

Chapter Five

Estimating Project Times and Costs

Estimating Projects

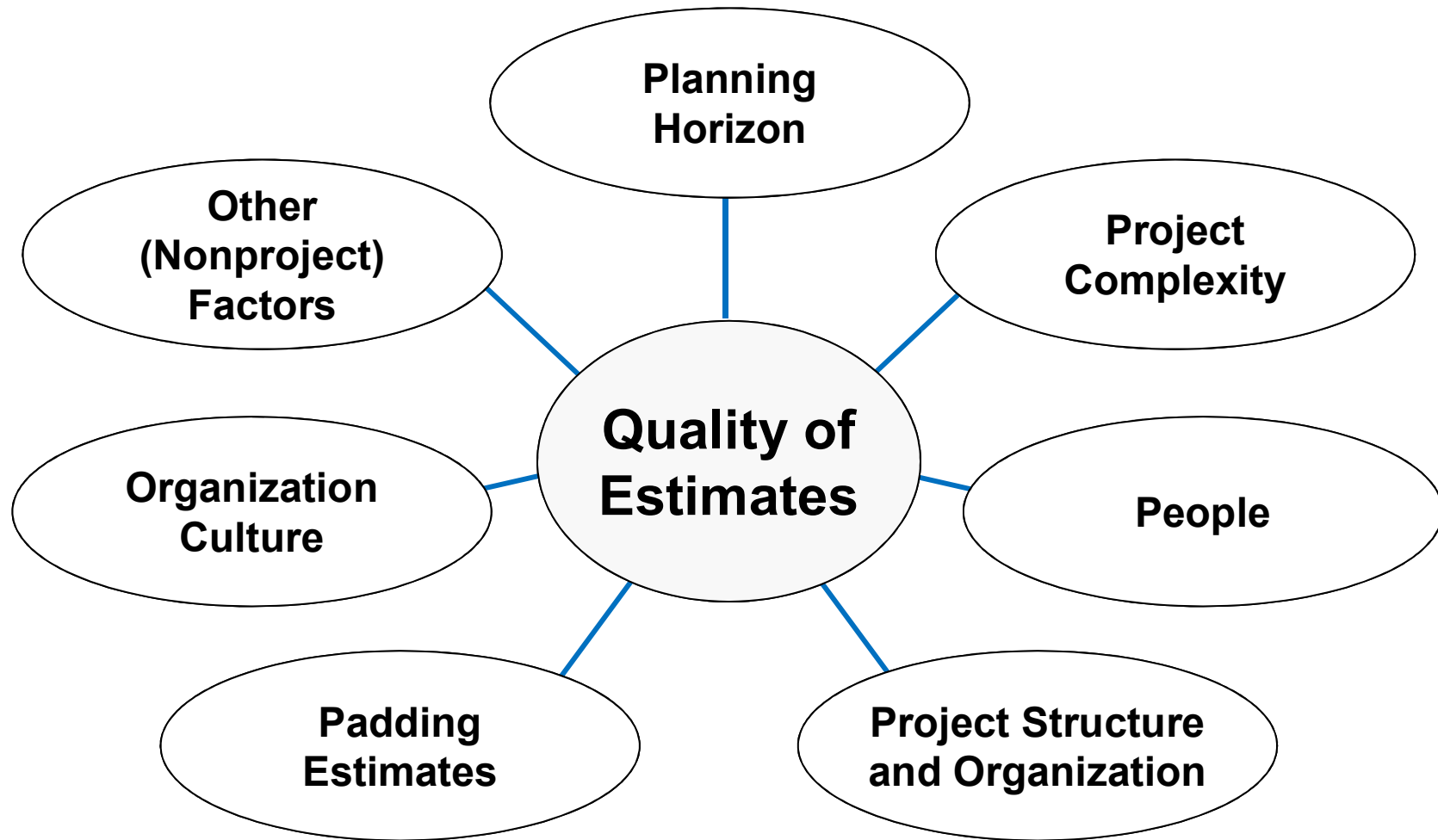
- Estimating
 - The process of forecasting or approximating the time and cost of completing project deliverables
 - The task of balancing expectations of stakeholders and need for control while the project is implemented
- Types of Estimates
 - Top-down (macro) estimates: analogy, group consensus, or mathematical relationships
 - Bottom-up (micro) estimates: estimates of elements of the work breakdown structure

