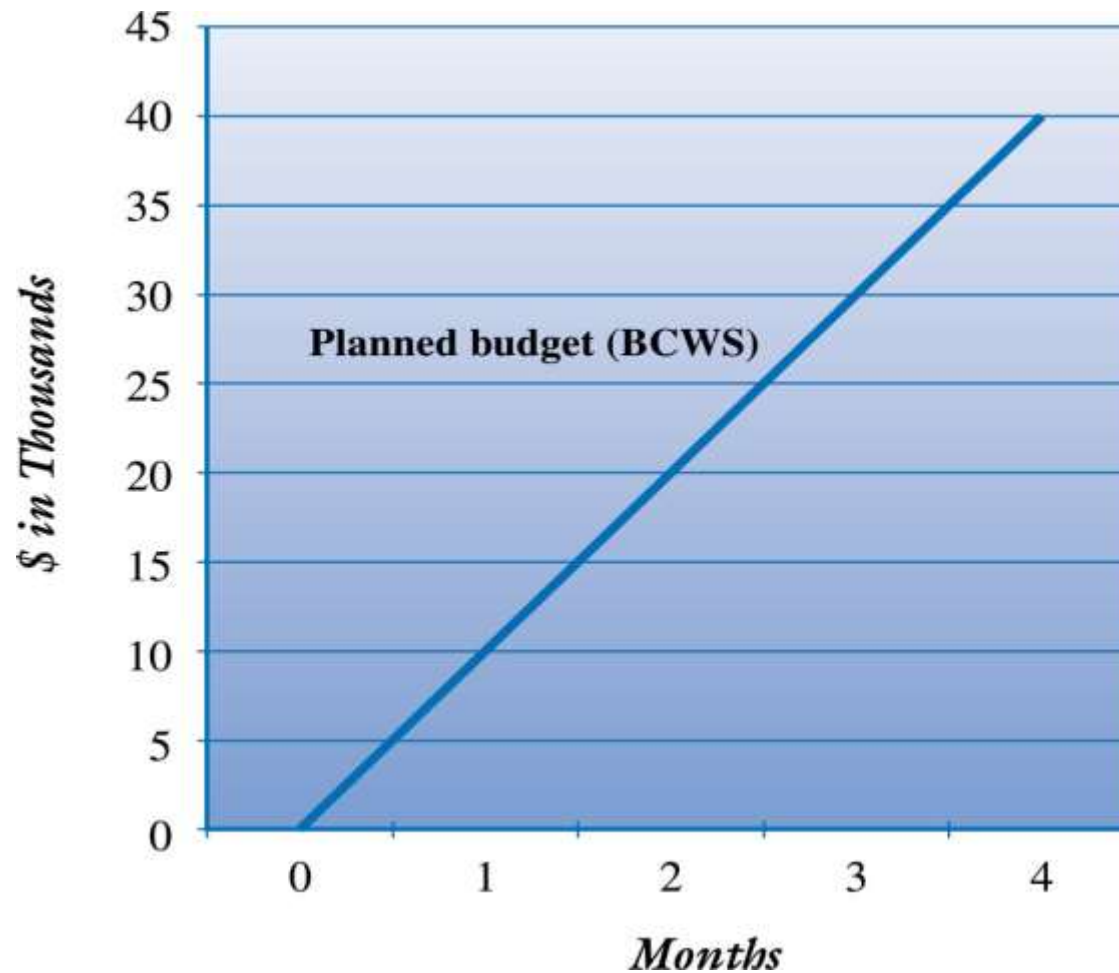
Rate of Performance

- **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.
- For example, suppose the server installation was halfway completed by the end of week 1. The rate of performance would be 50 percent ($50/100$) 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

- Suppose you just signed a contract with a consulting firm namely “Dewey” for developing an IS.
- Project Budget, Schedule, Tasks
 - \$40,000
 - 4 months
 - 20 Tasks (evenly divided over 4 months)
 - \$2,000 per task
 - 5 tasks per month
 - Therefore , you plan to pay \$10,000/month. This is called budgeted cost of work scheduled (BCWS).

