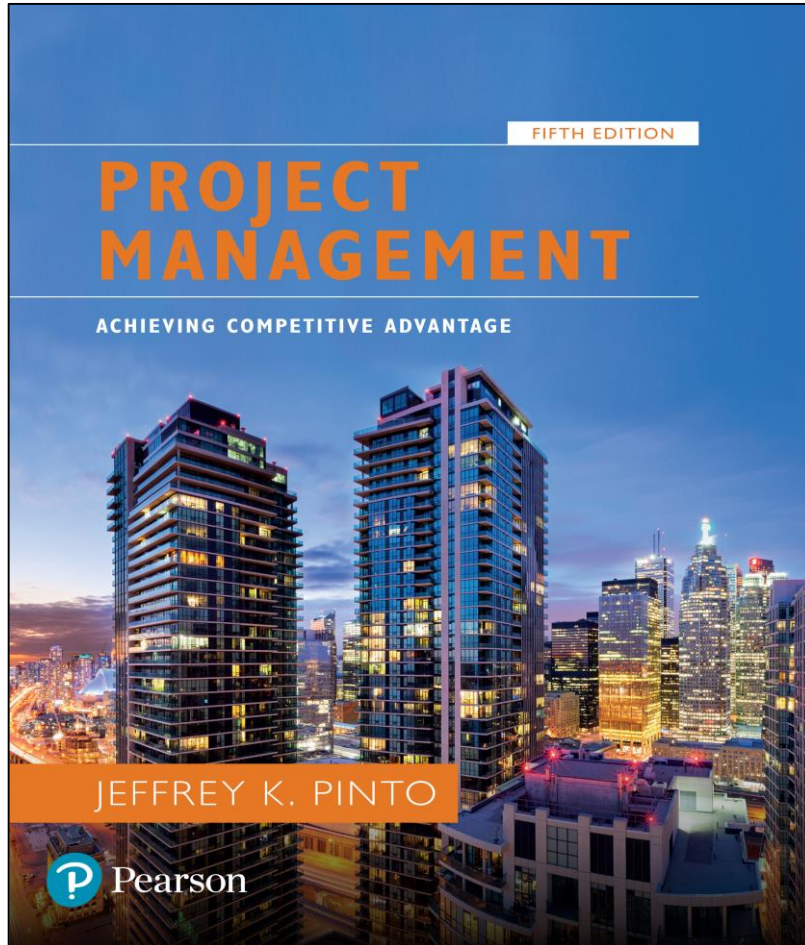# Project Management: Achieving Competitive Advantage

Fifth Edition

Chapter 8

Cost Estimation and Budgeting

Learning Objectives

8.1 Understand the various types of common project costs and key differences between them.

8.2 Apply common forms of cost estimation for project work, including ballpark estimates, definitive estimates, parametric estimates, and learning curve.

8.3 Apply top-down, bottom-up, activity-based, and time-phased budgeting procedures for cost management.

8.4 Recognize the appropriateness of applying contingency funds for cost estimation.

PMBoK Core Concepts

Project Management Body of Knowledge (PMBoK) covered in this chapter includes:

1. Plan Cost Management (PMBoK 7.1)

2. Estimate Costs (PMBoK 7.2)

3. Determine Budget (PMBoK 7.3)

4. Control Costs (PMBoK 7.4)

Cost Management

- **Cost management** has been defined to encompass data collection, cost accounting, and cost control.

- **Cost accounting** and **cost control** serve as the chief mechanisms for identifying and maintaining control over project costs.

