

Estimating Project Times and Costs

Estimating Projects

- Estimating

- The process of forecasting or approximating the time and cost of completing project deliverables.
- The task of balancing the expectations of stakeholders and the need for control while the project is implemented

- Types of Estimates

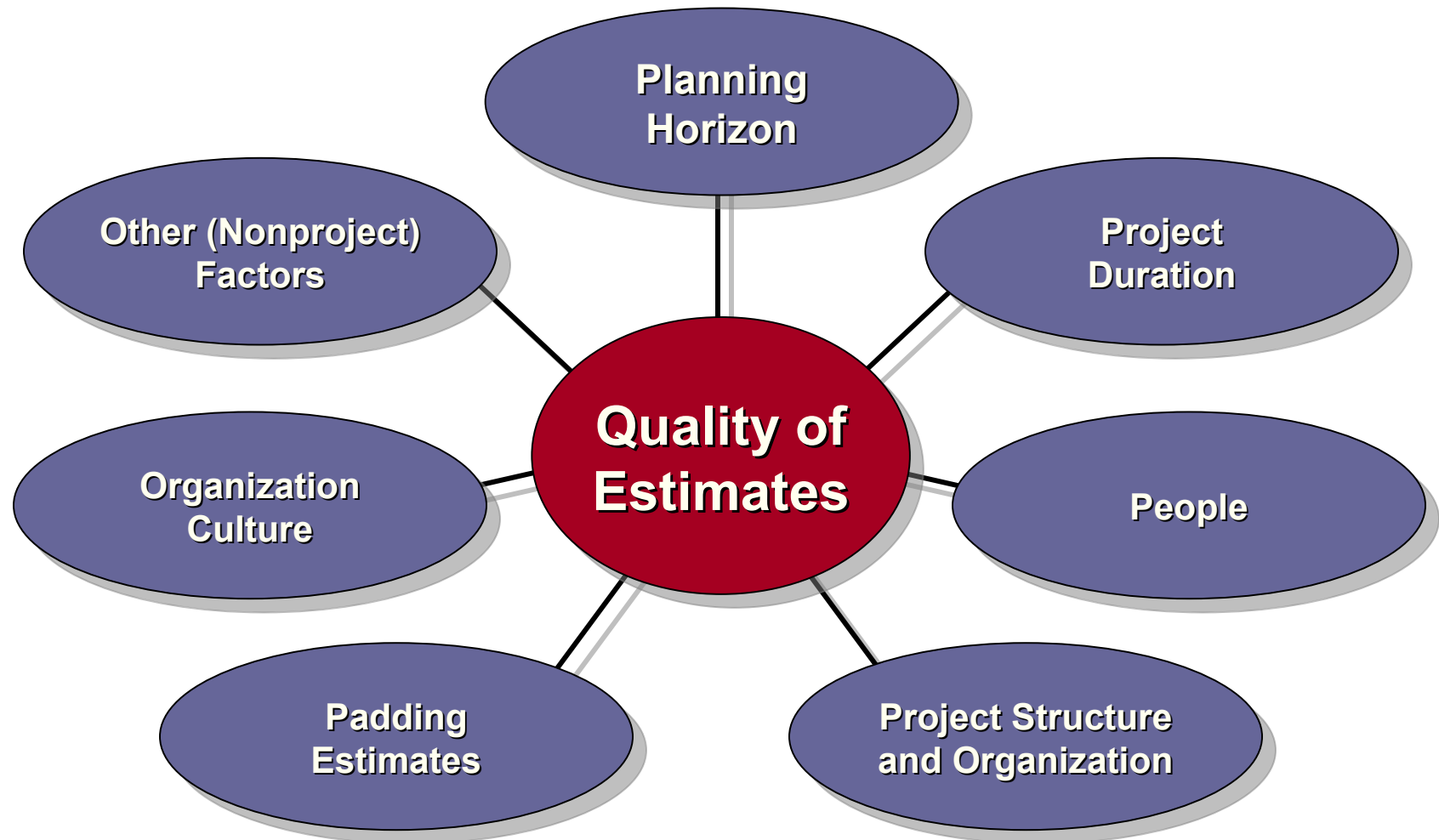
- Top-down (macro) estimates: analogy, group consensus, or mathematical relationships
- Bottom-up (micro) estimates: estimates of elements of the work breakdown structure