Planned Budget-Budgeted Cost of Work Scheduled (BCWS)



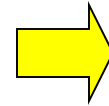
Invoice

End of Month 1

“Dewey”

Amount Due: \$8,000

Payment due immediately!



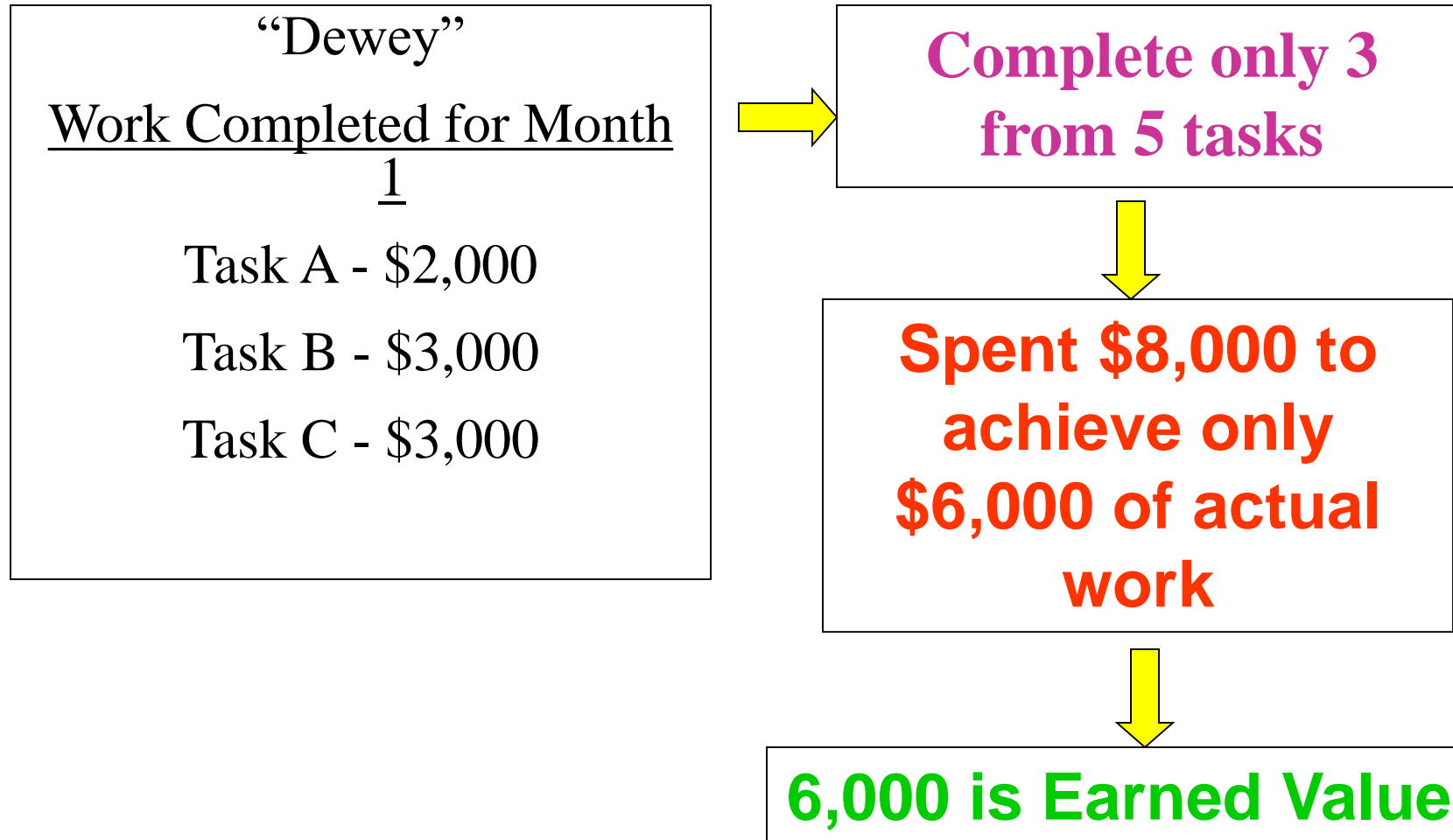
**Actual Cost of
Work
Performances
(ACWP)**