- **Cost estimation** processes create a reasonable budget baseline for the project.
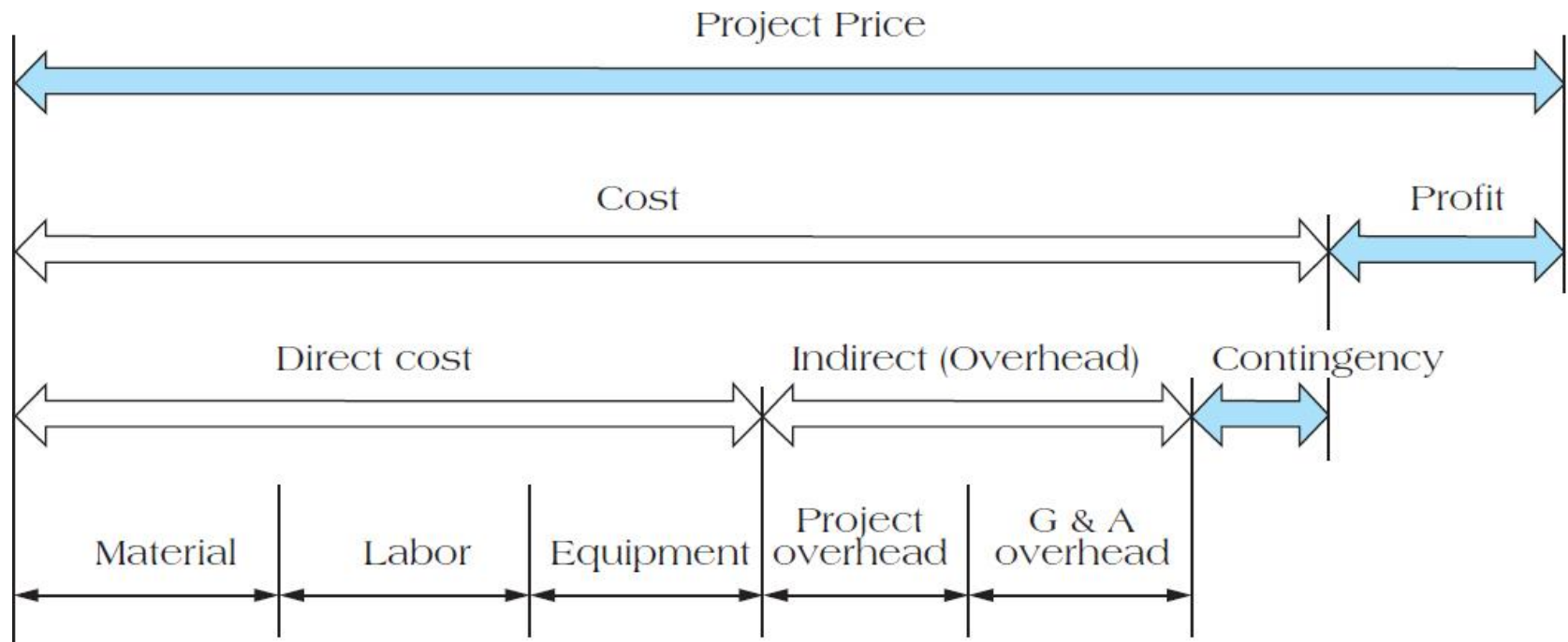
Common Sources of Project Cost

- Labor

- Materials

- Subcontractors

- Equipment and facilities

- Travel

Types of Costs

- Direct Versus Indirect

- Recurring Versus Nonrecurring

- Fixed Versus Variable

- Normal Versus Expedited

Figure 8.2 Project Price Breakdown

Table 8.2 Cost Classifications

Costs	Type		Frequency		Adjustment		Schedule	
	Direct	**Indirect**	**Recurring**	**Nonrecurring**	**Fixed**	**Variable**	**Normal**	**Expedited**
Direct Labor	X		X		X		X	
Building Lease		X	X		X		X	
Expediting Costs	X			X		X		X
Material	X		X			X	X	