Why Estimating Time and Cost Are Important... A Short List 😊

- Estimates are needed to support good decisions.
- Estimates are needed to schedule work.
- Estimates are needed to determine how long the project should take and its cost.
- Estimates are needed to determine whether the project is worth doing.
- Estimates are needed to develop cash flow needs.
- Estimates are needed to determine how well the project is progressing.
- Estimates are needed to develop time-phased budgets and establish the project baseline.

EXHIBIT 5.1

Factors Influencing the Quality of Estimates



Estimating Guidelines for Times, Costs, and Resources

1. Have people familiar with the tasks make the estimate.
2. Use several people to make estimates.
3. Base estimates on normal conditions, efficient methods, and a normal level of resources.
4. Use consistent time units in estimating task times.
5. Treat each task as independent, don't aggregate.
6. Don't make allowances for contingencies.
7. Adding a risk assessment helps avoid surprises to stakeholders.

Macro versus Micro Estimating

Conditions for Preferring Top-Down or Bottom-up Time and Cost Estimates

Condition	Macro Estimates	Micro Estimates
Strategic decision making	X	
Cost and time important		X
High uncertainty	X	
Internal, small project	X	
Fixed-price contract		X
Customer wants details		X
Unstable scope	X	

TABLE 5.1

Estimating Projects: Preferred Approach

- Make rough top-down estimates.
- Develop the WBS/OBS.
- Make bottom-up estimates.
- Develop schedules and budgets.
- Reconcile differences between top-down and bottom-up estimates

Methods for Estimating Project Times and Costs

- Macro (Top-down) Approaches
 - Consensus methods
 - Ratio methods
 - Apportion method
 - Function point methods for software and system projects
 - Learning curves



Apportion Method of Allocating Project Costs Using a (High Level) Work Breakdown Structure