BCWS Versus ACWP

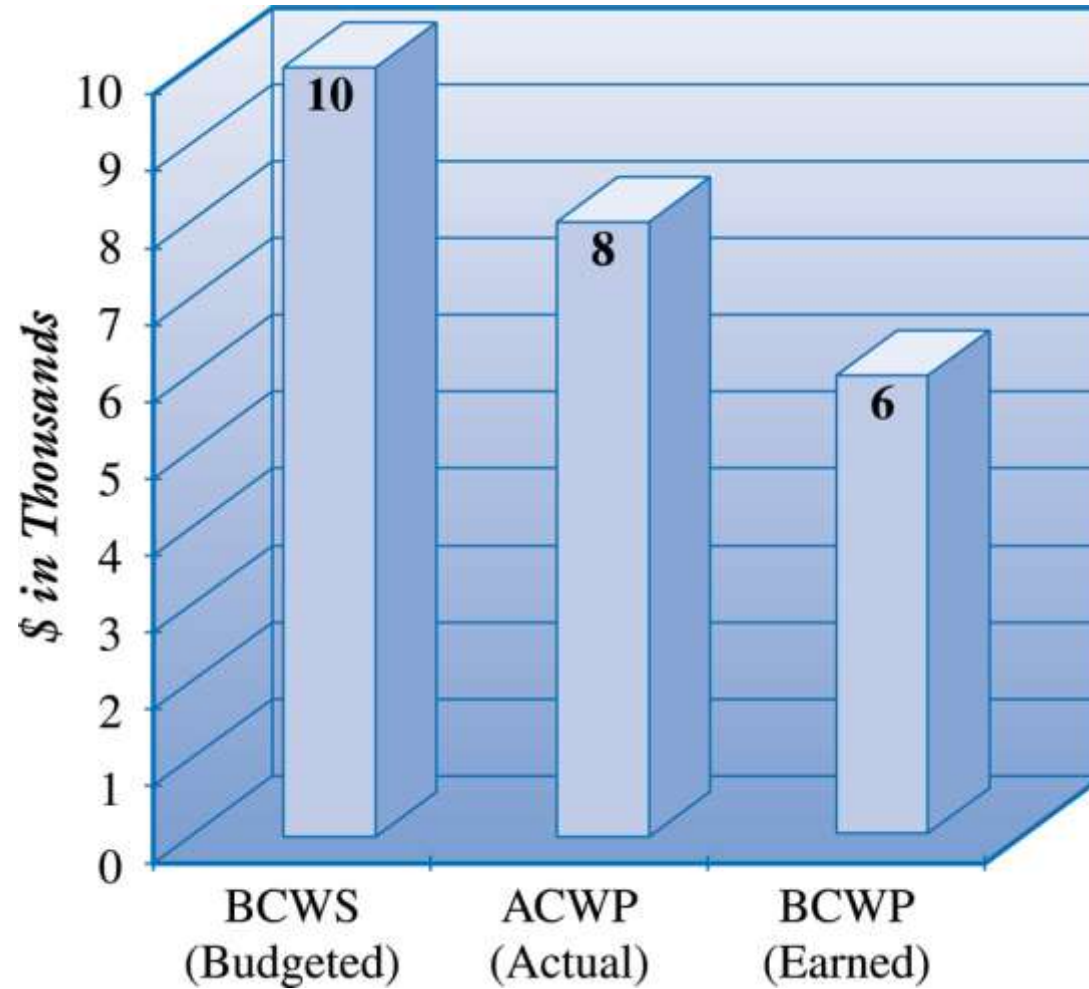


**Is your project
ahead of budget
\$2,000 ?**