Cost Estimation

- Ballpark (order of magnitude) $\pm30\%$

- Comparative $\pm15\%$

- Feasibility $\pm10\%$

- Definitive $\pm5\%$

Learning Curves

Each **doubling of output** results in a reduction in time to perform the last iteration.
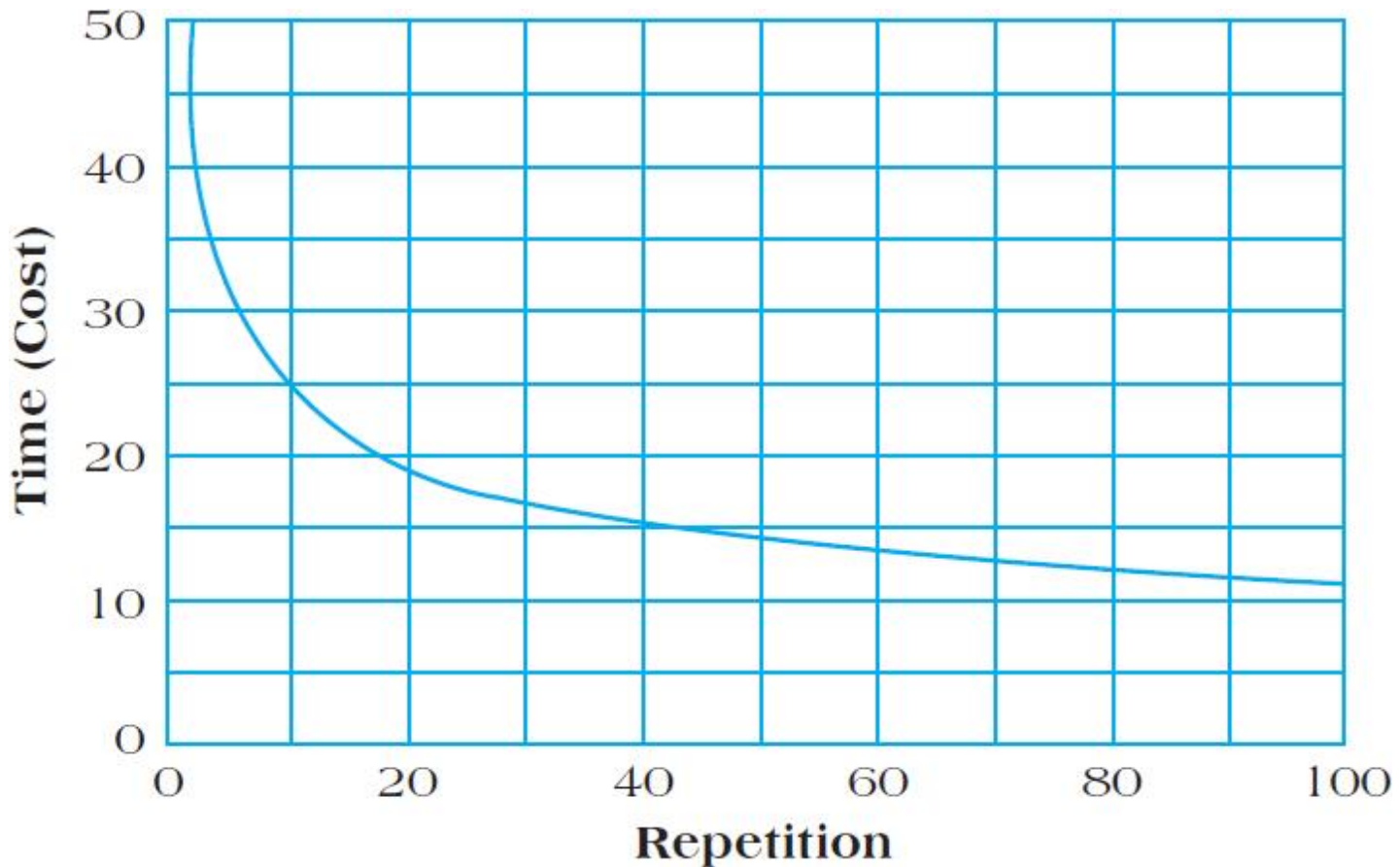
$$Y_x = aX^b$$

Where :

Y_x = the time required for the x unit of output

a = the time required for the initial unit of output

X = the number of units to be produced

b = learning curve slope $= \log\left(\text{learning \%}\right)\big/\log(2)$

# Figure 8.6 Unit Learning Curve Log-Linear Model

Software Project Estimation—Function Points

Function Point Analysis is a system for estimating the size of software projects based on what the software does.

