Fundamentals of Cost Accounting

6e

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FUNDAMENTALS OF COST ACCOUNTING, SIXTH EDITION

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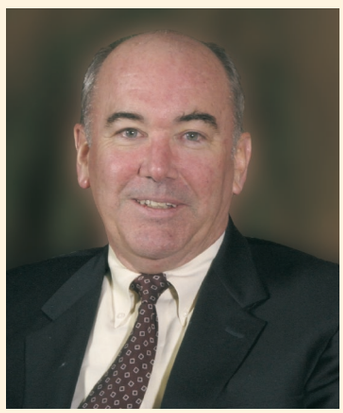

William N. Lanen

William Lanen is the KPMG Professor of Accounting Emeritus at the **University of Michigan**. He previously taught at the **Wharton School** at the **University of Pennsylvania**. He received his AB from the **University of California-Berkeley**, MS from **Purdue University**, and his PhD from the **Wharton School**. He has taught cost accounting to undergraduates, MBA students, and executives, including in global programs in Europe, South America, Australia, and Asia. He has also served as the director of the Office of Action-Based Learning at the Ross School of the University of Michigan. His research focuses primarily on performance evaluation and reward systems.

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Dedication

To my wife, Donna, and my children, Cathy and Tom, for encouragement, support, patience, and general good cheer throughout the years.

Bill

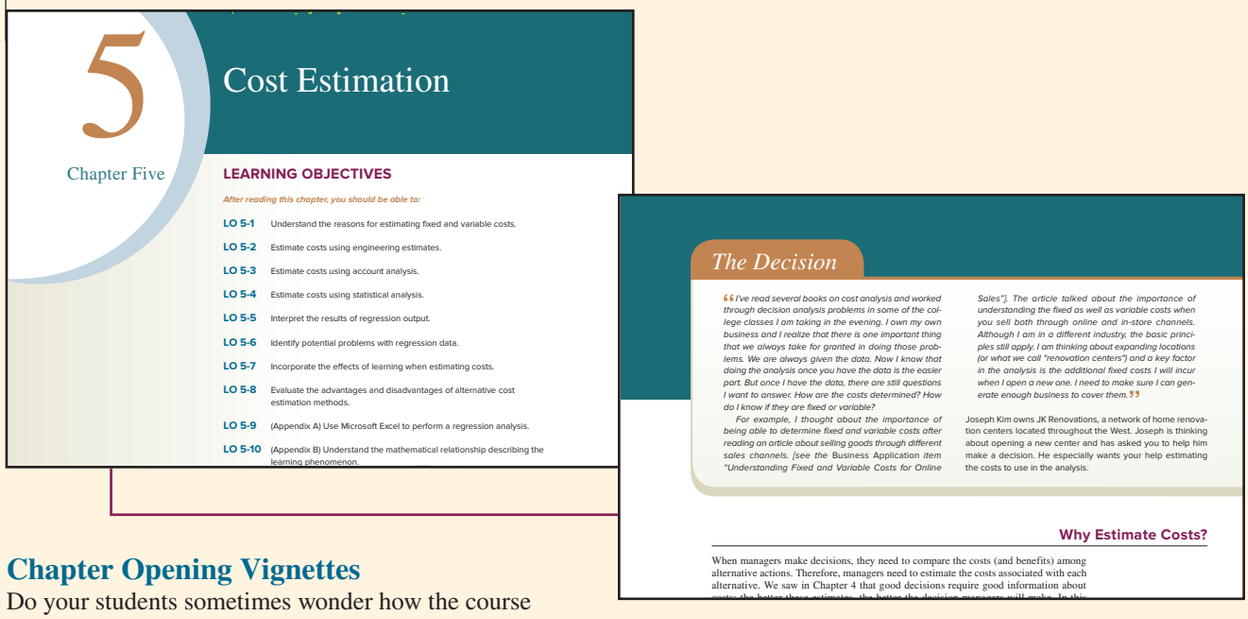
I dedicate this book to the extraordinary public school teachers and counselors who shaped my early development and modeled excellence in teaching, especially Don Bryant, Michael Varner, Carolyn Crouse, and Lee Martin; and to the teachers who had the first and most enduring influence on me, my parents, Max and Nina Weems.

Shannon

I dedicate this book to my wife, Kathleen; my children, Krista and Andrea; my stepchildren, Andrew and Emily; and to my extended family, friends, and colleagues who have provided their support and wisdom over the years.

Michael

Step into the Real World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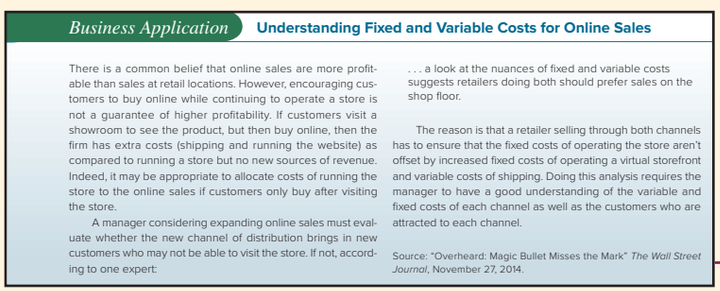
Chapter Five
Cost Estimation
LEARNING OBJECTIVES
After reading this chapter, you should be able to:
LO 5-1 Understand the reasons for estimating fixed and variable costs.
LO 5-2 Estimate costs using engineering estimates.
LO 5-3 Estimate costs using account analysis.
LO 5-4 Estimate costs using statistical analysis.
LO 5-5 Interpret the results of regression output.
LO 5-6 Identify potential problems with regression data.
LO 5-7 Incorporate the effects of learning when estimating costs.
LO 5-8 Evaluate the advantages and disadvantages of alternative cost estimation methods.
LO 5-9 (Appendix A) Use Microsoft Excel to perform a regression analysis.
LO 5-10 (Appendix B) Understand the mathematical relationship describing the learning phenomenon.
The Decision
"I've read several books on cost analysis and worked through decision analysis problems in some of the college classes I am taking in the evening. I own my own business and I realize that there is one important thing that we always take for granted in doing those problems. We are always given the data. Now I know that doing the analysis once you have the data is the easier part. But once I have the data, there are still questions I want to answer. How are the costs determined? How do I know if they are fixed or variable?
For example, I thought about the importance of being able to determine fixed and variable costs after reading an article about selling goods through different sales channels. [see the Business Application item "Understanding Fixed and Variable Costs for Online Sales"]. The article talked about the importance of understanding the fixed as well as variable costs when you sell both through online and in-store channels. Although I am in a different industry, the basic principles still apply. I am thinking about expanding locations (or what we call "renovation centers") and a key factor in the analysis is the additional fixed costs I will incur when I open a new one. I need to make sure I can generate enough business to cover them."
Joseph Kim owns JK Renovations, a network of home renovation centers located throughout the West. Joseph is thinking about opening a new center and has asked you to help him make a decision. He especially wants your help estimating the costs to use in the analysis.
Why Estimate Costs?
When managers make decisions, they need to compare the costs (and benefits) among alternative actions. Therefore, managers need to estimate the costs associated with each alternative. We saw in Chapter 4 that good decisions require good information about

Chapter Opening Vignettes

Do your students sometimes wonder how the course connects with their future? Each chapter opens with *The Decision,* a vignette in which a decision maker needs cost accounting information to make a better decision. This sets the stage for the rest of the chapter and encourages students to think of concepts in a business context.


Business Application Understanding Fixed and Variable Costs for Online Sales
There is a common belief that online sales are more profitable than sales at retail locations. However, encouraging customers to buy online while continuing to operate a store is not a guarantee of higher profitability. If customers visit a showroom to see the product, but then buy online, then the firm has extra costs (shipping and running the website) as compared to running a store but no new sources of revenue. Indeed, it may be appropriate to allocate costs of running the store to the online sales if customers only buy after visiting the store.
A manager considering expanding online sales must evaluate whether the new channel of distribution brings in new customers who may not be able to visit the store. If not, according to one expert:
. . . a look at the nuances of fixed and variable costs suggests retailers doing both should prefer sales on the shop floor.
The reason is that a retailer selling through both channels has to ensure that the fixed costs of operating the store aren't offset by increased fixed costs of operating a virtual storefront and variable costs of shipping. Doing this analysis requires the manager to have a good understanding of the variable and fixed costs of each channel as well as the customers who are attracted to each channel.
Source: "Overheard: Magic Bullet Misses the Mark" *The Wall Street Journal*, November 27, 2014.

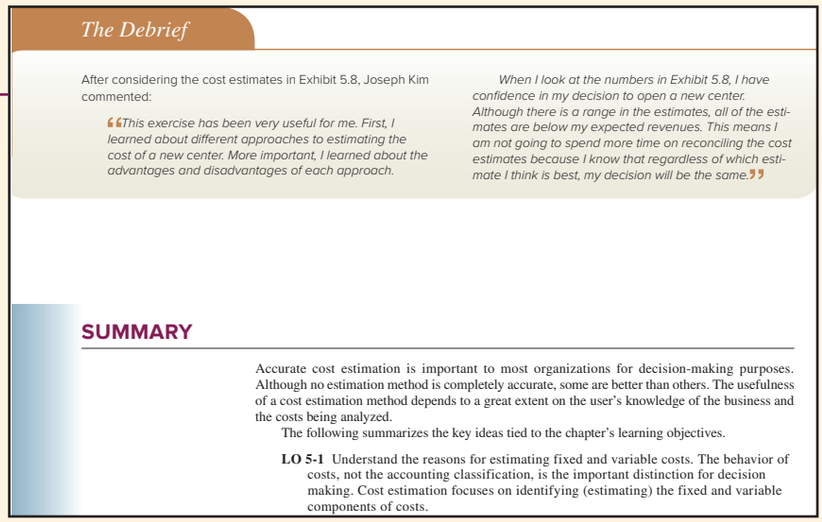
Business Application

Do your students need help connecting theory to application? The *Business Application* examples tie in to *The Decision* chapter-opening vignettes and are drawn from contemporary journals and the authors' own experiences. They illustrate how to apply cost accounting methods and tools.

> "[The Business Application features are] a very helpful piece to help students see how the course material becomes relevant in the professional world."
>
> —N. Ahadiat
> *University of California Pomona*

Debrief

Do your students understand how to apply the concepts in each chapter to become better decision makers? All chapters end with a Debrief feature that links the topics in the chapter to the decision problem faced by the manager in the opening vignette.



The Debrief

After considering the cost estimates in Exhibit 5.8, Joseph Kim commented:

"This exercise has been very useful for me. First, I learned about different approaches to estimating the cost of a new center. More important, I learned about the advantages and disadvantages of each approach. When I look at the numbers in Exhibit 5.8, I have confidence in my decision to open a new center. Although there is a range in the estimates, all of the estimates are below my expected revenues. This means I am not going to spend more time on reconciling the cost estimates because I know that regardless of which estimate I think is best, my decision will be the same."

SUMMARY

Accurate cost estimation is important to most organizations for decision-making purposes. Although no estimation method is completely accurate, some are better than others. The usefulness of a cost estimation method depends to a great extent on the user's knowledge of the business and the costs being analyzed.

The following summarizes the key ideas tied to the chapter's learning objectives.

LO 5-1 Understand the reasons for estimating fixed and variable costs. The behavior of costs, not the accounting classification, is the important distinction for decision making. Cost estimation focuses on identifying (estimating) the fixed and variable components of costs.

"Good illustrations and real-world examples. It has broad and comprehensive topic coverage."

—Robert Lin
California State University East Bay

use statistical analysis, so it will be based on real data and therefore objective." How might you respond?

5-28. Refer to the *Business Application*, "Understanding Fixed and Variable Costs for Online Sales." Consider a bank that offers both online and branch access for customers. Based on the costs of service, the bank has decided it should motivate customers to use online services in place of branch services. After several months, they have persuaded over 50 percent of their customers to use the online service for most of their business. However, with the latest profit report, it appears that the bank is actually making lower profits than before. Why might that be?

End-of-Chapter Material

Being able to assign end-of-chapter material with confidence is important. The authors have tested the end-of-chapter material over time to ensure quality and consistency with the chapter content. In the sixth edition the authors have updated several exercises and added several new questions.

"This is an excellent cost accounting book with quality end of chapter materials."

—Judy Daulton
Piedmont Technical College

"Well written; good end-of-chapter material."

—R. E. Bryson
University of Alabama in Huntsville

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Using Excel in the Classroom

Excel® is essential in today's business environment, and Lanen, 6e integrates Excel where appropriate in the text. Several exercises and problems in each chapter can be solved using Excel spreadsheets templates. An Excel logo appears in the text next to these problems. Additionally, commencing with the sixth edition many of these exercises are now algorithmically generated and assignable in *Connect*, with scoring of select inputs for gradebook inclusion.

NEW! Excel Simulations are auto-graded in *Connect* and allow students to practice their Excel skills, such as basic formulas and formatting, within the context of accounting in a simulated Excel environment. When enabled by the instructor, these questions feature animated, narrated Help and Show Me tutorials.

(LO 5-4, 5)

5-61. Interpretation of Regression Results: Simple Regression

Your company is preparing an estimate of its production costs for the coming period. The controller estimates that direct materials costs are $45 per unit and that direct labor costs are $21 per hour. Estimating overhead, which is applied on the basis of direct labor costs, is difficult.

