

Project Management

Estimating Project Times and Costs

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Factors influencing the quality of estimates

- **Planning horizon**—Accuracy of time and cost estimates will improve as you move from the conceptual phase to the work package definition phase
- **Project duration**—Given time, anything can happen.
- **People**—Skills of the team/people; availability; turnover; loss of a key player;
- **Project structure and organization**—advantages and disadvantages of team formation and organizational structure...
- **Padding estimates**—Adds to the estimate making it virtually worthless; a game played between team and management.
- **Organization culture**—Organization culture shapes every dimension of project management—including estimating. Is estimating worth it? Worthless? Padding ignored? Accuracy encouraged/rewarded?
- **Other Factors:** Equipment downtime; National holidays; vacations; legal limits; Project priority changes

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Estimating Project Times and Costs

- Macro approaches for estimating project times and costs
 - Ratio Method (Parametric)
 - Apportion Method
 - Function Point Method
 - Learning Curve

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Estimating Project Times and Costs

- Ratio Methods (Parametrics)
 - ❖ Concept phase
 - ❖ Compares to known values
- Example:
 - Square footage of retail space
 - Capacity
 - Features

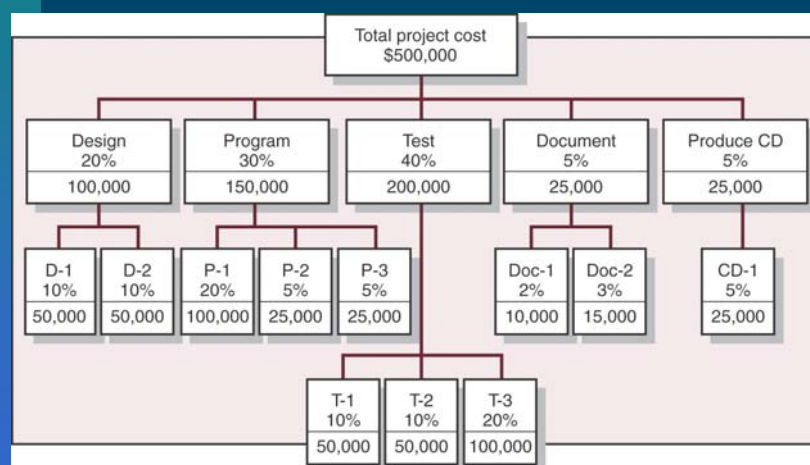
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Estimating Project Times and Costs— Apportion Method

- Apportion Method
 - ❖ Comparison to previous projects
 - ❖ Similar projects but with small variations
- Example: Progress payments based on percentage completed of a contract.

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Estimating Project Times and Costs—Apportion Method



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Estimating Project Times and Costs

- Function Point Method
 - ❖ Based on major function points/milestones of a project.
 - ❖ Weighted variables that are then adjusted to provide an estimate.
 - ❖ Regression Analysis based on past historical data

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Estimating Project Times and Costs

- Learning Curves
 - ❖ Skill on task improves with practice

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Estimating project times and costs:

- Disadvantage of Macro Estimating:
 - Time and cost for a specific task are not considered.
 - Errors of omission
 - Imposed time/costs restrict the project

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Micro approaches for estimating project times and costs

- Template Method
- Parametric Procedures
- Detailed Estimates for WBS
- Hybrid

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Template Method

- If similar, costs can be used from a past project, differences adjusted and costs adjusted to new values
 - Work Package of Proj. A cost \$100. Inflation @10%;
 - Work Package of Proj. B estimated now @\$110

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Parametric Procedures Applied to Specific Tasks

- ❖ Mathematical calculated estimate based on an example/prototype

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Detailed Estimates for the WBS Work Packages

- Probably the most reliable
- Ask the people who actually do the work!!! (
- PERT Analysis, based on Optimistic, Most likely, Pessimistic time/costs

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Hybrid: Phase Estimating

- Used when an unusual amount of uncertainty exists
- Begins with a Macro estimate then refines toward Micro
- Detailed estimate may be done for preliminary work, a less detailed estimate for subsequent Work Packages/deliverables
- Good for projects where the final product is not known and uncertainty is great.
- Advantage to the customer: opportunity to change features, reevaluate or cancel the project (Kill Point)

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Phase Estimating Template

Phase	Need 1	Specifications 2	Design 3	Produce 4	Deliver 5
1		Macro estimate			
2		Detailed estimate	Macro estimate		
3			Detailed estimate	Macro estimate	
4				Detailed estimate	Macro estimate
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Level of Detail

- Detail should be no more than is necessary and sufficient.
- Top management: Major accomplishments
- Middle Management: Milestones;
- First-Line managers: task or work package

Excessive detail means more unproductive paperwork
Project managers need to find the balance between too much and too little detail. Know your stakeholders!!!

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Estimating guidelines for times, costs, and resources

- Poor estimates are a major contributor to projects that have failed

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Seven Guidelines to developing useful work package estimates:

- **Responsibility**—should be made by the person most familiar with the task.
- **Use several people to estimate**—Delphi technique
- **Normal condition**—based on normal conditions, efficient methods and a normal level of resources. and modified as necessary.
- **Time units.**—all task time estimates need consistent time units.
- **Independence**—Each task time estimate should be considered independently of other activities.
- **Contingencies**—Work package estimates should NOT include allowances for contingencies. Creation of a separate contingency/buffer cost package is indicated
- **Risk Assessment**—avoids surprises
 - consider alternative methods, alter procedures, and change decisions.