Function Points are a standard unit of measure that represents the functional size of a software application.

Figure 8.7 Software Project Development Activities as a Function of Size
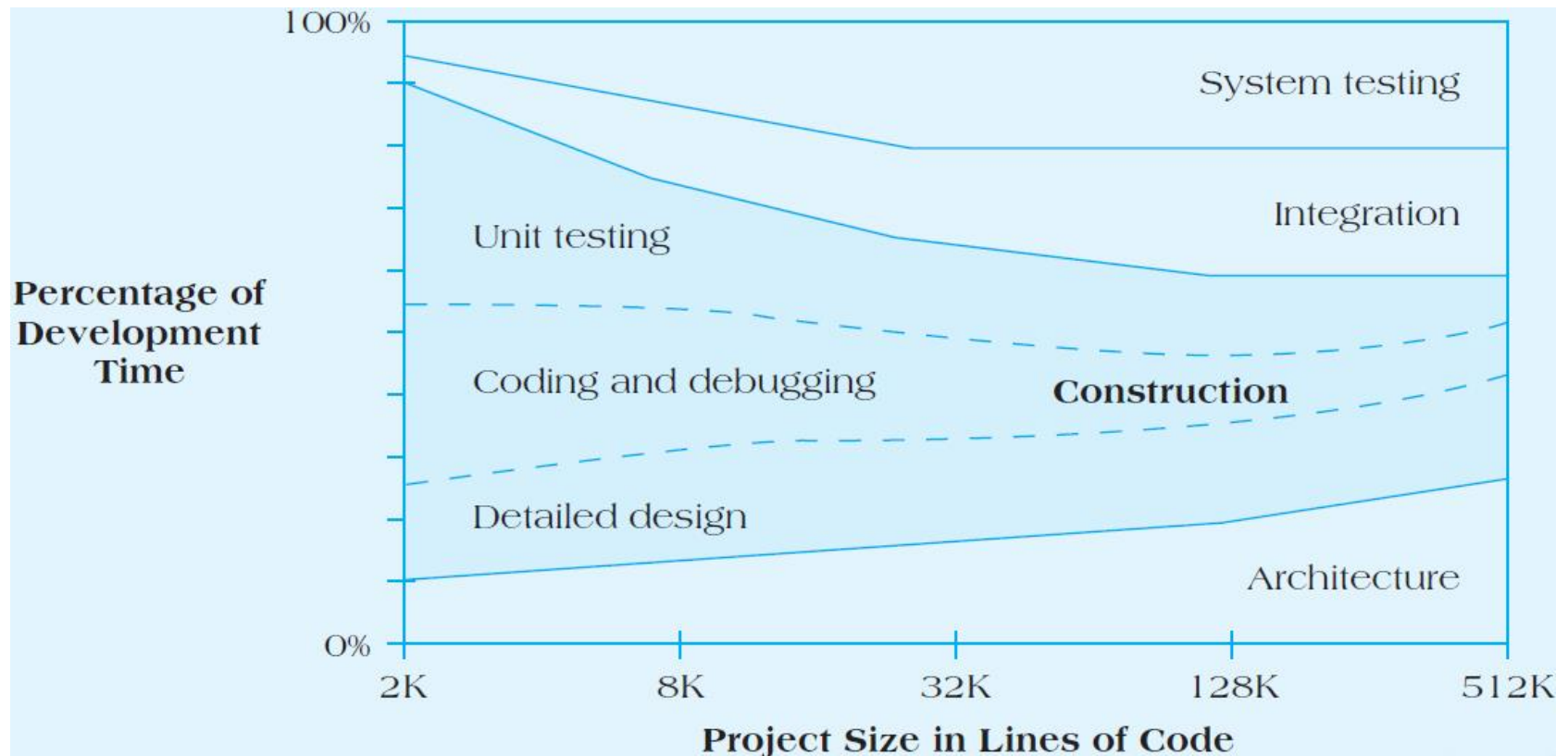
Table 8.4 Complexity Weighting Table for Function Point Analysis