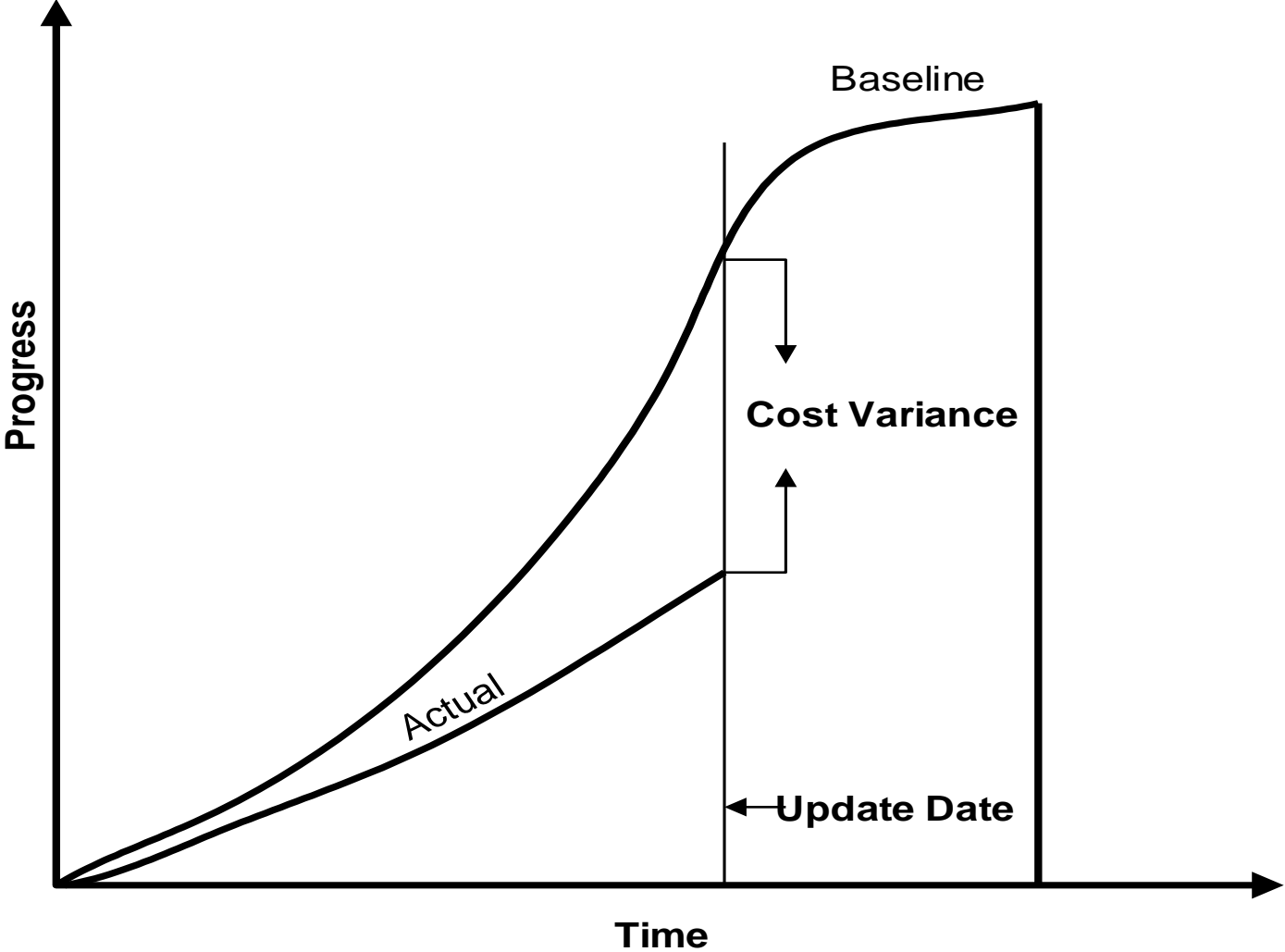
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