Why Estimating Time and Cost Is Important

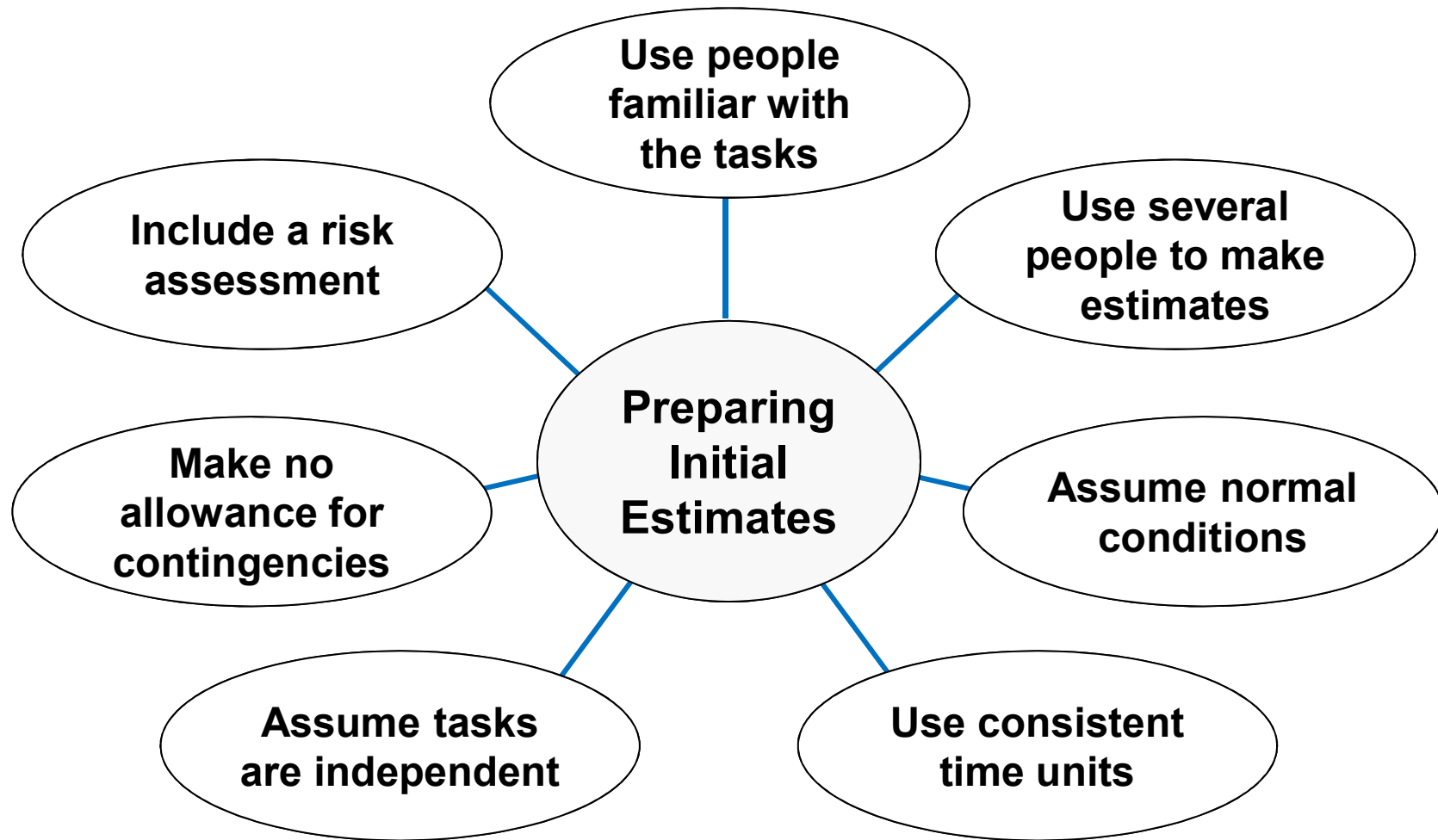
- To support good decisions
- To schedule work
- To determine how long the project should take and its cost
- To determine whether the project is worth doing
- To develop cash flow needs
- To determine how well the project is progressing

EXHIBIT 5.1

Factors Influencing the Quality of Estimates



Developing Work Package Estimates



Top-Down versus Bottom-Up Estimating

- Top-Down Estimates

- Are usually derived from someone who uses experience and/or information to determine the project duration and total cost.
- Are sometimes made by top managers who have little knowledge of the processes used to complete the project.