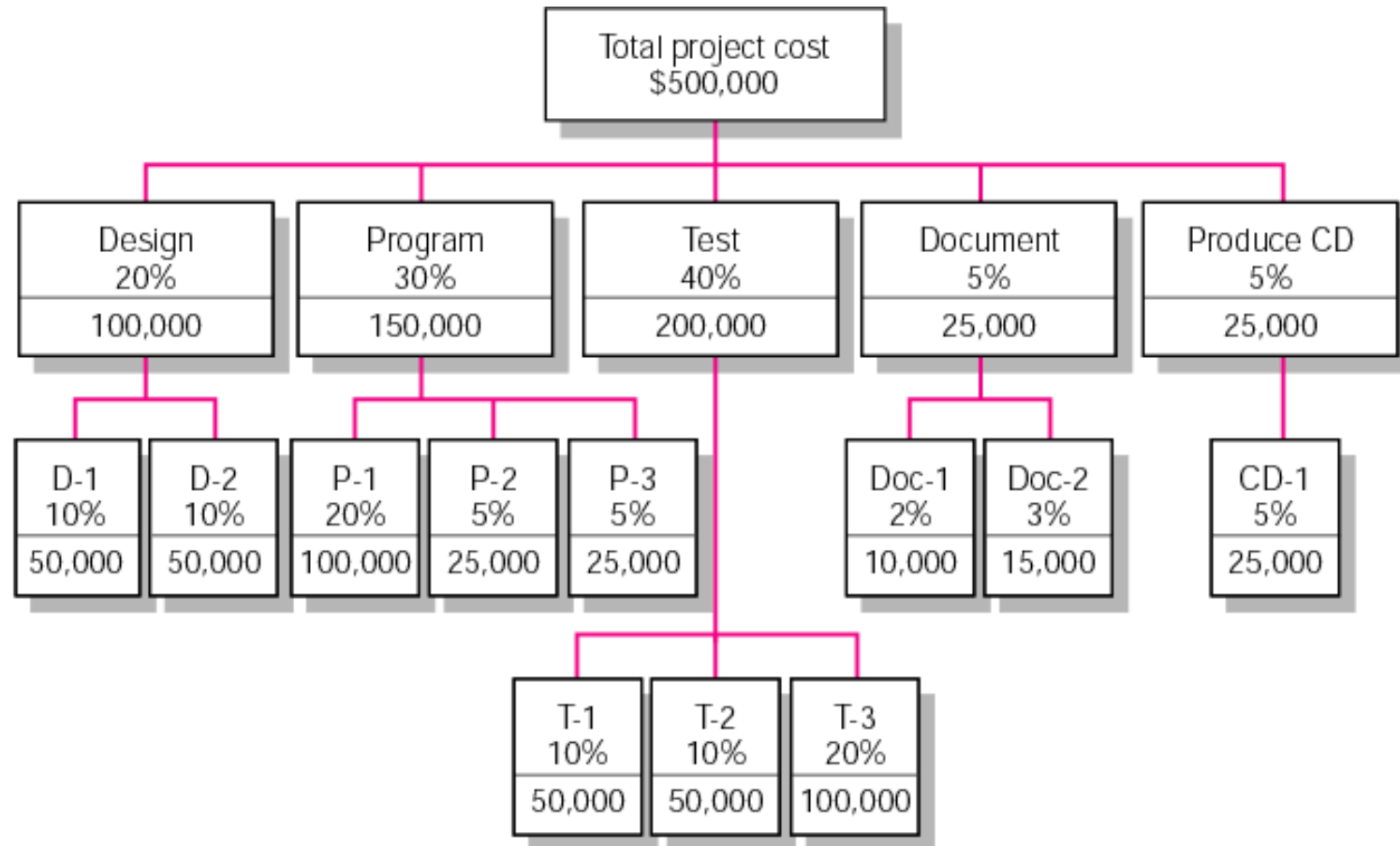


FIGURE 5.1

Simplified Basic Function Point Count Process for a Prospective Project or Deliverable: Example

Element	Complexity Weighting			Total
	Low	Average	High	
Number of <i>inputs</i>	_____ × 2 +	_____ × 3 +	_____ × 4	= _____
Number of <i>outputs</i>	_____ × 3 +	_____ × 6 +	_____ × 9	= _____
Number of <i>inquiries</i>	_____ × 2 +	_____ × 4 +	_____ × 6	= _____
Number of <i>files</i>	_____ × 5 +	_____ × 8 +	_____ × 12	= _____
Number of <i>interfaces</i>	_____ × 5 +	_____ × 10 +	_____ × 15	= _____

To pick nits: In this approach we are looking at durations, not costs (Which is dangerous before we take the considerations of Ch 6)

TABLE 5.2

Example: Function Point Count Method

Software Project 13: Patient Admitting and Billing