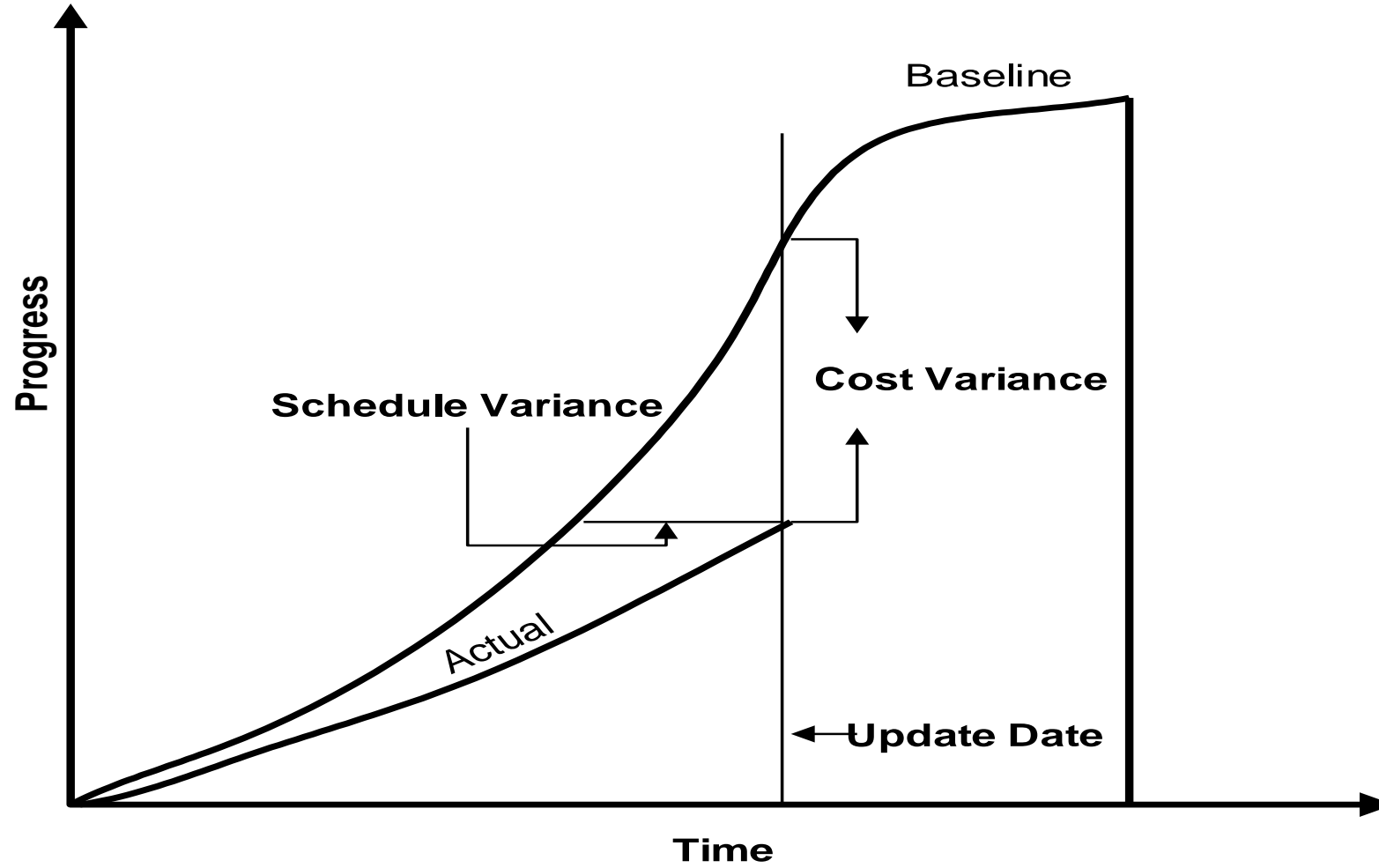
Comparison of BCWS, ACWP, and Budgeted Cost of Work Performed (BCWP)