Function	Complexity Weighting			Total
	Low	**Medium**	**High**	
Number of Inputs	2 × _____ =	4 × _____ =	6 × _____ =	
Number of Outputs	4 × _____ =	6 × _____ =	10 × _____ =	
Number of Interfaces	3 × _____ =	7 × _____ =	12 × _____ =	
Number of Queries	5 × _____ =	10 × _____ =	15 × _____ =	
Number of Files	2 × _____ =	4 × _____ =	8 × _____ =	

Pearson

Table 8.5 Function Point Calculations for Restaurant Reorder System

| Function	Complexity Weighting			Total
	Low	**Medium**	**High**	
Number of Inputs		4 × 15 =		60
Number of Outputs			10 × 20 =	200
Number of Interfaces	3 × 3 =			9
Number of Queries		10 × 6 =		60
Number of Files	2 × 40 =			80
Total				409

Problems with Cost Estimation

- Low initial estimates

- Unexpected technical difficulties

- Lack of definition

- Specification changes

- External factors

Creating a Project Budget

The **budget is a plan** that identifies the resources, goals, and schedule that allows a firm to achieve those goals.

Figure 8.8 The Relationship Among WBS, Scheduling, and Budgeting
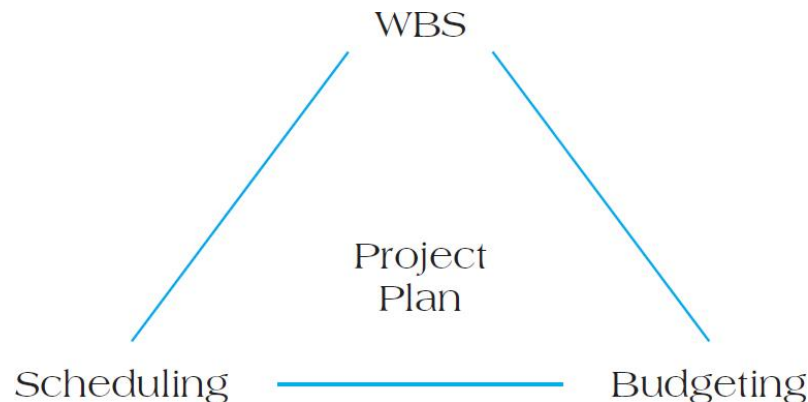
- Top-down

- Bottom-up

- Activity-based costing (ABC)

Activity-Based Costing

Projects use activities and activities use resources.

1. **Assign costs** to activities that use resources.

2. **Identify cost drivers** associated with this activity.

3. **Compute a cost rate** per cost driver unit or transaction.

4. **Multiply** the cost driver **rate times** the **volume** of cost driver units used by the project.

P Pearson

Table 8.6 Sample Project Budget

Activity	Direct Costs	Budget Overhead	Total Cost
Survey	3,500	500	4,000
Design	7,000	1,000	8,000
Clear Site	3,500	500	4,000
Foundation	6,750	750	7,500
Framing	8,000	2,000	10,000
Plumb and Wire	3,750	1,250	5,000

# Table 8.7 Sample Budget Tracking Planned and Actual Activity Costs

Activity	Direct Costs	Budget Overhead	Total Cost
Survey	4,000	4,250	250
Design	8,000	8,000	- 0 -
Clear Site	4,000	3,500	(500)
Foundation	7,500	8,500	1,000
Framing	10,000	11,250	1,250
Plumb and Wire	5,000	5,150	150
Total	38,500	40,650	2,150