15	Inputs	Rated complexity as low	(2)
5	Outputs	Rated complexity as average	(6)
10	Inquiries	Rated complexity as average	(4)
30	Files	Rated complexity as high	(12)
20	Interfaces	Rated complexity as average	(10)

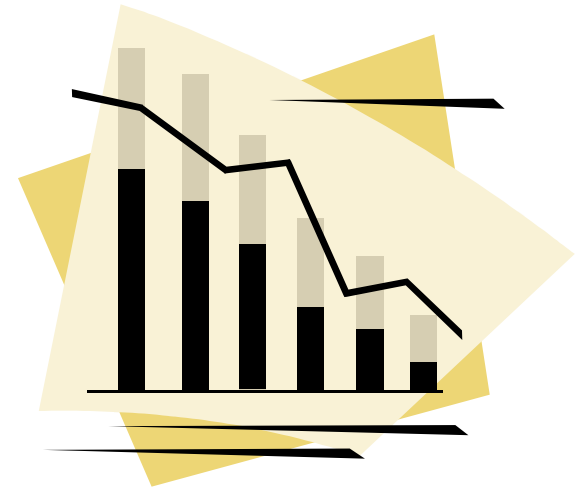
Application of Complexity Factor

Element	Count	Low	Average	High	Total
Inputs	15	× 2			= 30
Outputs	5		× 6		= 30
Inquiries	10		× 4		= 40
Files	30			× 12	= 360
Interfaces	20		× 10		= 200
				Total	<u>660</u>

TABLE 5.3

Methods for Estimating Project Times and Costs (cont'd)

- Micro (Bottom-up) Approaches
 - Template method
 - Parametric Procedures Applied to Specific Tasks
 - Detailed Estimates for the WBS Work Packages
 - Phase Estimating: A Hybrid



Example: Support Cost Estimate Worksheet- (about as detailed as it gets!)