The controller's office estimated overhead costs at $3,600 for fixed costs and $18 per unit for variable costs. Your colleague, Lance, who graduated from a rival school, has already done the analysis and reports the "correct" cost equation as follows:

Overhead = $10,600 + $16.05 per unit

Lance also reports that the correlation coefficient for the regression is .82 and says, "With 82 percent of the variation in overhead explained by the equation, it certainly should be adopted as the best basis for estimating costs."

When asked for the data used to generate the regression, Lance produces the following:

Month	Overhead	Unit Production
1	$57,144	3,048
2	60,756	3,248
3	77,040	4,176
4	56,412	3,000
5	81,396	3,408
6	72,252	3,928
7	63,852	3,336
8	73,596	4,016
9	77,772	4,120
10	60,048	3,192
11	61,632	3,368
12	73,920	4,080
13	73,248	3,888

The company controller is somewhat surprised that the cost estimates are so different. You have therefore been assigned to check Lance's equation. You accept the assignment with glee.

Required

Analyze Lance's results and state your reasons for supporting or rejecting his cost equation.

> "Strong end of chapter and test bank materials. Strong inclusion of Excel in the chapters"
>
> —Michael Flores,
> *Wichita State University*

INTEGRATIVE CASE

(LO 5-4, 5, 9)

5-72. Cost Estimation, CVP Analysis, and Decision Making

Luke Corporation produces a variety of products, each within their own division. Last year, the managers at Luke developed and began marketing a new chewing gum, Bubbs, to sell in vending machines. The product, which sells for $5.25 per case, has not had the market success that managers expected, and the company is considering dropping Bubbs.

The product-line income statement for the past 12 months follows.

Revenue		$14,682,150
Costs		
Manufacturing costs	$14,440,395	
Allocated corporate costs (@5%)	734,108	15,174,503
Product-line margin		$ (492,353)
Allowance for tax (@20%)		98,470
Product-line profit (loss)		$ (393,883)

All products at Luke receive an allocation of corporate overhead costs, which is computed as 5 percent of product revenue. The 5 percent rate is computed based on the most recent year's corporate cost as a percentage of revenue. Data on corporate costs and revenues for the past two years follow.

	Corporate Revenue	Corporate Overhead Costs
Most recent year	$ 106,750,000	$5,337,500
Previous year	$ 76,200,000	4,221,000

Roy O. Andre, the product manager for Bubbs, is concerned about whether the product will be dropped by the company and has employed you as a financial consultant to help with some analysis. In addition to the information given, Mr. Andre provides you with the following data on product costs for Bubbs.

Month	Cases	Production Costs
1	207,000	$1,139,828
2	217,200	1,161,328
3	214,800	1,169,981
4	228,000	1,185,523
5	224,400	1,187,827
6	237,000	1,208,673
7	220,200	1,183,699
8	247,200	1,226,774
9	238,800	1,225,226
10	252,600	1,237,325
11	250,200	1,241,760
12	259,200	1,272,451

Integrative Cases

Cases can generate classroom discussion or be the basis for good team projects. These integrative cases, which rely on cost accounting principles from previous chapters as well as the current chapter, ask students to apply the different techniques they have learned to a realistic situation.

What's New in the Sixth Edition?

Our primary goal in the sixth edition remains the same as in the previous five editions—to offer a cost accounting text that lets the student see the development of cost accounting tools and techniques as a natural response to decision making. We emphasize the intuition behind concepts and work to minimize the need to "memorize." We believe that students who develop this intuition will, first, develop an appreciation of what cost accounting is about and, second, will have an easier time understanding new developments that arise during their careers. Each chapter clearly establishes learning objectives, highlights numerous real-world examples, and identifies where ethical issues arise and how to think about these issues. Each chapter includes at least one integrative case that illustrates the links among the topics.

We present the material from the perspective of both the preparer of information as well as those who will use the information. We do this so that both accounting majors and those students planning other careers will appreciate the issues in preparing and using the information. The opening vignettes tie to one of the *Business Application* features in the chapter to highlight the relevance of cost accounting to today's business problems. All chapters end with a *Debrief* that links the topics in the chapter to the decision problem faced by the manager in the opening vignette.

The end-of-chapter material has increased by 9 to 16 percent, depending on the chapter, and 12 percent overall. Throughout the revision process, we have retained the clear writing style that is frequently cited as a strength of the text.

1 Cost Accounting: Information for Decision Making

- New opening vignette.
- Four new *Business Applications.*
- Updated link for IMA Ethics.
- Updated discussion and examples on Trends in Cost Accounting.
- Two new exercises.
- Four new problems.

2 Cost Concepts and Behavior

- New opening vignette.
- Two new *Business Applications.*
- Four new exercises.
- Four new problems.

3 Fundamentals of Cost-Volume-Profit Analysis

- New opening vignette.
- One new *Business Application.*
- One new critical discussion question.
- Four new exercises.
- Three new problems.

4 Fundamentals of Cost Analysis for Decision Making

- New opening vignette.
- Two new *Business Applications.*
- One new critical discussion question.
- Ten new problems.

5 Cost Estimation

- New opening vignette.
- One new *Business Application.*
- Added Learning Objective for learning curves (using existing material).
- One new critical discussion question.
- Three new exercises.
- Four new problems.

6 Fundamentals of Product and Service Costing

- New opening vignette.
- One new *Business Application.*
- Six new exercises.
- Two new problems.

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7 Job Costing
- New opening vignette.
- One new *Business Application*.
- Two new exercises.
- Four new problems.

8 Process Costing
- New opening vignette.
- Five new exercises.
- Three new problems.

9 Activity-Based Costing
- New opening vignette.
- One new *Business Application*.
- Two new critical discussion questions.
- Four new exercises.
- Two new problems.

10 Fundamentals of Cost Management
- New opening vignette.
- One new *Business Application*.
- One new critical discussion question.
- Three new exercises.
- Two new problems.

11 Service Department and Joint Cost Allocation
- New opening vignette.
- One new critical discussion question.
- Five new exercises.
- Two new problems.

12 Fundamentals of Management Control Systems
- New opening vignette.
- Two new *Business Applications.*
- Three new exercises.
- Two new problems.

13 Planning and Budgeting
- New opening vignette.
- Four new exercises.
- Two new problems.
- One new integrative case.

14 Business Unit Performance Measurement
- New opening vignette.
- One new *Business Application*.
- Three new exercises.
- Three new problems.

15 Transfer Pricing
- New opening vignette.
- One new *Business Application*.
- Four new exercises.
- Two new problems.

16 Fundamentals of Variance Analysis
- New opening vignette.
- Five new exercises.
- Three new problems.

17 Additional Topics in Variance Analysis
- New opening vignette.
- Four new exercises.
- Four new problems.

18 Performance Measurement to Support Business Strategy
- New opening vignette.
- Three new *Business Applications*.
- Four new exercises.
- Two new problems.

Appendix Capital Investment Decisions: An Overview
- One new exercise.
- One new problem.

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- Jordan Cunningham,
Eastern Washington University

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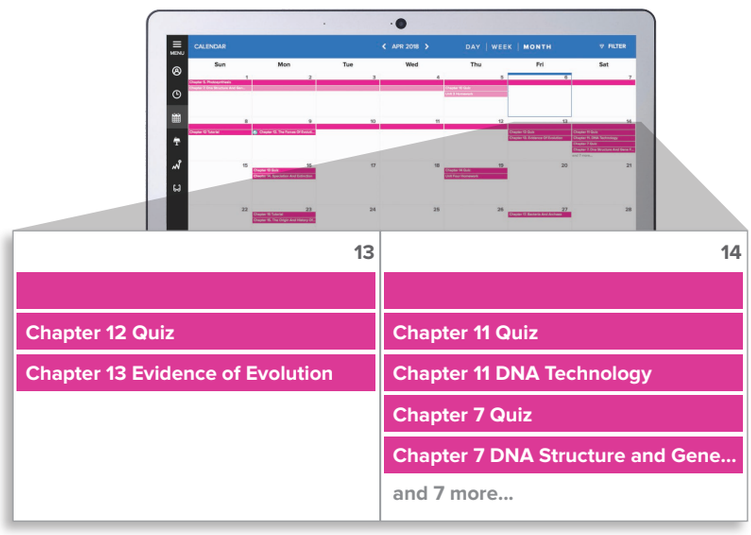

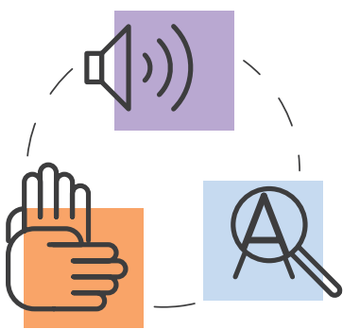

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Fundamentals of Cost Accounting

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2

Chapter Two

Cost Concepts and Behavior

LEARNING OBJECTIVES

After reading this chapter, you should be able to:

LO 2-1 Explain the basic concept of "cost."

LO 2-2 Explain how costs are presented in financial statements.

LO 2-3 Explain the process of cost allocation.

LO 2-4 Understand how material, labor, and overhead costs are added to a product at each stage of the production process.

LO 2-5 Define basic cost behaviors, including fixed, variable, semivariable, and step costs.

LO 2-6 Identify the components of a product's costs.

LO 2-7 Understand the distinction between financial and contribution margin income statements.

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The Decision

"When I graduated in engineering several years ago, I knew I wanted to go to work in manufacturing. I found the idea of turning metal or plastic or wood into products that people could use every day was exciting to me. I started here at Three Rivers Fabrication in the design department, but have also worked in R&D and manufacturing. Now I have moved into management as the plant manager at our Peoria plant.

As an engineer, I just assumed that the cost information provided by finance was correct. Now I am seeing the details and having a difficult time understanding what all the cost terms mean. There seem to be many terms for the same thing. Unfortunately, none of them help me with the decisions I have to make. For example, we are always getting requests for quotes on products and I am not sure whether we are too high when we don't get the business or too low when we do.

I am meeting later this week with Angela Berroa, our plant comptroller. She laughed when I asked for the meeting and said not to worry—every plant manager she has worked for has had the same request. I hope so, because I need to review our financials with the area manager next week and I want to show that I am ready for this job."

Ingrid Jensen is the new plant manager at the Peoria plant of Three Rivers Fabrication. The plant makes parts for heavy equipment manufacturers selling in both the agricultural and construction markets. She has been promoted into this position based on her success in managing several important projects on some of the company's newest products. She is expected to ensure that Peoria maintains a comparative advantage in cost without losing their reputation for quality and innovation. She is hoping to learn more about the basics of costs and the terminology that cost accountants use so she can manage more effectively.

Calculating the Costs of E-Books versus Paper Books — *Business Application*

Companies are interested in the costs of their products and services for many reasons, including pricing. In computing costs, the format of the product might make a difference. For example, many books, such as the one you are reading, come in both print and electronic formats. If one format, electronic for example, is less costly than another (print), this might make it possible for the publisher to lower the price of the electronic version relative to the print version.

The question then is: What is the difference in cost of production between an electronic and printed version of a book? A recent article suggests the following. Based on the selling price, the publisher receives about 50 percent from the retailer. Another 12 to 13 percent covers the cost of production and distribution. Finally, design, editing, marketing, and so on, constitute another 7 percent. These percentages are based on a retail price of $26. Of course, as you will learn later in the chapter, many of these unit costs will change as the number of books produced and sold increase and also on the particular selling price.

For an electronic book distributed, for example, by Apple Inc., the publisher pays the seller 30 percent commission. Converting the text to electronic format, editing, and marketing costs constitute about 10 percent of the selling price.

These are just some of the costs, but the discussion provides an example of firms considering the type of cost (marketing, for example) and how those costs will change as volume changes. The discussion also illustrates how important it is to be careful when using unit costs that depend on production volumes.

Source: Rich, Motoko, "Math of Publishing Meets the E-Book," *The New York Times,* February 28, 2010.

Cost accounting systems provide information to help managers make better decisions. Managers who use cost accounting information to make decisions need to understand the cost terms used in their organizations. Because cost accounting systems are tailored to the needs of individual companies, several terms are used in practice to describe the same or similar cost concepts, depending on the use or the audience. Therefore, before we discuss the design of cost systems to aid decision making, we introduce a set of terms that will be used throughout the book. These terms are important to the discussion because they will be the "language" we use to communicate for the remainder of the book. These terms are

common, but they are not universal, so you need to be aware that a company you work for may use different terms for some of the concepts we discuss here.

In addition, managers need to understand how financial statements are commonly prepared because this will often be the primary form in which the information is available. The effects of the decisions made by managers are shown publicly in the firm's published financial statements.

Although these statements allow investors to evaluate the firm, they are not useful for managing the business. Because most of you are familiar with traditional financial statements, either from earlier course work in accounting, your own investment analysis, or access to publicly available financial statements, we start by linking the fundamental concepts of cost accounting to financial statements.