- Bottom-Up Approach

- Can serve as a check on cost elements in the WBS by rolling up the work packages and associated cost accounts to major deliverables at the work package level.

Top-Down versus Bottom-Up Estimating

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

| Condition | Top-down Estimates | Bottom-up 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

Top-Down Approaches for Estimating Project Times and Costs

- Consensus methods
- Ratio methods (sometimes called parametric)
- Apportion method
- Function point methods for software and system projects
- Learning curves



Apportion Method of Allocating Project Costs Using the Work Breakdown Structure

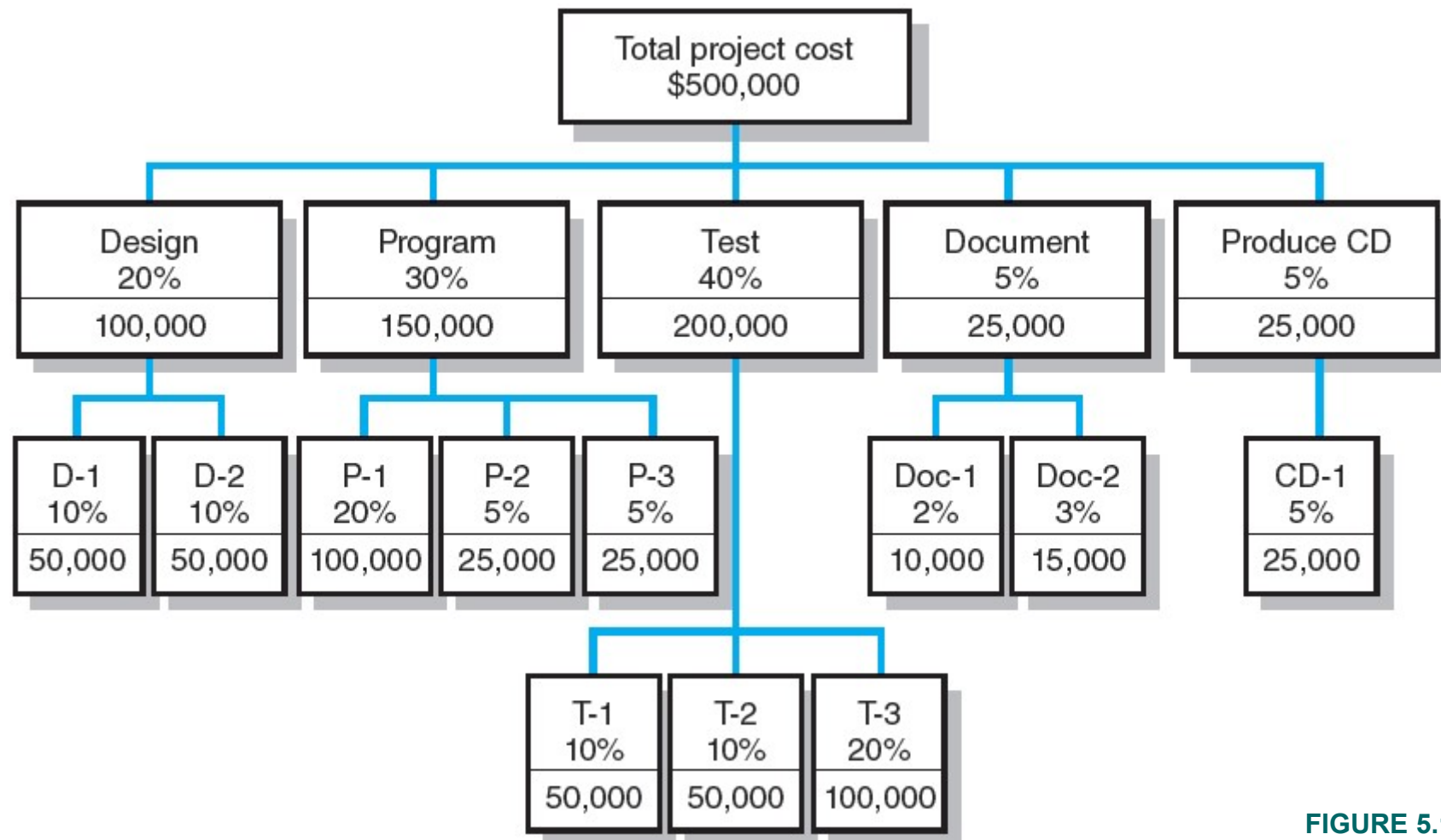


FIGURE 5.1

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

| 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 | = _____ |

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

Learning Curves Unit Values