Table 8.8 Example of a Time-Phased Budget

Activity	January	February	Months March	April	May	Total by Activity
Survey	4,000					4,000
Design		5,000	3,000			8,000
Clear Site		4,000				4,000
Foundation			7,500			7,500
Framing				8,000	2,000	10,000
Plumb and Wire				1,000	4,000	5,000
Monthly Planned	4,000	9,000	10,500	9,000	6,000	
Cumulative	4,000	13,000	23,500	32,500	38,500	38,500

Figure 8.9 Cumulative Budgeted Cost of the Project

Cumulative Budgeted Cost (in thousands)
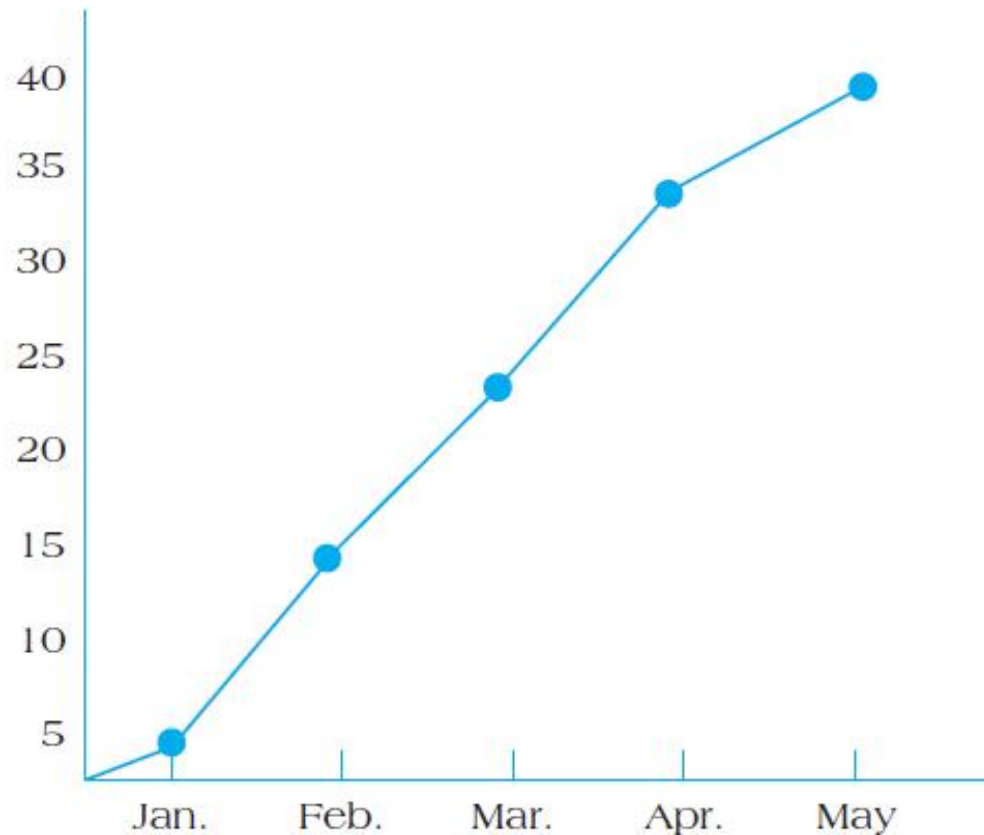
Budget Contingencies

The allocation of extra funds to cover uncertainties and improve the chance of finishing on time.

Contingencies are needed because:

1. Project scope may change

2. Murphy's Law is present

3. Cost estimation must anticipate interaction costs

4. Normal conditions are rarely encountered

Benefits to Contingency Funding

1. Recognizes future contains unknowns

2. Adds provision for company plans for an increase in project cost

3. Applies contingency fund as an early warning signal to a potential overdrawn budget

Summary

1. Understand the various types of common project costs and key differences between them.

2. Apply common forms of cost estimation for project work, including ballpark estimates, definitive estimates, parametric estimates, and learning curve.

3. Apply top-down, bottom-up, activity-based, and time-phased budgeting procedures for cost management.

4. Recognize the appropriateness of applying contingency funds for cost estimation.

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