We discussed in Chapter 1 the differences between cost and financial accounting. Although the two systems serve different purposes, they are not completely separate. The financial statements prepared by the firm for external reporting use information from the cost accounting system. Fundamentally, the cost accounting system records and maintains the use of economic resources by the organization. We illustrate how resources are used and costs are added to a product or service in different types of industries and how the use (cost) of these resources is reported in the financial statements. We explain the types of costs that managers use in making decisions. Finally, we present several diagrams that will help you track the different components of a product's cost.

Exhibit 2.16 in the chapter summary highlights the most important cost concepts in this chapter; refer to it often as you review for exams or need a quick reference.

What Is a Cost?

LO 2-1
Explain the basic concept of "cost."

cost
Sacrifice of resources.

A **cost** is a sacrifice of resources. Every day, we buy many different things: clothing, food, books, music, perhaps an automobile, and so on. When we buy one thing, we give up (sacrifice) the ability to use these resources (typically cash or a line of credit) to buy something else. The price of each item measures the sacrifice we must make to acquire it. Whether we pay cash or use another asset, whether we pay now or later (by using a credit card), the cost of the item acquired is represented by what we forgo as a result.

Cost versus Expenses

expense
Cost that is charged against revenue in an accounting period.

It is important to distinguish cost from expense. An **expense** is a cost charged against revenue in an accounting period; hence, expenses are deducted from revenue in that accounting period. We incur costs whenever we give up (sacrifice) resources, regardless of whether we account for it as an asset or an expense. (We may even incur costs that the financial accounting system never records as an asset or expense. An example is lost sales.) If the cost is recorded as an asset (for example, prepaid rent for an office building), it becomes an expense when the asset has been consumed (i.e., the building has been used for a period of time after making the prepayment). In this book, we use the term *expense* only when referring to external financial reports.

The focus of cost accounting is on costs, not expenses. Generally accepted accounting principles (GAAP) and regulations such as the income tax laws specify when costs are to be treated as expenses. Although the terms *cost* and *expense* are sometimes used as synonyms in practice, we use *cost* in this book for all managerial purposes.

outlay cost
Past, present, or future cash outflow.

opportunity cost
Forgone benefit from the best (forgone) alternative course of action.

The two major categories of costs are *outlay costs* and *opportunity costs.* An **outlay cost** is a past, present, or future cash outflow. Consider the cost of a college education—clearly, the cash outflows for tuition, books, and fees are outlay costs. Cash is not all that college students sacrifice; they also sacrifice their time to get a college education. This sacrifice of time is an opportunity cost. **Opportunity cost** is the forgone benefit that

could have been realized from the best forgone alternative use of a resource.[1] For example, many students give up jobs to take the time to earn a college degree. The forgone income is part of the cost of getting a college degree and is the forgone benefit that could be realized from an alternative use of a scarce resource—time. These are other examples of opportunity costs:

- The opportunity cost of funds that you invest in a bank certificate of deposit is the forgone interest you could have earned on another security, assuming that both securities are equal in risk and liquidity.
- The opportunity cost of spending spring break in Florida is the forgone income from a temporary job; the opportunity cost of taking a temporary job during spring break is the forgone pleasure of a trip to Florida.
- The opportunity cost of time spent working on one question on an examination is the forgone benefit of time spent working on another question.

Of course, no one can ever know all of the possible opportunities available at any moment. Hence, some opportunity costs are undoubtedly not considered. Accounting systems typically record outlay costs but not opportunity costs. As a result, it is easy for managers to overlook or ignore opportunity costs in making decisions. A well-designed cost accounting system presents all relevant information to managers, including opportunity costs that they may otherwise ignore in decision making.

Presentation of Costs in Financial Statements

LO 2-2
Explain how costs are presented in financial statements.

We are concerned with information for use by managers. Therefore, when we present or discuss financial statements, we assume that the statements are prepared for internal management use, not for external reporting. We also focus on **operating profit,** the excess of operating revenues over the operating costs incurred to generate those revenues. This figure differs from net income, which is operating profit adjusted for interest, income taxes, extraordinary items, and other adjustments required to comply with GAAP or other regulations such as tax laws.

operating profit
Excess of operating revenues over the operating costs necessary to generate those revenues.

It is important to remember that information from the cost accounting system is just a means to an end; the final products are managerial decisions and actions (and the change in firm value) that result from the information generated by the system. We are not seeking the "most accurate" information; we are looking for the best information, understanding how the information is used in decision making, and recognizing the cost of preparing and using the information. The following sections present some examples of how cost information appears in financial statements prepared for managers. These are basic statements on which we build. As we proceed through the book, we show you how to improve these basic statements and the data they contain to make them more informative.

A generic income statement for a firm, a division, a product, or any unit is shown in Exhibit 2.1. It summarizes the revenues (sales) of the unit and subtracts the costs of the unit. The costs include the cost of the goods or service the activity sells. Although the basic form of the income statement is the same regardless of the product or service an organization sells, the details, especially with respect to costs, vary depending on how the organization acquires the resources used to produce the product or service.

In the sections that follow, we illustrate three types of income statements where the organization sells (1) a service, (2) a product that it acquires from another organization (a retailer), or (3) a product that it builds using materials from other organizations (a manufacturer). It is important to

Revenue	XXX
Costs.	YYY
Operating profit .	ZZZ

Exhibit 2.1
Generic Income Statement

[1] In some definitions, the *outlay* cost is also an opportunity cost because you forgo the use of the cash that could be used to purchase other goods and services. In this text, we reserve the use of the term *opportunity costs* to those costs that are not outlay costs.

remember, however, that most firms are made up of activities that combine features of all three types of activities. Even in a manufacturing firm, you might find income statements for a unit, such as repair services, that look like those of a service business.

Similarly, many service firms, such as those in financial services, have important transactions and billing functions that use repeatable, discrete processes, not unlike many manufacturing processes. Because service firms have no inventory to value, some firms have not taken steps to understand how these discrete processes are associated with costs. However, as competitive pressures force firms to become more efficient and effective, even service firms have started to understand how important it is to associate costs and revenues with the distinct services they provide so that they can better evaluate the value-added equation that we discussed in Chapter 1. Service firms are now adopting cost management practices that were originally developed in manufacturing. For example, banks and brokerage firms are using activity-based costing and distribution firms are using customer profitability analysis to disentangle selling, general, and administrative (SG&A) costs. The methods of cost analysis that were first developed in manufacturing are now being translated into services to meet the universal demands for understanding costs as a part of strategic management of the value proposition.

Service Organizations

A service company provides customers with an intangible product. For example, consulting firms provide advice and analyses. Traditionally, labor costs were the most significant cost category for most service organizations. However, as information services become increasingly important, this is changing. Some service firms provide information, and for these companies information technology can represent the major cost. Other firms provide information analysis, and for these firms labor costs will likely remain the most important single cost.

The costs associated with RPE Associates, a compensation consulting firm, are shown in the income statement in Exhibit 2.2. The line item cost of services sold includes the costs of *billable hours,* which are the hours billed to clients plus the cost of other items billed to clients (for example, charges for performing an information search or printing reports). Costs that are not part of services billable to clients are included in the marketing and administrative costs. At RPE, many managers report costs both in the cost of services sold (working with a client) and in marketing and administrative costs (developing project proposals for new business). The distinction is based on the nature of the work, not who performs the task.

Retail and Wholesale Companies

When you buy food, clothes, or a book, you are buying from a retail (or maybe a wholesale) firm. Retail and wholesale firms sell but do not make a tangible product. The income statement for these companies includes revenue and cost items as does that for service companies, but for retailers and wholesalers, it has an added category of cost information (called *cost of goods sold*) to track the cost of the tangible goods they buy and sell.

Exhibit 2.2
Income Statement for a Service Company

RPE ASSOCIATES
Income Statement
For the Year Ended December 31, Year 2
($000)

Sales revenue	$32,000
Cost of services sold	23,500
Gross margin	$ 8,500
Marketing and administrative costs	4,300
Operating profit	$ 4,200

SOUTHWEST OFFICE PRODUCTS
Income Statement
For the Year Ended December 31, Year 2
($000)

Sales revenue		$3,225
Cost of goods sold (see following statement)		1,775
Gross margin		$1,450
Marketing and administrative costs		825
Operating profit		$ 625

Cost of Goods Sold Statement
For the Year Ended December 31, Year 2
($000)

Beginning inventory		$ 300
Cost of goods purchased		
Merchandise cost	$1,830	
Transportation-in costs	90	
Total cost of goods purchased		1,920
Cost of goods available for sale		$2,220
Less cost of goods in ending inventory		445
Cost of goods sold		$1,775

Exhibit 2.3
Income Statement for a Merchandise Company

Southwest Office Products is a retail company that sells office supplies, such as paper products and computer accessories. The company's income statement and cost of goods sold statement are shown in Exhibit 2.3. The cost of goods sold statement shows how the cost of goods sold was computed. Exhibit 2.3 shows the following information for Southwest:

- It had a $300,000 beginning inventory on January 1. This represents the cost of the paper, writing supplies, toner cartridges, and other salable items on hand at the beginning of the year.
- The company purchased $1,830,000 of goods during the year and had transportation-in costs of $90,000. Therefore, its total cost of goods purchased was $1,920,000 (= $1,830,000 for the purchases + $90,000 for the transportation-in costs).
- Based on the information so far, Southwest had a $2,220,000 cost of items available for sale (= $1,920,000 total cost of goods purchased + $300,000 from beginning inventory). The $2,220,000 is the cost of the goods that the company *could* have sold, in other words, the cost of goods *available* for sale.

At the end of the year, the company still had on hand inventory costing $445,000. Therefore, Southwest sold items costing $1,775,000 (= $2,220,000 − $445,000).

The income statement summarizes Southwest's operating performance with the following information:

- Sales revenue for the year was $3,225,000.
- The cost of goods sold amount, $1,775,000, came from the cost of goods sold statement. Therefore, the gross margin (the difference between sales revenue and cost of goods sold) is $1,450,000 (= $3,225,000 sales revenue − $1,775,000 cost of goods sold). If you were Southwest's manager, you would know that, on average, every $1 of sales gave you about $0.45 (= $1,450,000 ÷ $3,225,000) to cover marketing and administrative costs and earn a profit.
- The income statement also shows that marketing and administrative costs were $825,000, and operating profits were $625,000 (= $1,450,000 gross margin—$825,000 marketing and administrative costs).

cost of goods sold
Expense assigned to products sold during a period.

The term **cost of goods sold** includes only the actual costs of the goods that were sold. It does not include the costs required to sell them such as the salaries of salespeople, which are marketing costs, or the salaries of top executives, which are administrative costs.

Compare the income statement for Southwest Office Products with that for the service company, RPE Associates (Exhibit 2.2). Like other retail and wholesale organizations, Southwest has an entire category of amounts that do not appear in a service company's income statement. This category appears in the cost of goods sold statement, which accounts for the inventories, purchases, and sales of tangible goods. By contrast, the service company does not "purchase" anything to be held in inventory until sold. Service companies are generally most interested in measuring the cost of providing services while retail and wholesale firms focus on two items. The gross margin reflects the ability to price the products, while the marketing and administrative costs reflect relative efficiency in operating the business itself.

Manufacturing Companies

You are probably acquainted with the term *cost of goods sold* from a financial accounting course. It is likely that most, if not all, of the examples you encountered in studying financial accounting were retail firms. The reason is that in financial accounting the focus is on preparing and presenting the statements. In a retail firm, the unit cost of an item sold is known because it was purchased from a third party. A manufacturing company has a more complex income statement than do service or retail/wholesale companies. Whereas the retailer/wholesaler *purchases* goods for sale, the manufacturer *makes* them. For decision making, it is not enough for the manufacturer to know how much it paid for a good; it must also know the different costs associated with making it.

product costs
Costs assigned to the manufacture of products and recognized for financial reporting when sold.

period costs
Costs recognized for financial reporting when incurred.

Financial reporting distinguishes costs in a manufacturing firm based on when the costs are recognized as expenses on the financial statements. **Product costs** are those costs assigned to units of production and recognized (expensed) when the product is sold. Product (manufacturing) costs follow the product through inventory. **Period costs** (nonmanufacturing costs) include all other costs and are expensed as they are incurred. Although we are not directly concerned with financial statement preparation in this book, the cost accounting system must be able to provide cost information for the financial reporting system.

Before we present example statements for a manufacturing firm, we need to define some additional terms.

Direct and Indirect Manufacturing (Product) Costs

direct manufacturing costs
Product costs that can be feasibly identified with units of production.

indirect manufacturing costs
All product costs except direct costs.

Product costs consists of two types—direct and indirect costs. **Direct manufacturing costs** are those product costs that can be identified with units (or batches of units) at relatively low cost. **Indirect manufacturing costs** are all other product costs. The glass in a light bulb is a direct cost of the bulb. The depreciation on the light bulb manufacturing plant is an indirect cost.

Direct costs are classified further into direct materials cost and direct labor cost. The manufacturer purchases materials (for example, unassembled parts), hires workers to convert the materials to a finished good, and then offers the product for sale. Thus, there are three major categories of product costs:

direct materials
Materials that can be identified directly with the product at reasonable cost.

direct labor
Labor that can be identified directly with the product at reasonable cost.