| Units | 60% | 65% | 70% | 75% | 80% | 85% | 90% | 95% |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 2 | .6000 | .6500 | .7000 | .7500 | .8000 | .8500 | .9000 | .9500 |
| 3 | .4450 | .5052 | .5682 | .6338 | .7021 | .7729 | .8462 | .9219 |
| 4 | .3600 | .4225 | .4900 | .5625 | .6400 | .7225 | .8100 | .9025 |
| 5 | .3054 | .3678 | .4368 | .5127 | .5956 | .6857 | .7830 | .8877 |
| 6 | .2670 | .3284 | .3977 | .4754 | .5617 | .6570 | .7616 | .8758 |
| 7 | .2383 | .2984 | .3674 | .4459 | .5345 | .6337 | .7439 | .8659 |
| 8 | .2160 | .2746 | .3430 | .4219 | .5120 | .6141 | .7290 | .8574 |
| 9 | .1980 | .2552 | .3228 | .4017 | .4930 | .5974 | .7161 | .8499 |
| 10 | .1832 | .2391 | .3058 | .3846 | .4765 | .5828 | .7047 | .8433 |
| 12 | .1602 | .2135 | .2784 | .3565 | .4493 | .5584 | .6854 | .8320 |
| 14 | .1430 | .1940 | .2572 | .3344 | .4276 | .5386 | .6696 | .8226 |
| 16 | .1296 | .1785 | .2401 | .3164 | .4096 | .5220 | .6561 | .8145 |
| 18 | .1188 | .1659 | .2260 | .3013 | .3944 | .5078 | .6445 | .8074 |