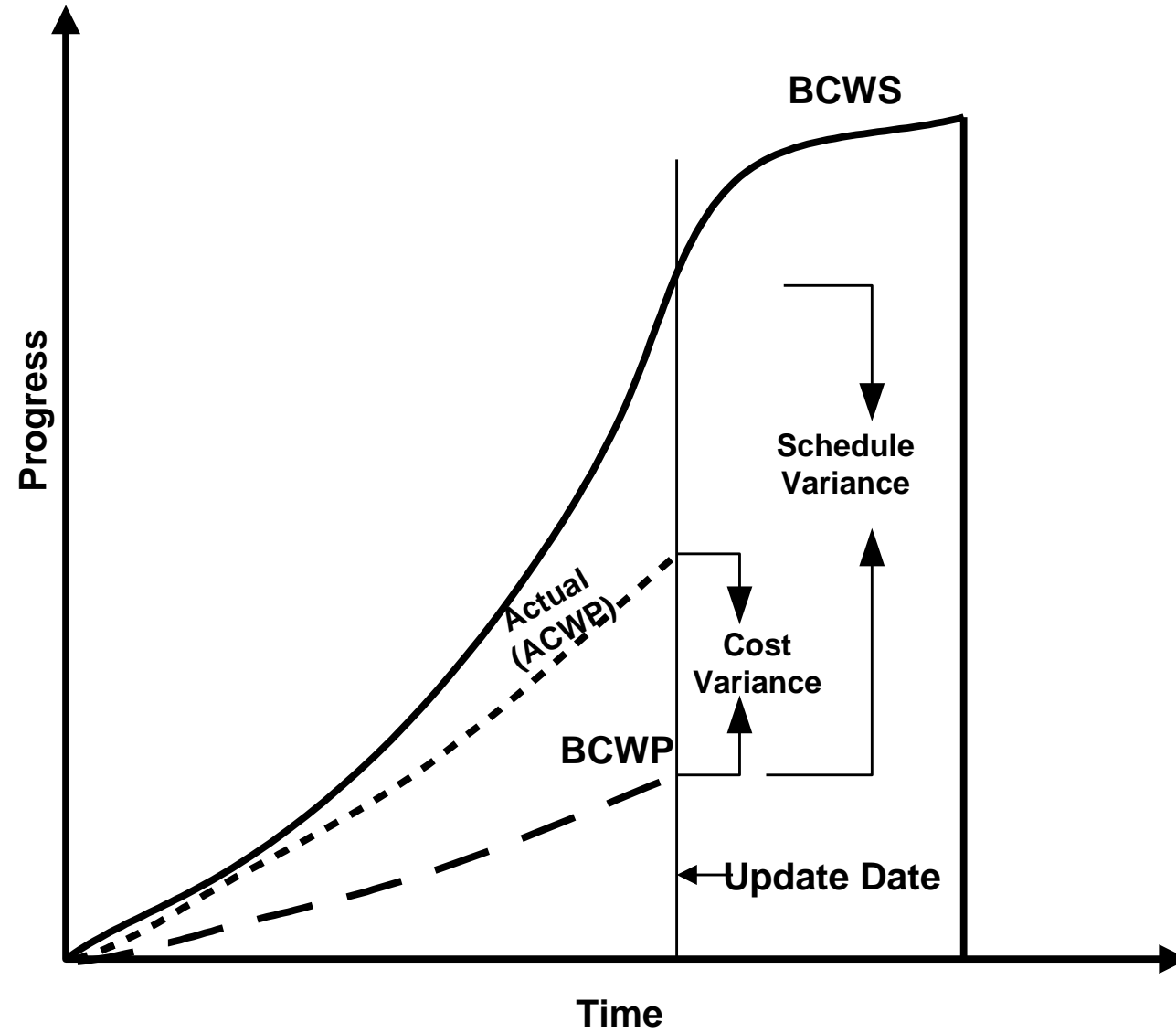
Cost Variance



Schedule Variance



The Full Story



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)	-7,500
Schedule Variance (SV)	-2,500
Cost Performance Index (CPI)	50%
Schedule Performance Index (SPI)	75%