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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

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Cost Control

- Inputs:
 - Cost baseline
 - Performance reports
 - Cost management plan
- Outputs:
 - Revised cost estimates
 - Budget updates
 - Corrective Action
 - Revised estimates for project completion
 - Lessons Learned

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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 the project is meeting its goals
- Sometimes called “*Earned Value Analysis—“EVA”*”—Not to be confused with:
 - EVA-Economic Value Added
 - EVA-Extra Vehicular Activity

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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 the percentage of work actually completed multiplied by the planned value

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Earned Value Calculations for One Activity After Week One

ACTIVITY	WEEK 1	WEEK 2	TOTAL	% COMPLETE AFTER WEEK 1	EARNED VALUE AFTER WEEK 1 (EV)
Purchase Web server	10,000	0	10,000	75%	7,500
Planned Value (PV)	10,000	0	10,000		
Actual Cost (AC)	15,000	5,000	20,000		
Cost Variance (CV)	-7,500				
Schedule Variance (SV)	-2,500				
Cost Performance Index (CPI)	50%				
Schedule Performance Index (SPI)	75%				

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Table 6-7. Earned Value Formulas

TERM	FORMULA
Earned Value	$EV = PV \text{ to date} \times \text{percent complete}$
Cost Variance	$CV = EV - AC$
Schedule Variance	$SV = EV - PV$
Cost Performance Index	$CPI = EV/AC$
Schedule Performance Index	$SPI = EV/PV$

To estimate what it will cost to complete a project or how long it will take based on performance to date, divide the budgeted cost or time by the appropriate index.

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Rules of Thumb for EVA Numbers

- **Negative numbers** for cost and schedule variance indicate **problems** in those areas. The project is costing more than planned or taking longer than planned
- **CPI and SPI less than 100%** indicate **problems**

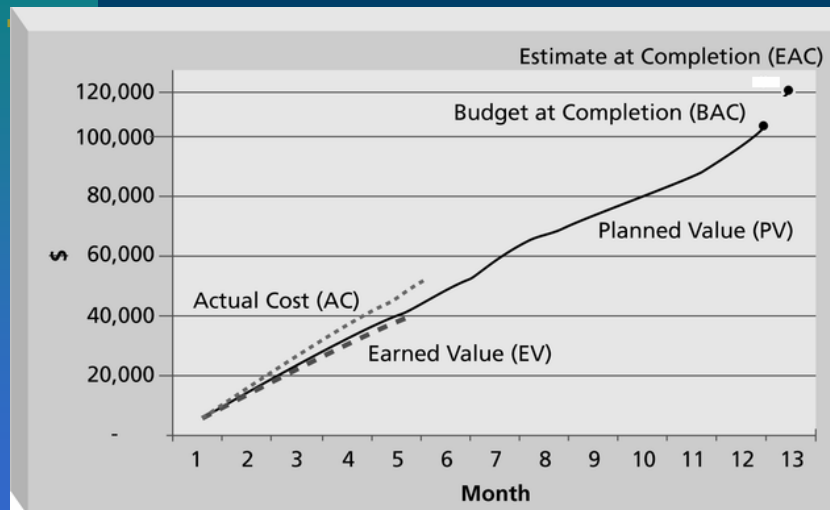
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Earned Value Calculations for a One-Year Project After Five Months

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	PV	% Complete	EV	
Plan and staff project	4,000	4,000											8,000	100	8,000	
Analyze requirements		6,000	6,000										12,000	100	12,000	
Develop ERDs			4,000	4,000									8,000	100	8,000	
Design database tables				6,000	4,000								10,000	100	10,000	
Design forms, reports, and queries					8,000	4,000							12,000	50	6,000	
Construct working prototype						10,000							10,000	-	-	
Test/evaluate prototype						2,000	6,000						8,000	-	-	
Incorporate user feedback							4,000	6,000	4,000				14,000	-	-	
Test system									4,000	4,000	2,000		10,000	-	-	
Document system											3,000	1,000	4,000	-	-	
Train users												4,000	4,000	-	-	
Monthly Planned Value (PV)	4,000	10,000	10,000	10,000	12,000	16,000	10,000	6,000	8,000	4,000	5,000	5,000	100,000		44,000	
Cumulative Planned Value (PV)	4,000	14,000	24,000	34,000	46,000	62,000	72,000	78,000	86,000	90,000	95,000	100,000				
Monthly Actual Cost (AC)	4,000	11,000	11,000	12,000	15,000											
Cumulative Actual Cost (AC)	4,000	15,000	26,000	38,000	53,000											
Monthly Earned Value (EV)	4,000	10,000	10,000	10,000	10,000											
Cumulative Earned Value (EV)	4,000	14,000	24,000	34,000	44,000											
Project EV as of May 31		44,000														
Project PV as of May 31		46,000														
Project AC as of May 31		\$ 53,000														
CV=EV-AC		\$ (9,000)														
SV=EV-PV		\$ (2,000)														
CPI=EV/AC		83%														
SPI=EV/PV		96%														
Estimate at Completion (EAC)		\$120,455	(original plan of \$100,000 divided by CPI of 83%)													
Estimated time to complete		12.55	(original plan of 12 months divided by SPI of 96%)													

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Earned Value Chart for Project After Five Months



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