1. **Direct materials** that can be feasibly identified directly, at relatively low cost, with the product. (To the manufacturer, purchased parts, including transportation-in, are included in direct materials.) Direct materials are often called *raw materials.* Materials that cannot be identified with a specific product (for example, paper for plant reports, lubricating oil for machines) are included in category 3.
2. **Direct labor** of workers who can be identified directly, at reasonable cost, with the product. These workers transform the materials into a finished product.

3. All other costs of transforming the materials into a finished product, often referred to in total as **manufacturing overhead.** Some examples of manufacturing overhead follow.
   - *Indirect labor,* the cost of workers who do not work directly on the product yet are required so that the factory can operate, such as supervisors, maintenance workers, and inventory storekeepers.
   - *Indirect materials,* such as lubricants for the machinery, polishing and cleaning materials, repair parts, and light bulbs, which are not a part of the finished product but are necessary to manufacture it.
   - *Other manufacturing costs,* such as depreciation of the factory building and equipment, taxes on the factory assets, insurance on the factory building and equipment, heat, light, power, and similar expenses incurred to keep the factory operating.

manufacturing overhead
All production costs except direct labor and direct materials.

Although we use *manufacturing overhead* in this book, common synonyms used in practice are *factory burden, factory overhead, burden, factory expense,* and the unmodified word, *overhead.*

Prime Costs and Conversion Costs

You are likely to encounter the following two categories of costs in manufacturing companies: prime costs and conversion costs. **Prime costs** are the direct costs, namely, direct materials and direct labor. In some companies, managers give prime costs much attention because they represent 80 to 90 percent of total manufacturing costs.

In other cases, managers give most of their attention to **conversion costs**, which are the costs to convert direct materials into the final product. These are the costs for direct labor and manufacturing overhead. Managers who focus on conversion costs use a controllability argument: "We can manage conversion costs. Direct materials costs are mostly outside our control."

prime costs
Sum of direct materials and direct labor.

conversion costs
Sum of direct labor and manufacturing overhead.

Generally, companies with relatively low manufacturing overhead focus on managing prime costs. Companies that have high direct labor and/or manufacturing overhead tend to be more concerned about conversion costs. In practice, you have to determine the cost information that decision makers need to manage effectively. It is not only the relative magnitude of costs that matters in determining which costs to monitor. The important issue is identifying the most important costs over which the firm has control. For example, in some processing firms, the largest costs are the direct materials costs. However, because those materials are commodities with prices set in well-functioning markets, it may be infeasible to exercise much control over those costs other than monitoring usage.

Exhibit 2.4 summarizes the relation between conversion costs and the three elements of manufactured product cost: direct materials, direct labor, and manufacturing overhead.

Nonmanufacturing (Period) Costs

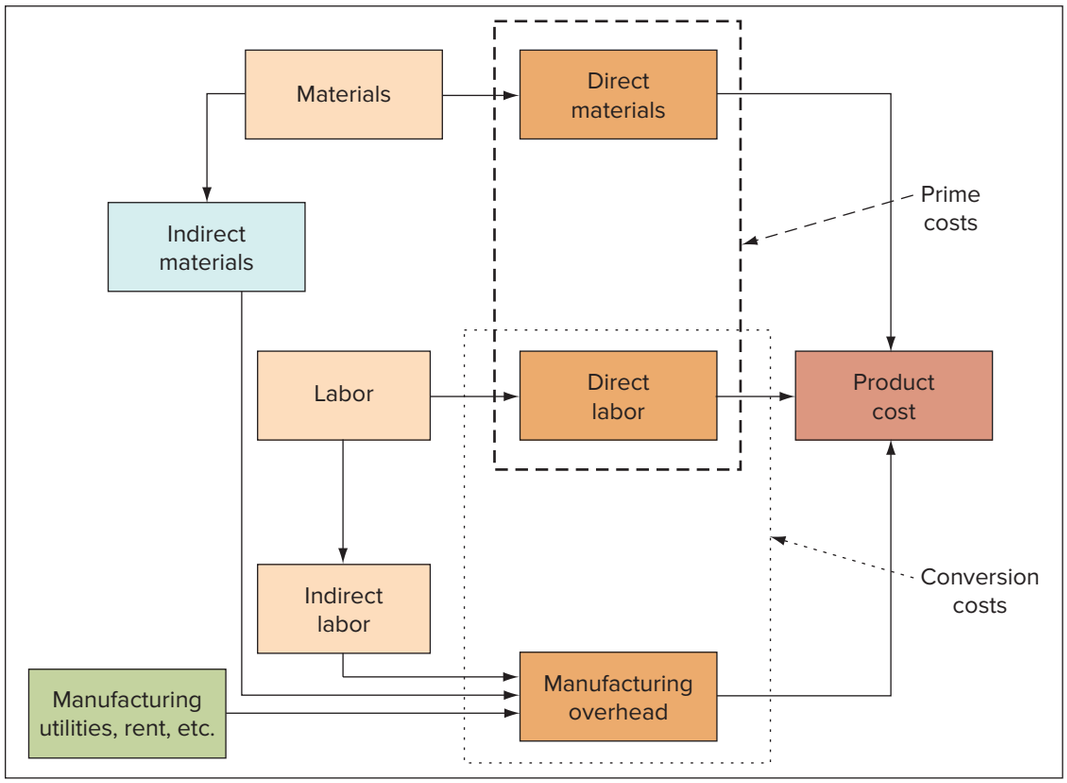
Nonmanufacturing costs have two elements: marketing costs and administrative costs. **Marketing costs** are the costs required to obtain customer orders and provide customers with finished products. These include advertising, sales commissions, shipping costs, and marketing departments' building occupancy costs. **Administrative costs** are the costs required to manage the organization and provide staff support, including executive and clerical salaries; costs for legal, financial, data processing, and accounting services; and building space for administrative personnel.

marketing costs
Costs required to obtain customer orders and provide customers with finished products, including advertising, sales commissions, and shipping costs.

administrative costs
Costs required to manage the organization and provide staff support, including executive salaries, costs of data processing, and legal costs.

Nonmanufacturing costs are expensed periodically (often in the period they are incurred) for financial accounting purposes. For managerial purposes, however, managers often want to see nonmanufacturing costs assigned to products. This is particularly true for commissions and advertising related to a specific product. For example, managers at consumer products companies such as Procter & Gamble and Anheuser-Busch want the cost of advertising a specific product, which can be substantial, to be assigned to that product. For most of our purposes, this distinction

Exhibit 2.4 Components of Manufactured Product Cost



between manufacturing and nonmanufacturing costs is artificial because we are interested in the costs that products and services impose on the firm, not in the financial accounting treatment of these costs.

Sometimes distinguishing between manufacturing costs and nonmanufacturing costs is difficult. For example, are the salaries of accountants who handle factory payrolls manufacturing or nonmanufacturing costs? What about the rent for offices for the manufacturing vice president? There are no clear-cut classifications for some of these costs, so companies usually set their own guidelines and follow them consistently.

Cost Allocation

LO 2-3
Explain the process of cost allocation.

cost allocation
Process of assigning indirect costs to products, services, people, business units, etc.

cost object
Any end to which a cost is assigned; examples include a product, a department, or a product line.

Many costs result from several departments sharing facilities (buildings, equipment) or services (data processing, maintenance staff). If you share an apartment with someone, the rent is a cost to the people sharing the apartment. If we want to assign costs to each individual, some method must be devised for assigning a share of the costs to each user. This process of assigning costs is called **cost allocation.**

We discuss implications of allocating costs throughout this book. However, cost allocation is a process that is familiar to most people, even those who do not study cost accounting. First, we need some definitions. A **cost object** is any end to which a cost is assigned, for example, a unit of product or service, a department, or a customer.

Managers make many decisions at the level of the cost object. Should we drop this *product*? How can we make this *customer* profitable? Costs in the **cost pool** are the costs we want to assign to the cost objects. Examples are department costs, rental costs, or travel costs a consultant incurs to visit multiple clients. The **cost allocation rule** is the method or process used to assign the costs in the cost pool to the cost object.

Consider the following simple example. Rockford Corporation has two divisions: East Coast (EC) and West Coast (WC). Computing services at Rockford are centralized and provided to the two divisions by the corporate Information Systems (IS) group. Total systems costs for the quarter are $1 million. Divisional financial statements are being prepared, and the accountant has asked for your help in allocating these costs to the divisions.

cost pool
Collection of costs to be assigned to the cost objects.

cost allocation rule
Method used to assign costs in the cost pool to the cost objects.

How would you suggest the accountant proceed? You might suggest that because there are two divisions, they share the costs equally, that is, each is charged $500,000 for IS services. The West Coast manager argues that this is unfair because WC is much smaller than EC. She argues that the allocation should be based on a measure of divisional size, such as revenues. The East Coast manager argues that this is not right because most of IS time is spent in the West Coast division, where the equipment is more complex and requires more maintenance. There is often no "right" way to solve this dilemma (but there may be some ways that result in poor decisions). As we will see throughout the book, the allocation of indirect costs can often lead to disputes both within the firm and between the firm and its customers. See the Business Application, Indirect Costs and Allocating Costs to Contracts, for an example.

Let's suppose the accountant chooses divisional revenue and that the revenue in EC is $80 million and the revenue in WC is $20 million. Then the allocation to the two divisions can be illustrated in the flowchart, or **cost flow diagram,** shown in Exhibit 2.5.

cost flow diagram
Diagram or flowchart illustrating the cost allocation process.

Because the East Coast division earns 80 percent (= $80 million of the total $100 million in revenues), it is assigned, or allocated, 80 percent of the IS costs, or $800,000 (= 80% of $1,000,000). Similarly, the West Coast division is assigned $200,000 (= 20% of $1,000,000). Many of the cost allocation methods we discuss are more complex than this simple example, but the fundamental approach is the same: (1) identify the cost objects, (2) determine the cost pools, and (3) select a cost allocation rule. We will make extensive use of cost flow diagrams such as the one in Exhibit 2.5 because they can help us understand (1) how a cost system works and (2) the likely effects on the reported costs of different cost objects from changes in the cost allocation rule.

Direct versus Indirect Costs

Any cost that can be unambiguously related to a cost object is a **direct cost** of that cost object. Those that cannot be unambiguously related to a cost object are **indirect costs.** We have already seen one use of this distinction in our discussion of manufacturing costs. Accountants use the terms *direct cost* and *indirect cost* much as a non-accountant might expect. One difficulty is that a cost may be direct to one cost object and indirect to another. For example, the salary of a supervisor in a manufacturing department is a direct cost of the department but an indirect cost of the individual items the department

direct cost
Any cost that can be directly (unambiguously) related to a cost object at reasonable cost.

indirect cost
Any cost that *cannot* be directly related to a cost object.

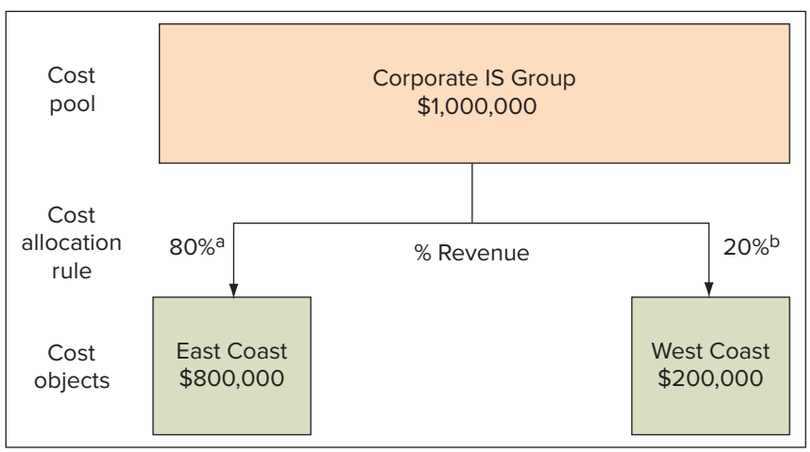


Exhibit 2.5
Cost Flow Diagram

[a] 80% = $80 million revenue ÷ ($80 million + $20 million)
[b] 20% = $20 million revenue ÷ ($80 million + $20 million)

produces. So when someone refers to a cost as either direct or indirect, you should immediately ask, direct or indirect with respect to what cost object? Units produced? A department? A division? (When we use *direct* and *indirect* to describe labor and materials, the cost object is the unit being produced.)

Whether a cost is considered direct or indirect also depends on the costs of linking it to the cost object. For example, it is possible to measure the amount of lubricating oil used to produce one unit by stopping the machine and measuring the amount of oil required to fill the reservoir. The cost of this is prohibitive in terms of lost production, so the oil cost is considered indirect.

Business Application Indirect Costs and Allocating Costs to Contracts

Many contracts, especially when selling to government agencies, specify prices based on the "cost" of the service or product. As we see in this section, when there are indirect costs, the calculated cost depends on how the indirect costs are allocated. When a company has multiple clients, it is possible that the choice of allocation method affects the prices (and profits) although the total costs have not changed. There is an incentive to allocate costs in a way to increase the company's profits. Depending on the terms of the contract, there can be both ethical and legal considerations in how indirect costs are allocated.

For example, the U.S. government is "conducting a civil and criminal investigation into Booz Allen Hamilton's cost accounting and indirect cost charging practices." When the news was released, Booz Allen Hamilton stock lost 12 percent of its value.