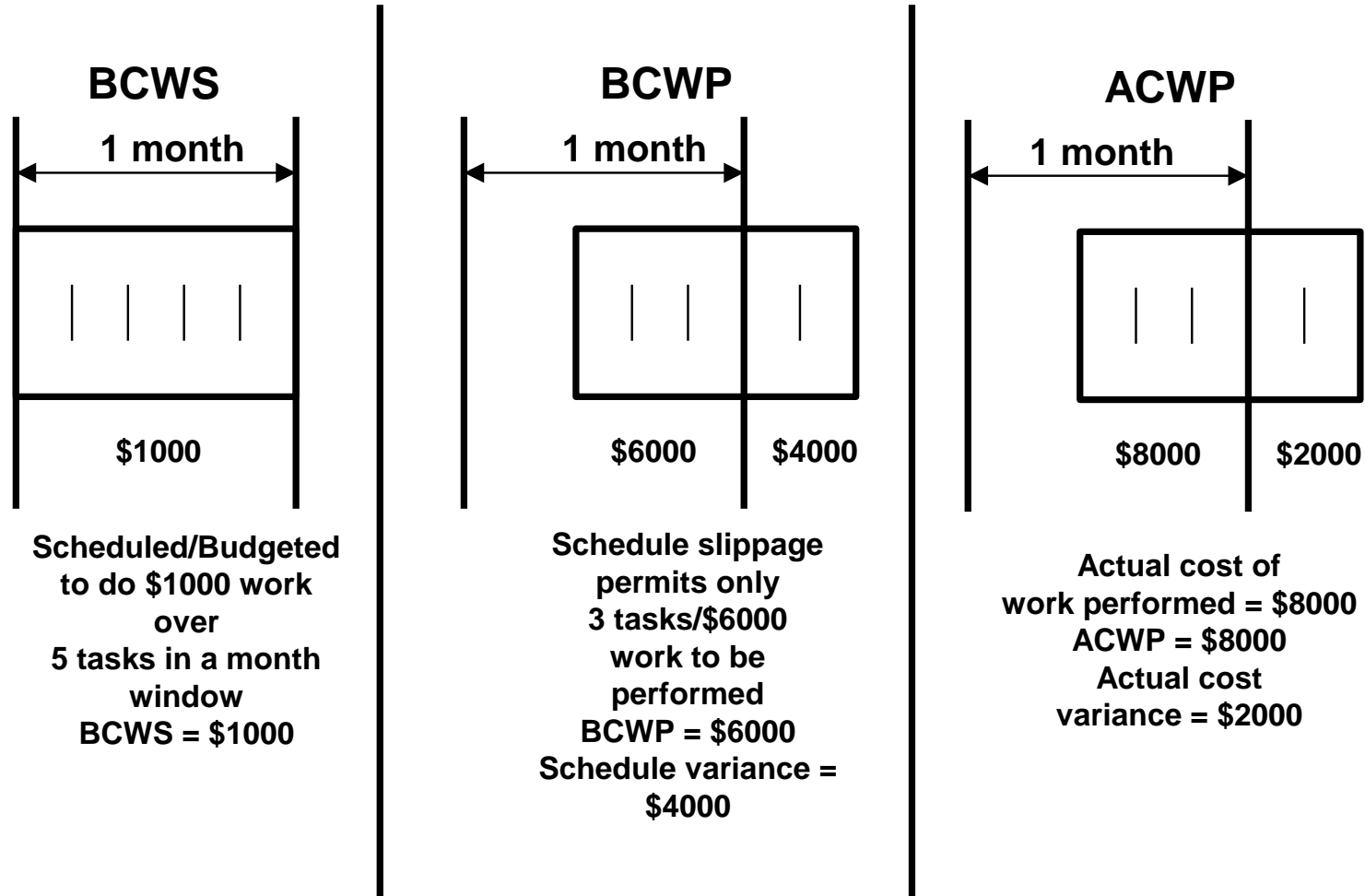
Earned Value Formulas

TERM	FORMULA
Earned Value	$EV = PV \text{ to date} \times RP$
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