TABLE A5.1

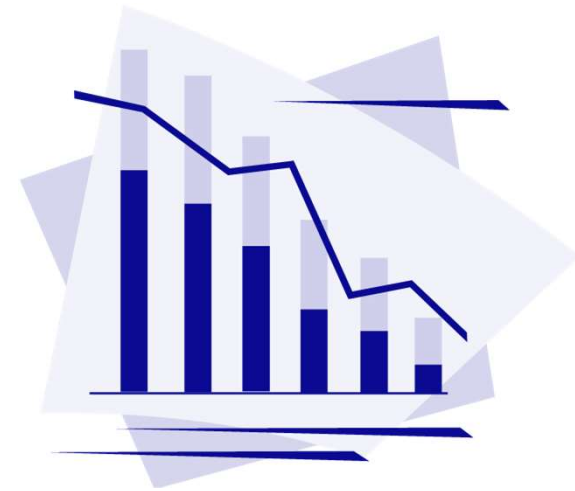
Learning Curves Cumulative Values

| Units | 60% | 65% | 70% | 75% | 80% | 85% | 90% | 95% |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| 2 | 1.600 | 1.650 | 1.700 | 1.750 | 1.800 | 1.850 | 1.900 | 1.950 |
| 3 | 2.045 | 2.155 | 2.268 | 2.384 | 2.502 | 2.623 | 2.746 | 2.872 |
| 4 | 2.405 | 2.578 | 2.758 | 2.946 | 3.142 | 3.345 | 3.556 | 3.774 |
| 5 | 2.710 | 2.946 | 3.195 | 3.459 | 3.738 | 4.031 | 4.339 | 4.662 |
| 6 | 2.977 | 3.274 | 3.593 | 3.934 | 4.299 | 4.688 | 5.101 | 5.538 |
| 7 | 3.216 | 3.572 | 3.960 | 4.380 | 4.834 | 5.322 | 5.845 | 6.404 |
| 8 | 3.432 | 3.847 | 4.303 | 4.802 | 5.346 | 5.936 | 6.574 | 7.261 |
| 9 | 3.630 | 4.102 | 4.626 | 5.204 | 5.839 | 6.533 | 7.290 | 8.111 |
| 10 | 3.813 | 4.341 | 4.931 | 5.589 | 6.315 | 7.116 | 7.994 | 8.955 |
| 12 | 4.144 | 4.780 | 5.501 | 6.315 | 7.227 | 8.244 | 9.374 | 10.62 |
| 14 | 4.438 | 5.177 | 6.026 | 6.994 | 8.092 | 9.331 | 10.72 | 12.27 |
| 16 | 4.704 | 5.541 | 6.514 | 7.635 | 8.920 | 10.38 | 12.04 | 13.91 |
| 18 | 4.946 | 5.879 | 6.972 | 8.245 | 9.716 | 11.41 | 13.33 | 15.52 |
| 20 | 5.171 | 6.195 | 7.407 | 8.828 | 10.48 | 12.40 | 14.64 | 17.13 |
| 22 | 5.379 | 6.492 | 7.819 | 9.388 | 11.23 | 13.38 | 15.86 | 18.72 |
| 24 | 5.574 | 6.773 | 8.213 | 9.928 | 11.95 | 14.33 | 17.10 | 20.31 |
| 25 | 5.668 | 6.909 | 8.404 | 10.19 | 12.31 | 14.80 | 17.71 | 21.10 |

TABLE A5.2

Bottom-Up Approaches for Estimating Project Times and Costs

- Template methods
- Parametric procedures applied to specific tasks
- Range estimates for the WBS work packages
- Phase estimating: A hybrid



Range Estimating Template

| | A | B | C | D | E | F | G | H |
|----|--|------------------------------|-----------------------------|----------|--------------------------------|-------|--------|---|
| 1 | Project number: 18 | | | | Project Manager: Dawn O'Connor | | | |
| 2 | Project description: New Organic Wine Launch | | | | Date: 2/17/2xxx | | | |
| 3 | | | Organic Wine Launch Project | | | | | |
| 4 | | | Range Estimates | | | | | |
| 5 | | | | | | | | |
| 6 | WBS | Description | Low | Average | High | Range | Risk | |
| 7 | ID | | Estimate | Estimate | Estimate | | Level | |
| 8 | | | Days | Days | Days | Days | | |
| 9 | | | | | | | | |
| 10 | 102 | Approval | 1 | 1 | 3 | 2 | low | |
| 11 | 103 | Design packaging | 4 | 7 | 12 | 8 | medium | |
| 12 | 104 | ID potential customers | 14 | 21 | 35 | 21 | high | |
| 13 | 105 | Design bottle logo | 5 | 7 | 10 | 5 | low | |
| 14 | 106 | Contract kiosk space | 8 | 10 | 15 | 7 | medium | |
| 15 | 107 | Construct kiosk | 4 | 4 | 8 | 4 | medium | |
| 16 | 108 | Design fair brochure | 6 | 7 | 12 | 6 | high | |
| 17 | 109 | Trade journal advertising | 10 | 12 | 15 | 5 | medium | |
| 18 | 110 | Production test | 10 | 14 | 20 | 10 | high | |
| 19 | 111 | Produce to inventory | 5 | 5 | 10 | 5 | high | |
| 20 | 112 | Business card scanner hookup | 1 | 2 | 3 | 2 | low | |
| 21 | 113 | Video hook up | 2 | 2 | 4 | 2 | medium | |
| 22 | 114 | Event rehearsal | 2 | 2 | 5 | 3 | high | |

FIGURE 5.2

Level of Detail

- Level of detail in the WBS varies with the complexity of the project, the need for control, the project size, cost, duration, and other factors.
- Excessive detail is costly.
 - Fosters a focus on departmental outcomes rather than on deliverable outcomes
 - Creates unproductive paperwork
- Insufficient detail is costly.
 - Lack of focus on goals
 - Wasted effort on nonessential activities