Source: Armental, Maria, "Justice Department Probing Booz Allen's Accounting, Billing Practices with U.S." *Wall Street Journal,* June 15, 2017.

Details of Manufacturing Cost Flows

LO 2-4
Understand how material, labor, and overhead costs are added to a product at each stage of the production process.

The Peoria Plant of Three Rivers Fabrication is the production facility of the company. It produces components such as pumps of various types (water, oil, fuel) for original equipment manufacturers (OEMs), such as automobile and farm equipment companies. Even if you have never been in a machine shop, you can imagine the process of making a pump. It would consist of three basic steps:

- First, you would see metal and plastic (direct material) being delivered to the receiving area, inspected, and then placed in the direct material inventory area (store) of the shop.
- Next, when it was time to produce pumps, the metal and plastic would be transported to an assembly line. It would be fed to large machines (presses, lathes, and so on) that would turn the unformed metal and plastic into the finished pump. While the metal is in this part of the factory, it is neither direct material nor a pump; it is **work in process.**
- Finally, the pump is complete, and it is moved out to a separate area in the factory with other completed products. These pumps are **finished goods** and ready for sale.

work in process
Product in the production process but not yet complete.

finished goods
Product fully completed, but not yet sold.

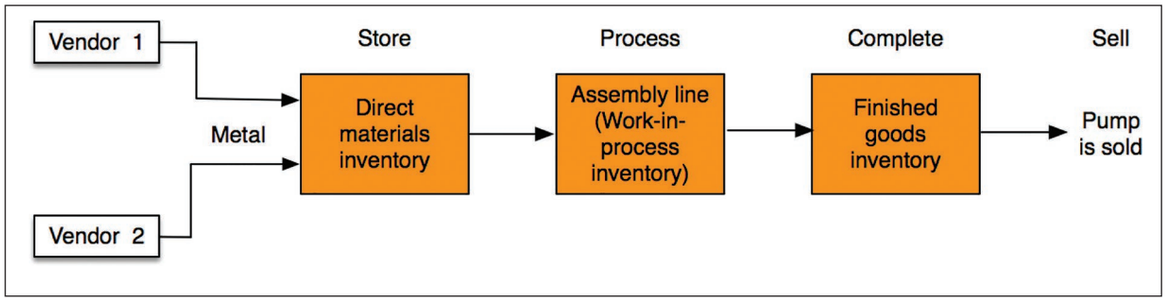
Just as the manufacturing plant at Three Rivers has direct material, work-in-process, and finished goods inventories, the cost accounting system at Three Rivers has three major categories of inventory accounts—one category for each of these three stages: Direct Materials Inventory, Work-in-Process Inventory, and Finished Goods Inventory. Our goal with the cost accounting system is simple: By tracing the physical flows with cost flows through the inventory accounts, we can represent the use of resources in the plant to produce the finished pumps.

Each inventory account is likely to have a beginning inventory amount, additions (debits) and withdrawals (credits) during the period, and an ending inventory based on what is still on hand at the end of the period. Those costs added (debited) to inventory accounts are called **inventoriable costs.**

inventoriable costs
Costs added to inventory accounts.

To show how this works, Exhibit 2.6 illustrates a simplified version of the actual production process at the Peoria Plant. It shows the stages of production from receipt of materials through manufacturing to shipment to the finished goods warehouse.

Exhibit 2.6 Production Process at the Peoria Plant



The Peoria Plant receives raw metal (steel, brass, etc.) at its Direct Materials Receiving Department. The people in this department are responsible for checking each order to be sure that it meets quality specifications and that the goods received are what were ordered.

If the Three Rivers uses just-in-time (JIT) inventory methods, people in direct materials receiving send the components—metals, plastics—to the machining line immediately.

If Three Rivers does not use JIT, people in this department send the components to a materials warehouse until it is needed for production. Any product that has been purchased but not yet transferred to manufacturing departments will be part of Direct Materials Inventory on the balance sheet at the end of the accounting period.

When the production process begins, the metal moves along the machining line as it is transformed (rods added to the pumps, individual bowls cut, and so on). Any pumps that are not complete—that is, those still on the machining line at the end of an accounting period—are part of Work-in-Process Inventory on the balance sheet.

After the completed pumps are inspected, they are moved to a holding area awaiting shipment to customers around the country. The cost of any product that is finished but not yet sold to customers is included in Finished Goods Inventory at the end of an accounting period.

How Costs Flow through the Statements

Income Statements

Now that we understand the physical flow of the product through the process, we can use a numerical example to show how to report revenues and expenses at Three Rivers Fabrication. The result is a typical income statement for a manufacturing company (see Exhibit 2.7). The income statement shows that Three Rivers generated sales revenue of $40,900,000, had cost of goods sold of $26,200,000, and incurred marketing and administrative costs of $7,700,000 for the year, thereby generating an operating profit of $7,000,000.

THREE RIVERS FABRICATION
Income Statement
For the Year Ending December 31, Year 2
($000)

Sales revenue	$40,900
Cost of goods sold (see Exhibit 2.8)	26,200
Gross margin	$14,700
Less marketing and administrative costs	7,700
Operating profit before taxes	$ 7,000

Exhibit 2.7
Income Statement for a Manufacturing Firm

Exhibit 2.8
Cost of Goods Manufactured and Sold Statement for a Manufacturing Firm

THREE RIVERS FABRICATION
Cost of Goods Manufactured and Sold Statement
For the Year Ending December 31, Year 2
($000)

Beginning work-in-process inventory, January 1			$540
Manufacturing costs during the year:			
Direct materials:			
Beginning inventory, January 1	$ 190		
Add purchases	11,254		
Direct materials available	$11,444		
Less ending inventory, Dec. 31	144		
Direct material put into production		$11,300	
Direct labor		2,440	
Manufacturing overhead		13,560	
Total manufacturing costs incurred			27,300
Total work-in-process during the year			$27,840
Less ending work-in-process inventory, December 31			620
Cost of goods manufactured			$27,220
Beginning finished goods inventory, January 1			840
Finished goods available for sale			$28,060
Less ending finished goods inventory, December 31			1,860
Cost of goods sold			$26,200

Cost of Goods Manufactured and Sold

We now demonstrate how to derive the cost of goods manufactured and sold amount on the income statement from the company's activities. The resulting statement is the cost of goods manufactured and sold statement, which appears in Exhibit 2.8. You will be able to see how these items appear in the cost of goods manufactured and sold statement if you track each amount from the following example in Exhibit 2.8.

Direct Materials

Assume the following for the company:

- Direct materials inventory on hand January 1 totaled $190,000.
- Materials purchased during the year cost $11,254,000.
- Ending inventory on December 31 was $144,000.
- Therefore, the cost of direct materials put into production during the year was $11,300,000, computed as follows (in thousands of dollars).

Beginning direct materials inventory, January 1	$ 190
Add purchases during the year	11,254
Direct materials available during the year	$11,444
Less ending direct materials inventory, December 31	144
Cost of direct materials put into production	$11,300

Work in Process

Consider the following:

- The Work-in-Process Inventory account had a beginning balance of $540,000 on January 1, as shown in Exhibit 2.8.

- Exhibit 2.8 shows that costs incurred during the year totaled $11,300,000 in direct materials (as shown in the preceding direct materials inventory schedule), $2,440,000 in direct labor costs, and $13,560,000 in manufacturing overhead. The sum of materials, labor, and manufacturing overhead costs incurred, $27,300,000, is the total manufacturing costs incurred during the year. Managers in production and operations give careful attention to these costs. Companies that want to be competitive in setting prices must manage these costs diligently.
- From here on the process can seem complicated, but it's not really so difficult if you realize that accountants are just adding and subtracting inventory values. In other words, just as materials, in different forms, are moving from one inventory in the plant to another, the costs in the cost accounting system are moving from one inventory account to another. Adding the $540,000 beginning work-in-process inventory to the $27,300,000 total manufacturing costs gives $27,840,000, the total cost of work in process during the year. This is a measure of the resources that have gone into production. Some of these costs were in the work-in-process inventory on hand at the beginning of the period (that is, the $540,000 in beginning inventory), but most have been incurred this year (that is, the $27,300,000 total manufacturing costs).
- At year-end, the work-in-process inventory has a $620,000 cost, which is subtracted to arrive at the cost of goods manufactured during the year: $27,220,000 (= $27,840,000 − $620,000), which represents the cost of pumps and other products finished during the year. Production departments usually have a goal for goods completed each period. Managers would compare the cost of goods manufactured to that goal to see whether the production departments were successful in meeting it.

Finished Goods Inventory

The work finished during the period is transferred from the production department to the finished goods storage area or is shipped to customers. If goods are shipped to customers directly from the production line, no finished goods inventory exists. Three Rivers has a finished goods inventory, however, because some of the products are common across manufacturers and so it keeps some of them on hand to expedite orders. Here's how the amounts appear on the financial statements:

- Exhibit 2.8 shows that Three Rivers had $840,000 of finished goods inventory on hand at the beginning of the year (January 1). From the discussion about work in process, we know that Three Rivers completed $27,220,000 worth of product, which was transferred to finished goods inventory. Therefore, Three Rivers had $28,060,000 finished goods inventory available for sale, in total.
- Of the $28,060,000 available, Three Rivers had $1,860,000 finished goods still on hand at the end of the year. This means that the cost of goods sold was $26,200,000 (= $28,060,000 available − $1,860,000 in ending inventory).

Cost of Goods Manufactured and Sold Statement

As part of its internal reporting system, Three Rivers prepares a cost of goods manufactured and sold statement (Exhibit 2.8). Such statements are for managerial use; you will rarely see one published in external financial statements. Exhibit 2.8 incorporates and summarizes information from the preceding discussion.

Manufacturing companies typically prepare a cost of goods manufactured and sold statement to summarize and report manufacturing costs such as those discussed for Three Rivers Fabrication, most often for managers' use. Some companies have experimented with preparing these statements for production workers and supervisors, who in some cases have found them effective communication devices once these people learn how to read them. For example, managers at Three Rivers use the cost of goods manufactured and sold statement to communicate the size of manufacturing overhead and inventories to stimulate creative ideas for reducing these items.

The cost of goods manufactured and sold statement in Exhibit 2.8 has three building blocks. The first reports the cost of direct materials. Next is the work-in-process account with its beginning balance, costs added during the period, ending balance, and cost of goods manufactured. Third, the statement reports the beginning and ending finished goods inventory and cost of goods sold.

These financial statements are presented in a standard format that you will find used by many companies and on the CPA and CMA examinations. Please be aware that we discuss many variations in this book, but many more exist in practice. For example, some companies prepare separate statements of cost of goods sold and cost of goods manufactured. It is important that financial statements effectively present the information that best suits the needs of your customers or information users (for example, managers of your company or your clients). For managerial purposes, it is important that the format of financial statements be tailored to what users want (or to what you want if you are the user of financial information).

Self-Study Questions

1. A review of accounts showed the following for Pacific Parts for last year.

Administrative costs	$1,216,000
Depreciation, manufacturing	412,000
Direct labor	1,928,000
Direct materials purchases	1,252,000
Direct materials inventory, January 1	408,000
Direct materials inventory, December 31	324,000
Finished goods inventory, January 1	640,000
Finished goods inventory, December 31	588,000
Heat, light, and power—plant	348,000
Marketing costs	1,088,000
Miscellaneous manufacturing costs	48,000
Plant maintenance and repairs	296,000
Sales revenue	8,144,000
Supervisory and indirect labor	508,000
Supplies and indirect materials	56,000
Work-in-process inventory, January 1	540,000
Work-in-process inventory, December 31	568,000

Prepare an income statement with a supporting cost of goods manufactured and sold statement. Refer to Exhibits 2.7 and 2.8.

2. Using the data from question 1, place dollar amounts in each box in Exhibit 2.4.

The solutions to these questions are at the end of this chapter.

An Interim Debrief

Ingrid Jensen and Angela Berroa take a break from their meeting. Ingrid summarizes what she has learned so far:

> "Learning the cost terms will really help me communicate with both Angela and the finance staff at corporate. One important lesson I learned is that there are different costs for different purposes. Financial reporting is important, but for the day-to-day management of the plant, I am going to need more detailed cost information.
>
> I also have a better understanding of the different types of costs. It really helped to see how these costs are related to the production flow; that's something I understand. I understand now why some of these costs are not useful for managing the plant. For example, I know that for any decision I might make, some of the costs—plant supervision, for example—are not likely to change. When Angela returns, I am going to find out how to identify the costs that will be important for my decisions and how I can get the cost information summarized in a way that helps me."

Manufacturing or Service: Not Always Clear *Business Application*

Although we think of companies as either manufacturing or service firms, the distinction is not always clear. This is especially true as technology is making it much less expensive for manufacturers to monitor their customers' use of the product. Monitoring the use of an automobile or a piece of heavy equipment, manufacturing firms use the information to sell additional services. These might include upgrades to automobile systems over the Internet or repair services to companies whose equipment is about to fail.

For example, Joy Global Inc., a unit of Komatsu Global, can connect mining equipment to the company's Smart Services program, which monitors performance. Although only a relatively small part of the business, "executives consider it a growth business for a company where 65 percent of sales now come from service and replacement parts, after soft markets for mined commodities choked off demand for new equipment."