Definitions

- Budgeted Cost of Work Scheduled (BCWS)
 - Planned expenditure cash flows based on the completion of tasks in accordance with the project's budget and schedule
- Actual Cost of Work Performed (ACWP)
 - Actual Project Expense based on completed tasks
- Earned Value or Budgeted Cost of Work Performed (BCWP)
 - The amount of the budget that we should have spent for a given amount of work completed

Cost/Performance Indicators



Earned Value Example

- Retailer is replacing 5 kiosk check-out scanners per week for 24 week across its stores
 - Project costs estimated to be \$2,500 per check-out scanner
 - What is the Budget At completion?
 - Use the information provided to calculate the BAC.
- Sometimes BAC will be given to you.

Earned Value Example

- Project costs estimated to be \$2,500 per check-out scanner
- What is the Budget At Completion?
- Retailer is replacing 5 kiosks check-out scanner per week for 24 weeks across its stores
 - Project duration=24 weeks
 - Weekly cost=\$2,500 per kiosk*5 kiosks=\$12,500
 - BAC=24weeks*\$12,500 per week
 - BAC=\$300,000

Earned Value Example

- Retailer is replacing 5 kiosks check-out scanner per week for 24 weeks across its stores
- Project costs estimated to be \$2,500 per check-out scanner
- BAC=\$300,000
- After 4 weeks work, the kiosks check-out scanners cost an average of \$3,000 to replace
- 22 scanner have been replaced

Earned Value -Answer

	Calculation	Answer	Interpretation
PVc	$4/24 * \$300,000$ or $4 * 5 * \$2,500$	50,000	We should have done \$50,000 worth of work
EVc	$22/120 * \$300,000$ or $22 * \$2,500$	55,000	We have actually completed \$55,000 worth of work
ACc	$22 * \$3,000$	66,000	We spent \$66,000
BAC	$24 \text{ weeks} * \$12,500$	3000,000	Budget is \$ 300,000
CVc	$55,000 - 66,000$ EV-AC	-11,000	Over budget by \$11,000

Earned Value -Answers

	Calculation	Answer	Interpretation
CPI	$55,000/66,000$ EV/AC	0.8333	We are getting 83 cents out of every dollar invested
SV	$55,000-50,000$ CV-PV	5,000	We are ahead of schedule
SPI	$55,000-50,000$ EV/PV	1.10	We are progressing at 110% of the planned rate
EAC	$300,000-0.8333$ BAC/CPIc	360,000	We estimated the total project cost will be \$360,000
ETC	$360,000/66,000$ EAC-AC	294,000	We need to spend \$294,000 to finish the project
VAC	$3000,000-360,000$ EAC-EAC	-60,000	\$60,000 over budget when the project will be completed

Earned Value -Answer

	Calculation	Answer	Interpretation
TCPI (Based on meeting the total original budget of \$300,000)	$\frac{(300,000-55,000)}{(300,000-66,000)}$ $(BAC-EV)/(BAC-AC)$	1.05	We must achieve this cost performance to complete work on budget (BAC)
TPCI (Based not meeting the total original budget and receiving approval on a revised forecasted estimated (EAC) of \$360,000)	$\frac{(300,000-55,000)}{(360,000-66,000)}$ $(BAC-EV)/(EAC-AC)$	0.8333	With a revised approved forecasted estimated (EAC) of %360,000 we must achieved this cost performance to complete the remaining work based on the revised EAC

Earned Value Summary

- CV and SV should be ≥ 0
- CPI and SPI should be ≥ 1

Code of Ethics and Professional Conduct

- Errors or omission
 - Take ownership and accountability, make correction promptly
 - Communicate those caused by others to the appropriate body as soon as they are discovered
- Provide equal access to information to those who are authorized to have that information
- Earnestly seek to understand the truth
- Be truthful in our communication and in our conduct
- Provide accurate information in a timely manner