- Poll several different people (not all together, preferably anonymously), take the average of their estimates.
- Ratio = (Avg. Long – Avg. Short)/Avg.Med
- Later: this s-m-l estimate will provide a basis for assessing risk (Ch7)

WBS ID Description	Person 1			Person 2			Person 3			avg short	avg.med	avg,long	Ratio
	short	med	long	short	med	long	short	med	long				
102 Engineering	95	100	105	97	100	103	93	96	100	95.0	98.7	102.7	8%
103 PM	14	15	17	14	16	18	13	14	15	13.7	15.0	16.7	20%
104 R/W Property Acc	44	48	52	45	50	52	43	46	49	44.0	48.0	51.0	15%
105 Base maps	36	38	40	36	37	39	35	36	37	35.7	37.0	38.7	8%
106 Coordinate Utils	7	8	9	7	8	9	8	9	10	7.3	8.3	9.3	24%
107 EPA Accept	13	14	15	14	15	16	13	15	17	13.3	14.7	16.0	18%
108 Alignment Surveys	32	35	38	32	35	37	32	34	35	32.0	34.7	36.7	13%
subtotal	241	258	276	245	261	274	237	250	263	241	256.3	271	

Based on FIGURE 5.2

Phase Estimating over Product Life Cycle

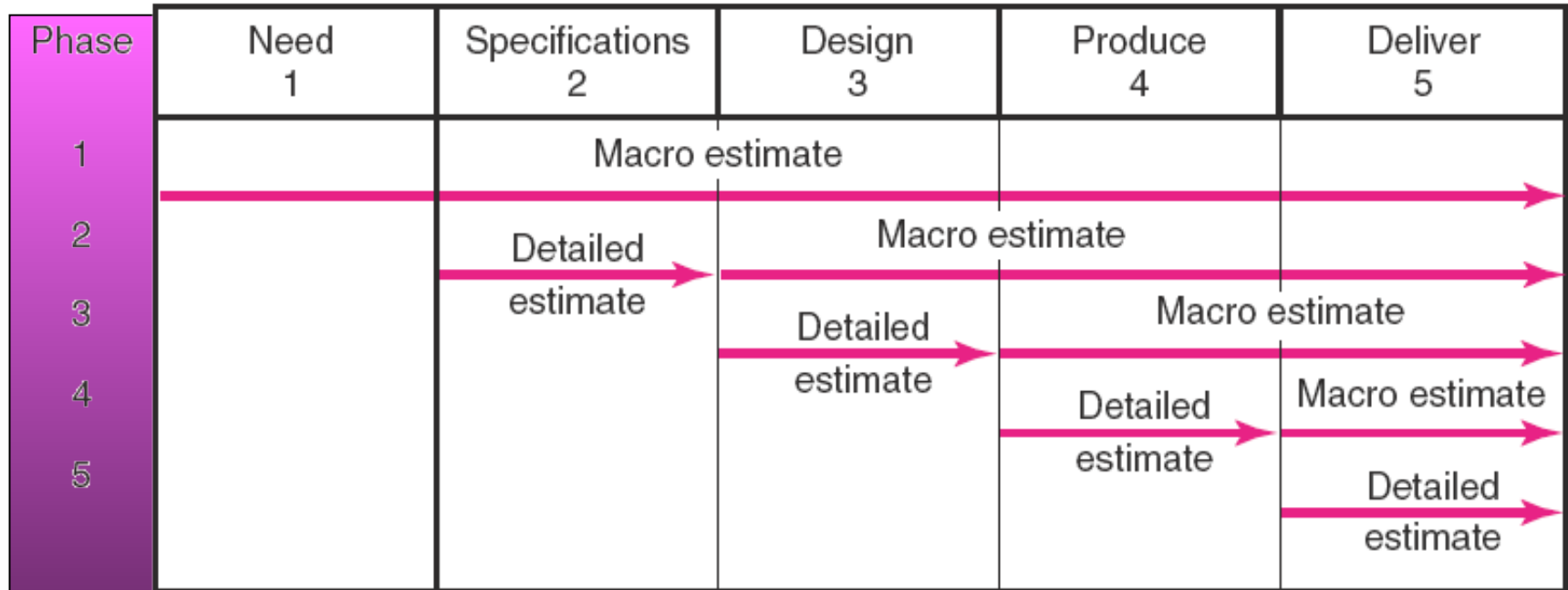


FIGURE 5.3

Level of Detail

- Level of detail is different for different levels of management.
- Level of detail in the WBS varies with the complexity of the project.
- Excessive detail is costly.
 - Fosters a focus on departmental outcomes
 - Creates unproductive paperwork
- Insufficient detail is costly.
 - Lack of focus on goals
 - Wasted effort on nonessential activities

Developing Budgets

- Time-Phased Budgets

- A cost estimate is not a budget unless it is time-phased.

- Time phasing begins with the time estimate for a project.
 - Time-phased budgets mirror how the project's cash needs (costs) will occur or when cash flows from the project can be expected.
 - Budget variances occur when actual and forecast events do not coincide.