Source: Tita, Bob, "Big Data Gives Manufacturers a New Revenue Source," *Wall Street Journal,* June 2, 2015.

Cost Behavior

LO 2-5
Define basic cost behaviors, including fixed, variable, semivariable, and step costs.

The financial statements of Three Rivers Fabrication report what happened, but they fail to show why. For that, we need to understand how costs behave and how managers analyze costs to arrive at their decisions. Managerial decisions lead to the activities that the firm undertakes, and these activities create (or destroy) the value in an organization. Information from the cost accounting system is a key ingredient in making these decisions.

Cost behavior deals with the way costs respond to changes in activity levels. Throughout this book, we refer to the idea of a cost driver. As defined in Chapter 1, a cost driver is a factor that causes, or "drives," costs. For example, the cost driver for the cost of lumber for the activity of building a house could be the number of board feet of lumber used or the size of the house in square feet. The cost driver for direct labor costs could be the number of labor-hours worked.

Managers need to know how costs behave to make informed decisions about products, to plan, and to evaluate performance. We classify the behavior of costs as being in one of four basic categories: fixed, variable, semivariable, and step costs, as discussed next.

Fixed versus Variable Costs

Suppose that management contemplates a change in the volume of a company's activity. Some questions different managers might ask follow:

- *An operations manager at United Airlines*: How much will our costs decrease if we reduce the number of flights by 5 percent?
- *A manager at the U.S. Postal Service*: How much will our costs decrease if we eliminate Saturday deliveries?
- *A business school dean:* How much will costs increase if we reduce average class size by 10 students by increasing the number of classes offered?

fixed costs
Costs that are unchanged as volume changes within the relevant range of activity.

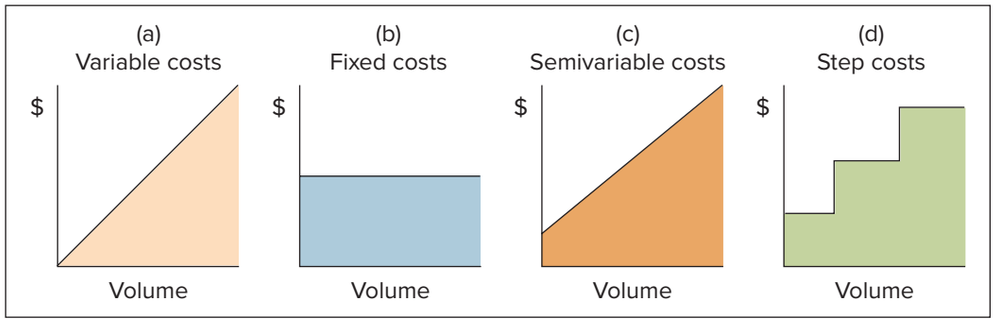
variable costs
Costs that change in direct proportion with a change in volume within the relevant range of activity.

To answer questions such as these, we need to know which costs are **fixed costs** that remain unchanged as the volume of activity changes and which are **variable costs** that change in direct proportion to the change in volume of activity.

If the activity is producing units, variable manufacturing costs typically include direct materials, certain manufacturing overhead (for example, indirect materials, materials-handling labor, energy costs), and direct labor in some cases (such as temporary workers). Certain nonmanufacturing costs such as distribution costs and sales commissions are typically variable. Much of manufacturing overhead and many nonmanufacturing costs are typically fixed costs.

For Air France, the cost of executive salaries is fixed. The cost of fuel is variable per hour or per mile flown. ©Royalty-Free/Corbis

Exhibit 2.9 Four Cost Behavior Patterns



Although labor has traditionally been considered a variable cost, today the production process at many firms is capital intensive, and the amount of labor required is not sensitive to the amount produced. In a setting in which a fixed amount of labor is needed only to keep machines operating, labor is probably best considered to be a fixed cost.

In merchandising, variable costs include the cost of the product and some marketing and administrative costs. All of a merchant's product costs are variable. In manufacturing, a portion of the product cost is fixed. In service organizations, variable costs typically include certain types of labor (such as temporary employees), supplies, and copying and printing costs. Exhibit 2.9 depicts (a) variable cost behavior, and (b) fixed cost behavior. Note in the graph that volume is on the horizontal axis, and total costs (measured in dollars) are on the vertical axis. Item (a) shows that total variable costs increase in direct proportion to changes in volume. Thus, if volume doubles, total variable costs also double. Item (b) shows that fixed costs are at a particular level and do not increase as volume increases.

The identification of a cost as fixed or variable is valid only within a certain range of activity. For example, the manager of a restaurant in a shopping mall increased the capacity from 150 to 250 seats, requiring an increase in rent costs, utilities, and many other costs. Although these costs are usually thought of as fixed, they change when activity moves beyond a certain range. This range within which the total fixed costs and unit variable costs do not change is called the **relevant range.**

relevant range
Activity levels within which a given total fixed cost or unit variable cost will be unchanged.

Four aspects of cost behavior complicate the task of classifying costs into fixed and variable categories. First, not all costs are strictly fixed or variable. For example, electric utility costs may be based on a fixed minimum monthly charge plus a variable cost for each kilowatt-hour. Such a **semivariable cost** has both fixed and variable components. Semivariable costs, also called *mixed costs*, are depicted in Exhibit 2.9 (c).

semivariable cost
Cost that has both fixed and variable components; also called *mixed cost.*

Second, some costs increase with volume in "steps." **Step costs,** also called *semifixed costs,* increase in steps as shown in Exhibit 2.9 (d). For example, one supervisor might be needed for up to four firefighters in a fire station, two supervisors for five to eight, and so forth as the number of firefighters increases. The supervisors' salaries represent a step cost.

step cost
Cost that increases with volume in steps; also called *semifixed cost.*

Third, as previously indicated, the cost relations are valid only within a relevant range of activity. In particular, costs that are fixed over a small range of activity are likely to increase over a larger range of activity.

Finally, the classification of costs as fixed or variable depends on the measure of activity used. For example, at Three Rivers, part of the production cost is setting up the machines to run a specific part. Plant engineers have to calibrate the machine for each production run, but each run can produce up to 4,000 parts. If production volume is the activity measure, then the plant engineer costs are a step cost. However, if the number of production runs is the activity measure, then the plant engineer costs are variable; they spend the same amount of time for each run.

Understanding cost behavior is an important part of using cost accounting information wisely for decisions. Consider a recent example at Three Rivers. Calumet Tractors, a

	A	B	C	D
1	Cost Item	Amount		Notes
2	Develop production specifications for CT-24SF	$ 2,000		This is a one-time expenditure for drawings.
3	Direct materials (metal)	10.00		This is the cost per pump.
4	Direct labor	2.00		This is the cost per pump.
5	Set-up machinery	1,000		Up to 5,000 pumps can be produced in a single production run.
6	Inspect pumps: Equipment	500		A new measuring device is required.
7	Labor	0.25		Per pump.
8				

Exhibit 2.10
Cost Data for Price Quotation

longtime customer of Three Rivers, has requested a price quotation from Three Rivers for a modified version of a common water pump. The modified pump is the CT-24SF. Calumet wants the quotation to cover a volume of CT-24SF pumps from 4,000 to 7,500, because it is not sure of its final requirement.

Angela Berroa, the plant controller, has prepared the preliminary cost data in Exhibit 2.10 for Mark Mays, the Three Rivers sales representative for Calumet. The cost for developing production specifications is fixed. It does not depend on the volume of pumps actually produced. The direct materials and the direct labor costs are variable. They increase proportionately with volume.

The cost for setting up the machinery is neither fixed nor variable with respect to volume. The setup costs are semifixed—they are incurred to set up the initial production run, and then they are not affected by production until 5,000 pumps have been produced. To produce more than 5,000 pumps, another fixed amount must be spent. The inspection costs are semivariable. The new measuring device is a fixed cost and the $0.25 per part is variable.

Components of Product Costs

LO 2-6
Identify the components of a product's cost.

We have now seen that various concepts of costs exist. Some are determined by the rules of financial accounting. Some are more useful for managerial decision making. In this section, we develop several diagrams to explain various cost concepts and identify the differences.

Starting with Exhibit 2.11, assume that Three Rivers Fabrication estimates the cost to produce a specialized tractor pump during year 3. The **full cost** to manufacture and sell one pump is estimated to be $40, as shown on the left side of Exhibit 2.11. The unit cost of manufacturing the pump is $29, also shown on the left side of the exhibit. (One unit is one pump.) This full cost of manufacturing the one unit is known as the **full absorption cost.** It is the amount of inventoriable cost for external financial reporting according to GAAP. The full absorption cost "fully absorbs" the variable and fixed costs of manufacturing a product.

full cost
Sum of all fixed and variable costs of manufacturing and selling a unit.

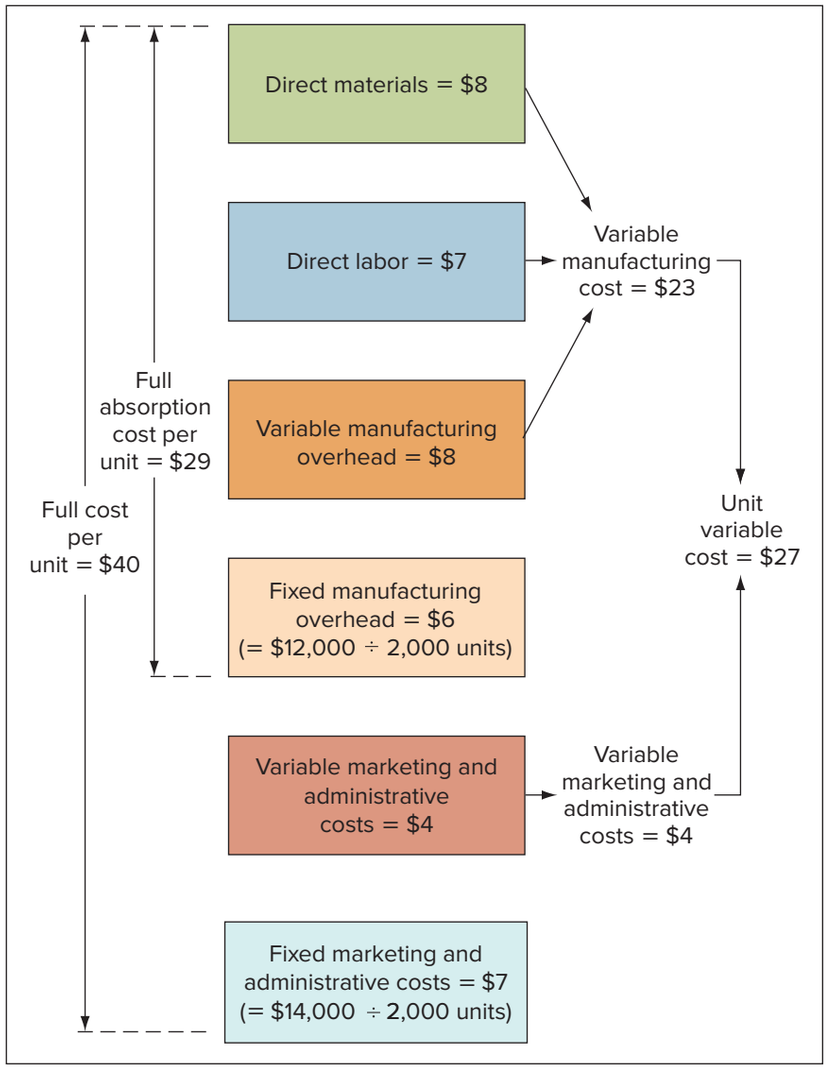
full absorption cost
All variable and fixed manufacturing costs; used to compute a product's inventory value under GAAP.

The full absorption cost excludes nonmanufacturing costs, however, so marketing and administrative costs are not inventoriable costs. These nonmanufacturing costs equal $11 per unit, which is the sum of the two blocks at the bottom of Exhibit 2.11.

The variable costs to make and sell the product are variable manufacturing costs, $23 per unit, and variable nonmanufacturing costs, $4 per unit. Variable nonmanufacturing costs could, in general, be either administrative or marketing costs. For Three Rivers, variable nonmanufacturing costs are primarily selling costs. In other cases, variable administrative costs could include costs of data processing, accounting, or any administrative activity that is affected by volume.

Exhibit 2.11 also includes unit fixed costs. The unit fixed costs are valid only at one volume—2,000 units (of this pump) per year—for Three Rivers. By definition, total fixed costs do not change as volume changes (within the relevant range, of course). Therefore, a change in volume results in a change in the unit fixed cost, as demonstrated by Self-Study Question 3.

Exhibit 2.11
Product Cost Components—Three Rivers Fabrication



Unit Fixed Costs Can Be Misleading for Decision Making

When analyzing costs for decisions, you should use unit fixed costs very carefully. Many managers fail to realize that they are valid at only one volume. When fixed costs are allocated to each unit, accounting records often make the costs appear as though they are variable. For example, allocating some of factory rent to each unit of product results in including rent as part of the "unit cost" even though the total rent does not change with the manufacture of another unit of product. Cost data that include allocated common costs therefore may be misleading if used incorrectly. The following example demonstrates the problem.