Three Views of Cost

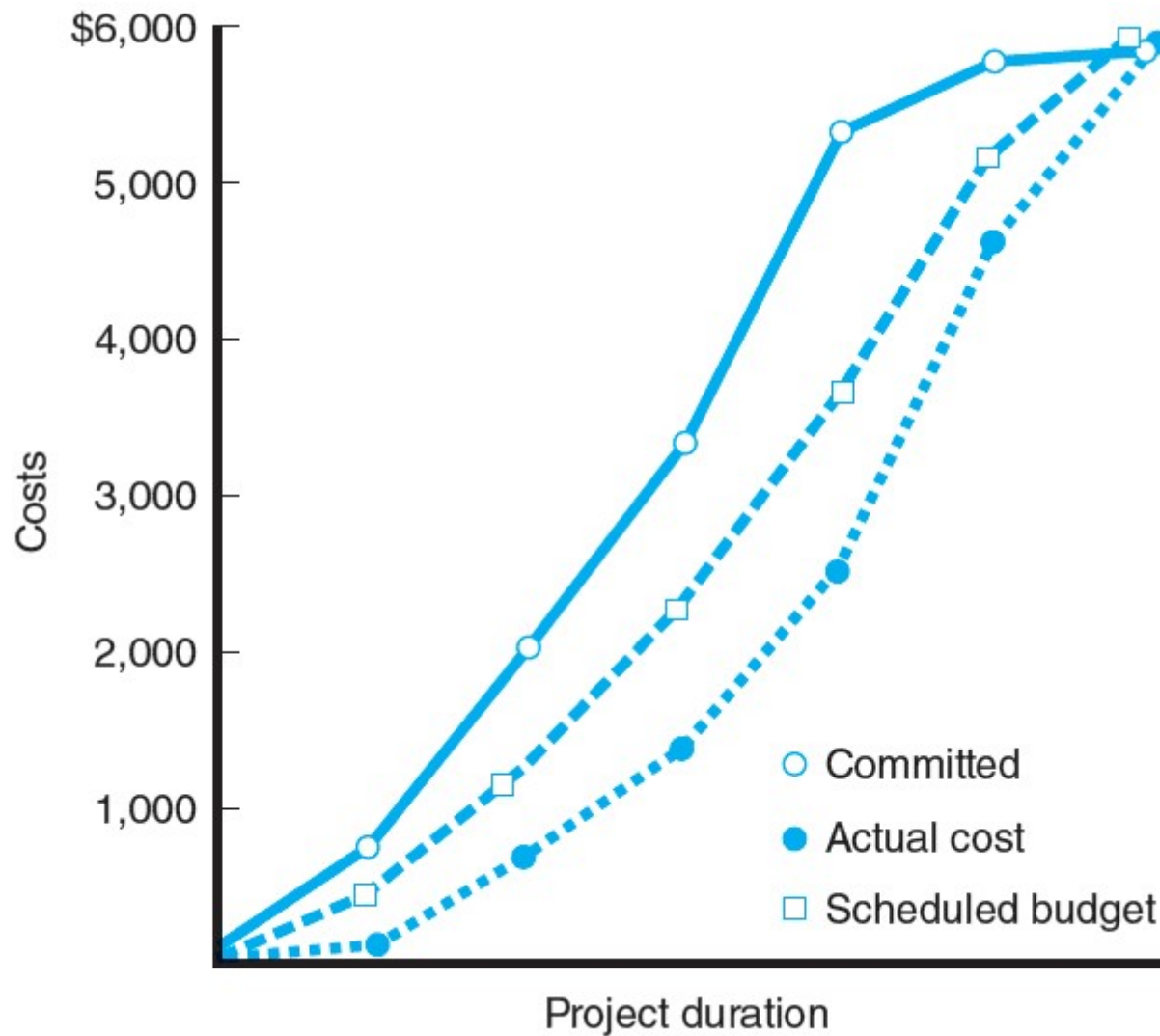


FIGURE 5.6

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
 - Overly optimistic
 - Strategic misrepresentation
- Adjusting Estimates
 - Time and cost estimates of specific activities are adjusted as the risks, resources, and situation particulars become more clearly defined.

Three Steps of the Reference Class Forecasting (RCF) Process

- Select a reference class of projects similar to your potential projects.
- Collect and arrange outcome data as a distribution. Create a distribution of cost overruns as a percentage of the original project estimate.
- Use the distribution data to arrive at a realistic forecast. Compare the original cost estimate for the project with the reference class projects.