Three Views of Cost Accrual

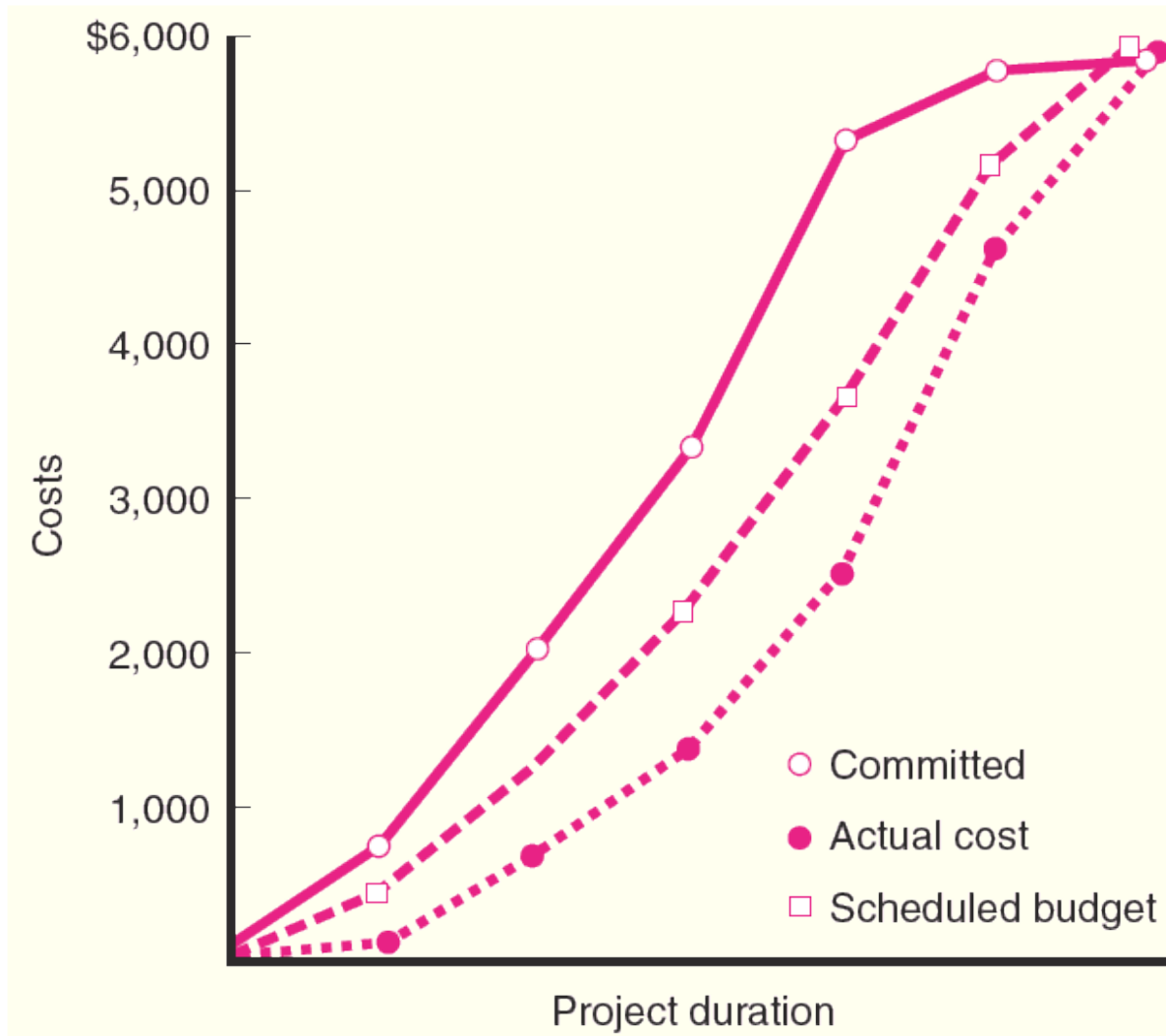


FIGURE 5.5

Types of Costs

- Direct Costs

- Costs that are clearly chargeable to a specific work package.

- Labor, materials, equipment, and other

- Direct (Project) Overhead Costs

- Costs incurred that are directly tied to an identifiable project deliverable or work package.

- Salary, rents, supplies, specialized machinery

- General and Administrative Overhead Costs

- Organization costs indirectly linked to a specific package that are apportioned to the project

Example: Contract Bid Summary Costs

Direct costs	\$80,000
Direct overhead	\$20,000
G&A overhead (20%)	\$20,000
Profit (20%)	\$24,000
Total bid	\$144,000