One of the parts Three Rivers sells has a unit manufacturing cost of $2.80 ($1.50 per unit variable manufacturing cost + $1.30 per unit fixed manufacturing cost), computed as follows (each part is one unit).

Variable manufacturing costs per unit	$1.50
Fixed manufacturing costs:	
Unit cost = $\frac{\text{Fixed manufacturing cost per month}}{\text{Units produced per month}} = \frac{\$130{,}000}{100{,}000 \text{ units}} =$	1.30
Total unit cost used as the inventory value for external financial reporting	$2.80

Three Rivers received a special order for 10,000 parts at $2.75 each. These units could be produced with currently idle capacity. Marketing, administrative, and the total fixed manufacturing costs of $130,000 would not be affected by accepting the order, nor would accepting this special order affect the regular market for this part.

Marketing managers believed the special order should be accepted as long as the unit price of $2.75 exceeded the cost of manufacturing each unit. When the marketing managers learned from accounting reports that the inventory value was $2.80 per unit, their initial reaction was to reject the order because, as one manager stated, "We are not going to be very profitable if our selling price is less than our production cost!"

Fortunately, some additional investigation revealed the variable manufacturing cost to be only $1.50 per unit. Marketing management accepted the special order, which had the following impact on the company's operating profit.

Revenue from special order (10,000 units × $2.75)	$27,500
Variable costs of making special order (10,000 units × $1.50)	15,000
Contribution of special order to operating profit	$12,500

The moral of this example is that it is easy to interpret unit costs incorrectly and make incorrect decisions. In this example, fixed manufacturing overhead costs had been allocated to units, most likely to value inventory for external financial reporting and tax purposes. The resulting $2.80 unit cost appeared to be the cost to produce a unit. Of course, only $1.50 was a per unit variable cost; the $130,000 per month fixed cost would not be affected by the decision to accept the special order.

Self-Study Question

3. Refer to the Three Rivers example in Exhibit 2.11 that is based on a volume of 2,000 units per year. Assume the same total fixed costs and unit variable costs but a volume of only 1,600 units. What are the fixed manufacturing costs per unit and the fixed marketing and administrative costs per unit?

The solution to this question is at the end of this chapter.

Exhibits 2.12 and 2.13 are designed to clarify definitions of gross margin, contribution margin, and operating profit. You may recall from your study of financial accounting statements that the **gross margin** appears on external financial statements as the difference between revenue and cost of goods sold. We refer to this format as a *traditional income statement.* Cost of goods sold is simply the full absorption cost per unit times the number of units sold. Exhibit 2.12 presents the gross margin per unit for the pumps that Three Rivers produces and sells for $45 each.

gross margin
Revenue – Cost of goods sold on income statements. Per unit, the gross margin equals Sales price – Full absorption cost per unit.

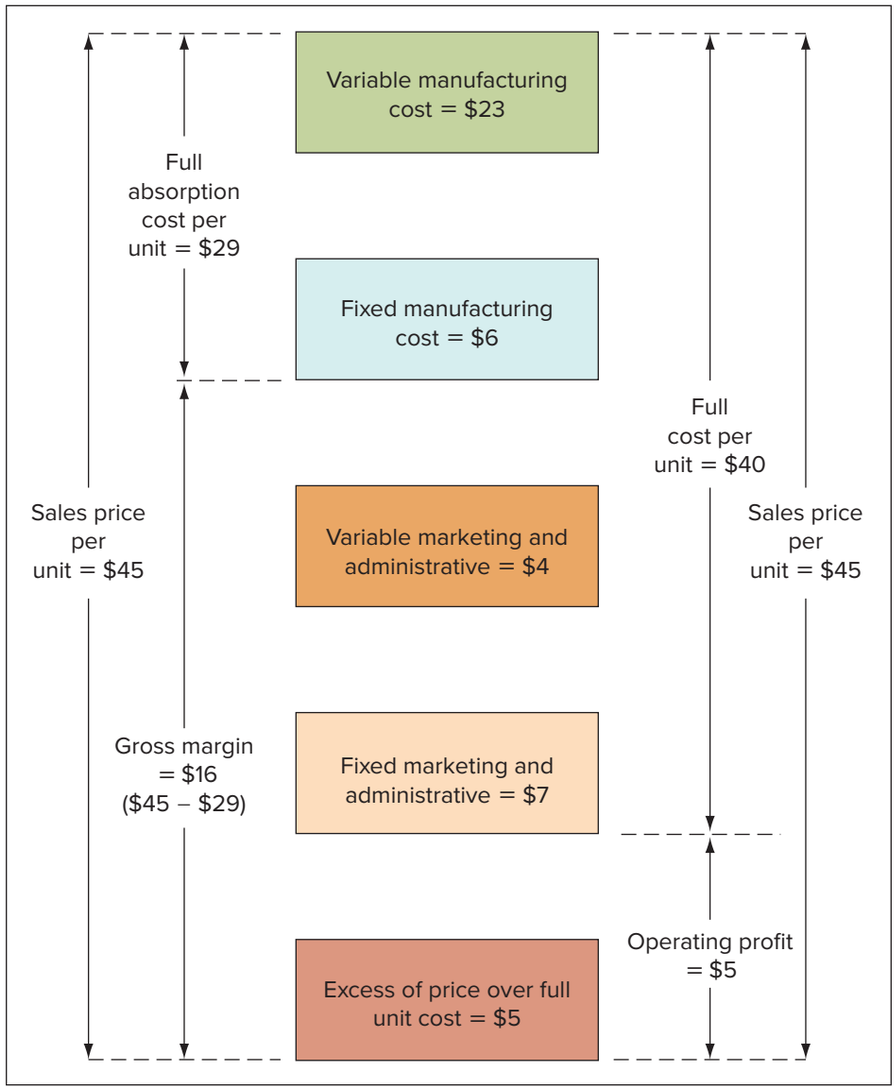
Recall from Exhibit 2.11 that each pump is estimated to have a $29 full absorption cost. Therefore, the gross margin per unit is $16 (= $45 − $29). The operating profit per unit is the difference between the sales price and the full cost of making and selling the product. For Three Rivers, Exhibit 2.12 shows the operating profit per unit to be $5 (= $45 sales price − $40 full cost).

Exhibit 2.13 also shows the contribution margin per unit. On a per unit basis, the **contribution margin** is the difference between the sales price and the variable cost per unit. Think of the contribution margin as the amount available to cover fixed costs and earn a profit.

contribution margin
Sales price – Variable costs per unit.

The contribution margin is important information for managers because it allows them to assess the profitability of products before factoring in fixed costs (which tend to be more difficult to change in the short run). For example, a coffee shop sells both drip coffee and espresso drinks. A cup of drip coffee sells for $1.50 and a cappuccino sells for $2.50. Which product contributes more per unit to profits? Answer: We don't know until we know the contribution margin per unit for each product. Suppose that the variable cost

Exhibit 2.12
Gross Margin per Unit—Three Rivers Fabrication



per cup is $0.25 for drip coffee and $1.50 for cappuccino. Then the contribution margins (per unit) are as follows:

- Drip coffee $1.25 (= $1.50 sales price − $0.25 variable cost).
- Cappuccino $1.00 (= $2.50 sales price − $1.50 variable cost).
- Although the cappuccino sells for more, the drip coffee provides a higher contribution per unit toward covering fixed costs and earning a profit.

Self-Study Questions

Refer to the Three Rivers examples in Exhibits 2.12 and 2.13.

4. Assume that the variable marketing and administrative cost falls to $3 per unit; all other cost numbers remain the same. What are the new gross margin, contribution margin, and operating profit amounts?

5. Assume that the fixed manufacturing cost dropped from $12,000 to $10,000 in total, or from $6 to $5 per unit. All other unit cost numbers remain the same as in Exhibits 2.12 and 2.13. What are the new gross margin, contribution margin, and operating profit amounts?

The solutions to these questions are at the end of the chapter.

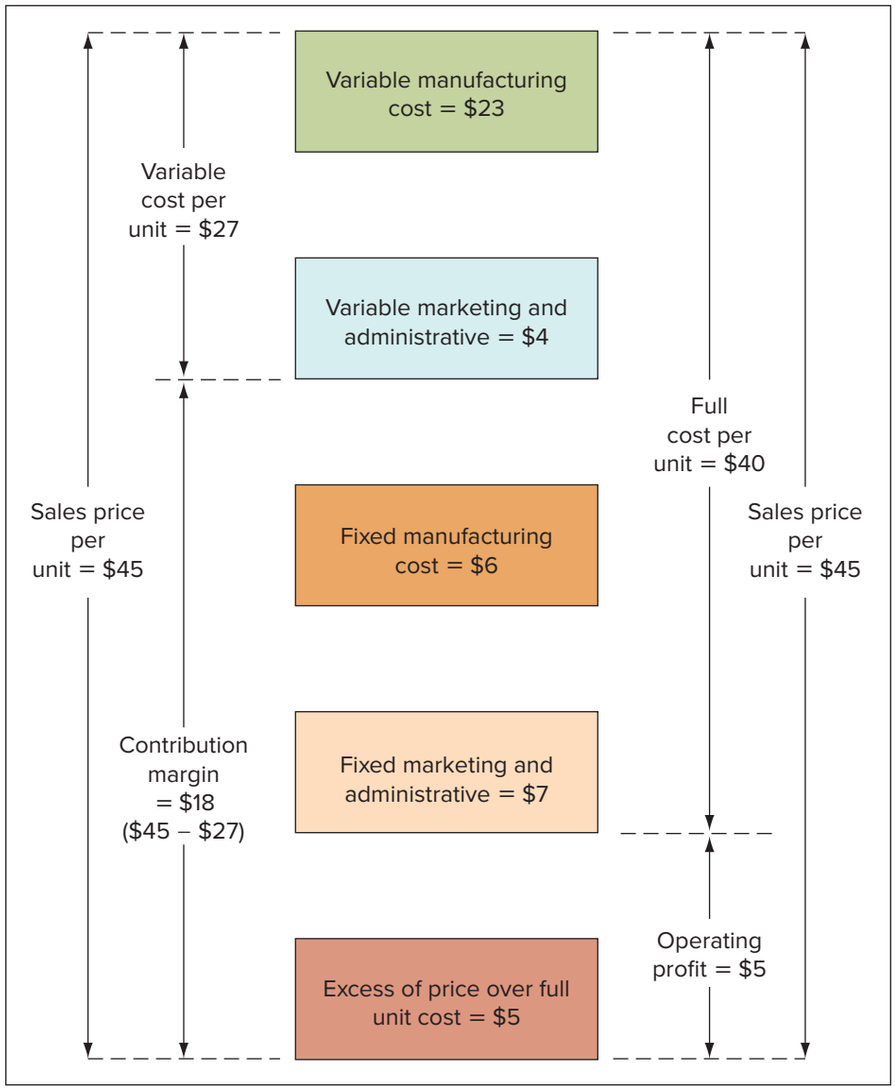


Exhibit 2.13
Contribution Margin per Unit—Three Rivers Fabrication

How to Make Cost Information More Useful for Managers

LO 2-7
Understand the distinction between financial and contribution margin income statements.

As discussed earlier, cost accountants divide costs into product or period categories. In general, product costs are more easily attributed to products; period costs are more easily attributed to time intervals. Once product costs are defined, all other costs are assumed to be period costs. It is important to note, however, that the determination of product costs varies, depending on the approach used. Three common approaches are outlined here:

- *Full absorption costing (traditional income statement).* Under this approach required by GAAP, all fixed and variable manufacturing costs are product costs. All other costs are period costs.
- *Variable costing (contribution margin income statement).* Using this approach, only variable manufacturing costs are product costs. All other costs are period costs.
- *Managerial costing.* This approach assumes that management determines which costs are associated with the product and should be considered product costs. Management asks whether adding a product will incur new costs. Any new costs are considered *product costs.* For example, management could decide that promotional

campaigns associated with a new product are product costs. Under the other two approaches, promotional costs would be period costs. Clearly, the managerial costing approach to defining product costs is subjective and depends on management's use of cost information.

Gross Margin versus Contribution Margin Income Statements

A traditional income statement using full absorption costing (the first approach in the list) and a contribution margin income statement using variable costing (the second approach) for a special order of pumps are shown in Exhibit 2.14. The data come from Exhibits 2.12 and 2.13, but unit costs are multiplied by 2,000 pumps to give total amounts for year 3. Operating profit is the same for each approach because total units produced equal total units sold, but note the difference in product costs on each statement. We do not provide an income statement example for the third approach (managerial costing) because the treatment of product costs using this approach varies from one company to the next.

Product costs for units not yet sold are assigned to inventory and carried in the accounts as assets. When the goods are sold, the costs flow from inventory to the income statement. At that time, these previously inventoried costs become expenses.

Developing Financial Statements for Decision Making

While the gross margin and contribution margin statements illustrated in Exhibit 2.14 are common, there is no reason to restrict managers to these statements. The goal of the cost accounting system is to provide managers with information useful for decision making. In designing the cost accounting system, we determine the information that managers use in making decisions and then provide it to them in ways that support their work.

For example, many firms are concerned with ensuring that the activities they undertake add value to their product or service. If this is important to managers for making decisions, we can develop financial statements that classify costs into value-added or nonvalue-added categories. By classifying activities as value added or nonvalue added, managers are better able to reduce or eliminate nonvalue-added activities and therefore reduce costs.