FIGURE 5.6

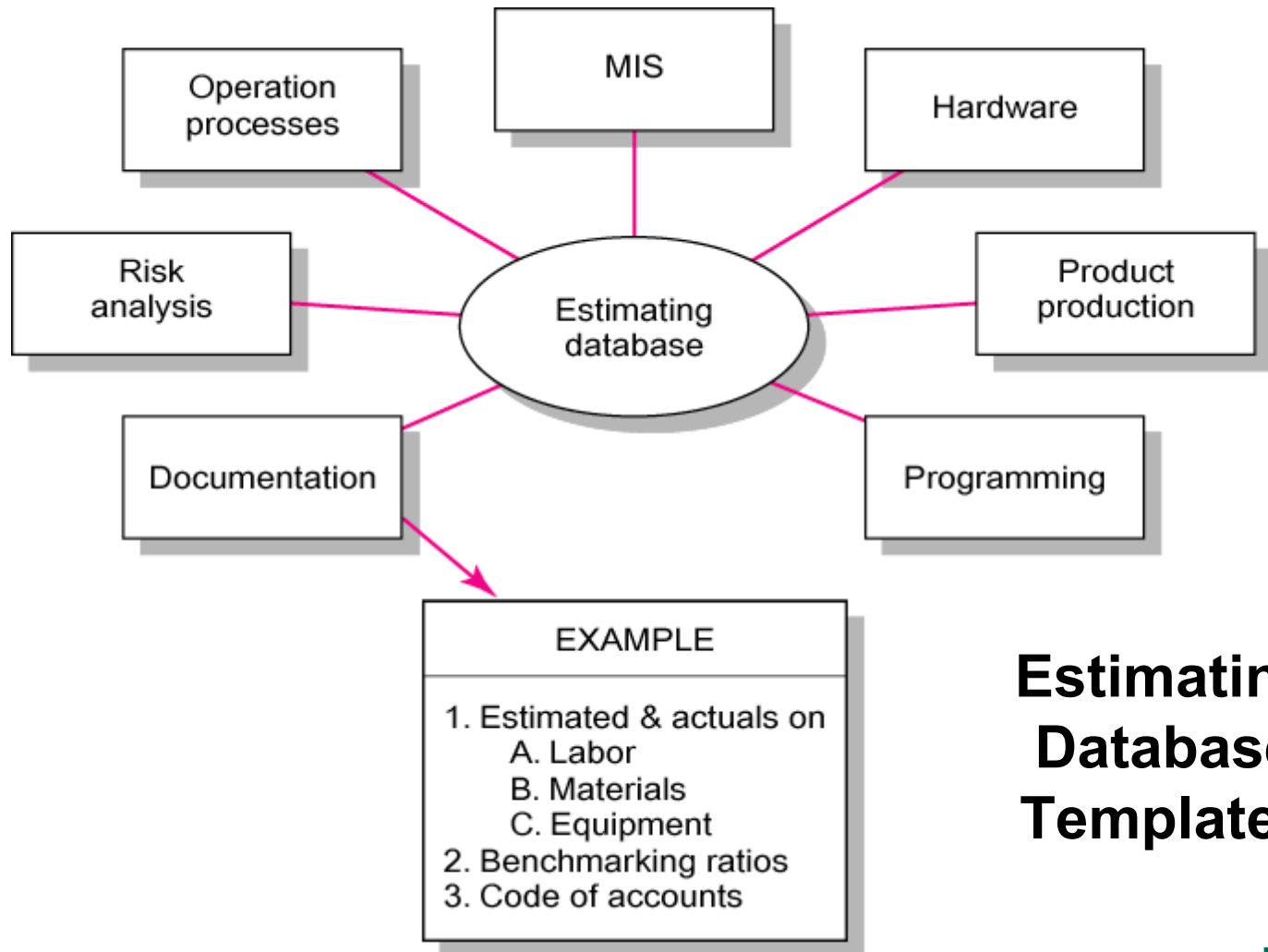
Refining Estimates

- Reasons for Adjusting Estimates
 - Interaction costs are hidden in estimates.
 - Normal conditions do not apply.
 - Things go wrong on projects.
 - Changes in project scope and plans.
- Adjusting Estimates
 - Time and cost estimates of specific activities are adjusted as the risks, resources, and situation particulars become more clearly defined.

Refining Estimates (cont'd)

- Contingency Funds and Time Buffers
 - Are created independently to offset uncertainty.
 - Reduce the likelihood of cost and completion time overruns for a project.
 - Can be added to the overall project or to specific activities or work packages.
 - Can be determined from previous similar projects.
- Changing Baseline Schedule and Budget
 - Unforeseen events may dictate a reformulation of the budget and schedule.

Creating a Database for Estimating



Estimating Database Templates

FIGURE 5.7

Refining Estimates

- Reasons for Adjusting Estimates
 - Interaction costs are hidden in estimates.
 - Normal conditions do not apply.
 - Things go wrong on projects.
 - Changes in project scope and plans.
- Adjusting Estimates
 - Time and cost estimates of specific activities are adjusted as the risks, resources, and situation particulars become more clearly defined.

Refining Estimates...

- **Contingency Funds and Time Buffers**
 - Are created independently to offset uncertainty
 - Reduce the likelihood of cost and completion time overruns for a project
 - Can be added to the overall project or to specific activities or work packages
 - Can be partially determined from previous similar projects, if any
- **Changing Baseline Schedule and Budget**
 - Unforeseen events may dictate a reformulation of the budget and schedule.

Example: Firewall Project

- Using the “complexity weighting” scheme shown in Table 5.2 and the function point complexity weighted table shown below, estimate the total function point count. Historical data suggest 5 function points equal 1 person*month. Currently, 6 people are assigned to work on the project.

- 1.What is the estimated project duration? Overall project cost?
- 2.What is the majority of time being spent on?
- 3.What if we increased our project team to 20 people? What assumptions must we make?

Complexity Weight Table

Number of inputs	10	Rated complexity low	low
Number of outputs	20	Rated complexity average	avg
Number of inquiries	10	Rated complexity average	avg
Number of files	30	Rated complexity high	high
Number of interfaces	50	Rated complexity high	high