Suppose that Ingrid Jensen, the plant manager of Three Rivers, wants to know which costs add value in the case of the special order. The controller reviews production activities and related costs in detail for the order and prepares the value income statement shown in Exhibit 2.15. The data come from Exhibit 2.14. However, costs are shown in greater detail and separated into nonvalue-added and value-added categories. For example, variable marketing and administrative costs of $8,000 from Exhibit 2.14 are shown as two line items under variable marketing and administrative costs in Exhibit 2.15: marketing and administrative services used to sell products totaling $6,000 and marketing and

Exhibit 2.14 Gross Margin versus Contribution Margin Income Statements

Gross Margin Income Statement		Contribution Margin Income Statement	
Sales revenue	$90,000	Sales revenue	$90,000
Variable manufacturing costs	46,000	Variable manufacturing costs	46,000
Fixed manufacturing costs	12,000	Variable marketing and administrative costs	8,000
Gross margin	$32,000	Contribution margin	$36,000
Variable marketing and administrative costs	8,000	Fixed manufacturing costs	12,000
Fixed marketing and administrative costs	14,000	Fixed marketing and administrative costs	14,000
Operating profit	$10,000	Operating profit	$10,000

Exhibit 2.15 Value Income Statement

THREE RIVERS FABRICATION
Value Income Statement Special Order
For the Year Ending December 31, Year 3

	Nonvalue-Added Activities	Value-Added Activities	Total
Sales revenue		$90,000	$90,000
Variable manufacturing costs			
Materials used in production		15,000	15,000
Materials waste	$ 1,000		1,000
Labor used in production		11,500	11,500
Labor used to rework products	2,500		2,500
Manufacturing overhead used in production		15,500	15,500
Manufacturing overhead used to rework products	500		500
Variable marketing and administrative costs			
Marketing and administrative services used to sell products		6,000	6,000
Marketing and administrative services used to process returned products	2,000		2,000
Contribution margin	$(6,000)	$42,000	$36,000
Fixed manufacturing			
Fixed manufacturing costs used in production		10,500	10,500
Salaries of employees reworking products	1,500		1,500
Fixed marketing and administrative costs			
Marketing and administrative services used to sell products		13,500	13,500
Marketing and administrative services used to process returned products	500		500
Operating profit (loss)	$(8,000)	$18,000	$10,000

administrative services used to process returned products totaling $2,000. The value income statement outlines costs linked to three segments of the value chain: production, marketing, and distribution. Remember that the primary idea of the value chain is that value is added to the product in each business function. The goal is to maximize value-added activities and minimize nonvalue-added activities.

The controller identifies nonvalue-added activities associated with two areas—materials waste and reworked products. *Materials waste* refers to material that was thrown away because of incorrect cuts or defective material. *Reworked products* consist of products that have been manufactured incorrectly (for example, incorrect pump size or number of teeth) and have to be fixed (or reworked). Costs to rework products are generally incurred by the production, marketing, and administration departments. Marketing gets involved because failure detection sometimes does not occur until the customer returns the goods. Thus, nonvalue-added activities are not limited to production.

Assume that the company sold 2,000 units in year 3, and the controller uses the per unit costs outlined in Exhibit 2.13. The controller's value income statement shows total nonvalue-added activities to be $8,000. This amount is only 10 percent of total costs but is 80 percent of operating profit. Clearly, reducing nonvalue-added activities could significantly increase profits.

Reducing nonvalue-added activities is not a simple task. For example, how should the production process be changed to reduce materials waste? Should higher-quality materials be purchased, resulting in higher direct materials costs? Or should production personnel be trained and evaluated based on materials wasted? However, providing the information highlights the problem and the potential effect that changes could have on firm performance. Depending on the business and strategic environment of the firm, we could construct financial statements around activities related to quality, environmental compliance, or new product development.

The Debrief

Ingrid Jensen studied the value income statement (Exhibit 2.15) and commented:

> *"This is exactly the type of information I need to manage the plant. It is clear that one of my first priorities has to be improving quality. With the traditional financial statements I would not have seen the opportunity for increasing value. My production supervisor and I were aware, of course, that we had some waste associated with scrap and rework, but until we put a value on it I wasn't sure how important a problem it was. When we get that additional manufacturing back here, we will have a much better chance of keeping it here."*

SUMMARY

The term *cost* is ambiguous when used alone; it has meaning only in a specific context. The adjectives used to modify *cost* constitute that context. Exhibit 2.16 summarizes definitions of the word. It is important to consider how the use of these terms in cost accounting differs from common usage. For example, in common usage, a variable cost may vary with anything (geography, temperature, and so forth). In cost accounting, variable cost depends solely on volume.

Exhibit 2.16
Summary of Cost Terms and Definitions

Nature of Cost	
Cost	A *sacrifice* of resources.
Opportunity cost	The forgone benefit from the best (forgone) alternative course of action.
Outlay cost	A past, present, or future cash outflow.
Expense	A cost that is charged against revenue in an accounting period.
Cost Concepts for Cost Accounting Systems	
Product cost	Cost that can be attributed to a product.
Period cost	Cost that can be attributed to time intervals.
Full absorption cost	All variable and fixed manufacturing costs; used to compute a product's inventory value under GAAP.
Direct cost	Cost that can be directly (unambiguously and at low cost) related to a cost object.
Indirect cost	Cost that *cannot* be directly related to a cost object.
Cost Concepts for Describing Cost Behavior	
Variable cost	Cost that changes in direct proportion with a change in volume within the relevant range of activity.
Fixed cost	Cost that is unchanged as volume changes within the relevant range of activity.

The following summarizes key ideas tied to the chapter's learning objectives.

LO 2-1 Explain the basic concept of "cost." A *cost* is a sacrifice of resources, and an *expense* is a cost charged against revenue in an accounting period, typically for external reporting purposes.

LO 2-2 Explain how costs are presented in financial statements. Cost of goods sold in a merchandising organization simply includes the costs of purchase and incoming transportation of the goods. Cost of goods sold for manufacturing organizations is much more complicated and includes direct materials (raw materials), direct labor, and manufacturing overhead. Cost of goods (i.e., services) sold in a service organization primarily includes labor and overhead.

LO 2-3 Explain the process of cost allocation. Cost allocation is required to assign, or allocate, costs recorded in various accounts (the cost pools) to the cost objects (product, department, customer) of interest. An allocation rule specifies how this is done because there is generally no economically feasible way of associating the costs directly with the cost objects.

LO 2-4 Understand how materials, labor, and overhead costs are added to a product at each stage of the production process. Manufacturing organizations have three stages of production: direct materials, work in process, and finished goods. All items not sold at the end of the period are included in inventory as an asset on the balance sheet. All finished goods sold at the end of the period are included as cost of goods sold in the income statement.

LO 2-5 Define basic cost behaviors, including fixed, variable, semivariable, and step costs. Cost behavior can be classified in one of four ways: fixed, variable, semivariable, or step costs.

LO 2-6 Identify the components of a product's costs.

- Variable cost per unit.
- Full absorption cost per unit, which is the inventoriable amount under GAAP.
- Full cost per unit of making and selling the product.
- Gross margin, which equals sales price minus full absorption cost.
- Contribution margin, which equals sales price minus variable cost.
- Profit margin, which equals sales price minus full cost.

LO 2-7 Understand the distinction between financial and contribution margin income statements. The traditional income statement format is used primarily for external reporting purposes, and the contribution margin income statement format is used more for internal decision-making and performance evaluation purposes. A third alternative is the value approach, which categorizes costs into value- and nonvalue-added activities.

KEY TERMS

administrative costs, *49*
contribution margin, *61*
conversion costs, *49*
cost, *44*
cost allocation, *50*
cost allocation rule, *51*
cost flow diagram, *51*
cost object, *50*
cost of goods sold, *48*
cost pool, *51*
direct cost, *51*
direct labor, *48*
direct manufacturing costs, *48*
direct materials, *48*
expense, *44*
finished goods, *52*
fixed costs, *57*
full absorption cost, *59*
full cost, *59*
gross margin, *61*
indirect cost, *51*
indirect manufacturing costs, *48*
inventoriable costs, *52*
manufacturing overhead, *49*
marketing costs, *49*
operating profit, *45*
opportunity cost, *44*
outlay cost, *44*
period costs, *48*
prime costs, *49*
product costs, *48*
relevant range, *58*
semivariable cost, *58*
step cost, *58*
variable costs, *57*
work in process, *52*

REVIEW QUESTIONS

2-1. What is the difference in meaning between the terms *cost* and *expense*?
2-2. What is the difference between *product* costs and *period* costs?
2-3. What is the difference between *outlay* cost and *opportunity* cost?
2-4. Provide a business example illustrating opportunity costs.
2-5. Is "cost-of-goods sold" an expense?
2-6. Is "cost-of-goods" a product cost or a period cost?
2-7. What are the similarities between the Direct Materials Inventory account of the manufacturer and the Merchandise Inventory account of the merchandiser? Are there any differences between the two accounts? If so, what are they?
2-8. What are the three categories of product cost in a manufacturing operation? Describe each element briefly.
2-9. What is the difference between *gross margin* and *contribution margin*?
2-10. To a manager making a decision, which is likely more important: *gross margin* or *contribution margin*? Why?
2-11. What do the terms *step costs* and *semivariable costs* mean?
2-12. What do the terms *variable costs* and *fixed costs* mean?
2-13. How does a value income statement differ from a gross margin income statement? From a contribution margin income statement?
2-14. Why is a value income statement useful to managers?

CRITICAL ANALYSIS AND DISCUSSION QUESTIONS

2-15. "Materials and labor are always direct costs, and supply costs are always indirect." What is your opinion of this statement?
2-16. The cost per seat-mile for a major U.S. airline is 14.1¢. Therefore, to estimate the cost of flying a passenger from Detroit to Los Angeles, we should multiply 1,980 miles by 14.1¢. Do you agree? Explain.
2-17. In evaluating product profitability, we can ignore marketing costs because they are not considered product costs. Do you agree?
2-18. You and two friends drive your car to Texas for spring break. A third friend asks if you can drop her off in Oklahoma. How would you allocate the cost of the trip among the four of you?
2-19. The friend in question 2-18 decides that she does not want to go to Oklahoma after all. How will the costs of your trip change? Was your choice of allocation in question 2-18 incorrect? Why?
2-20. Consider a digital music service such as those provided by Amazon or Apple. What are some of the major cost categories? Are they mostly fixed or mostly variable?
2-21. Consider a ride-sharing service such as Uber or Lyft. What are some of the major cost categories? Are they mostly fixed or mostly variable? How are the costs different from those incurred by the drivers?
2-22. Pick a unit of a hospital (for example, intensive care or maternity). Name one example of a direct materials cost, one example of a direct labor cost, and one example of an indirect cost.
2-23. The dean of Midstate University Business School is trying to understand the costs of the school's two degree programs: Bachelor's (BBA) and Master's (MBA). She has asked you for recommendations on how to allocate the costs of the following services, which are used by students in both programs: cafeteria, library, and career placement. How would you respond?
2-24. Currently, generally accepted accounting principles (GAAP) in the United States require firms to expense research and development (R&D) costs as period costs. Therefore, when the resulting product is sold, R&D costs are not part of reported product costs. Does this mean that R&D costs are irrelevant for decision making?
2-25. If value income statements are useful for decision making, why are value income statements not used in financial reporting?

All applicable Exercises are included in Connect. connect

EXERCISES

2-26. Basic Concepts (LO 2-1, 5)

For each of the following statements, indicate whether it is true, false, or uncertain. Explain why. Give examples in your answer.

a. A cost is something used up to produce revenues in a particular accounting period.

b. Variable costs are direct costs; only fixed costs are indirect costs.

c. The cost of direct materials is fixed per unit but variable in total.

2-27. Basic Concepts (LO 2-1, 5)

For each of the following costs incurred in a manufacturing firm, indicate whether the costs are most likely fixed (F) or variable (V) and whether they are most likely period costs (P) or product costs (M) under full absorption costing.

a. Depreciation on the building for administrative staff offices.

b. Cafeteria costs for the factory.

c. Overtime pay for assembly workers.

d. Transportation-in costs on materials purchased.

e. Salaries of top executives in the company.

f. Sales commissions for sales personnel.

g. Assembly line workers' wages.

h. Controller's office rental.

i. Administrative support for sales supervisors.

j. Energy to run machines producing units of output in the factory.

2-28. Basic Concepts (LO 2-1, 2)

For each of the following costs incurred in a manufacturing operation, indicate whether they are included in prime costs (P), conversion costs (C), or both (B).

a. Assembly line worker's salary.

b. Direct materials used in the production process.

c. Property taxes on the factory.

d. Lubricating oil for plant machines.

e. Transportation-in costs on materials purchased.

2-29. Basic Concepts (LO 2-1, 2, 5)

Place the number of the appropriate definition in the blank next to each concept.

Concept	Definition
_____ Period cost	1. Sacrifice of resources.
_____ Indirect cost	2. Cost that *cannot* be directly related to a cost object.
_____ Fixed cost	3. Cost that varies with the volume of activity.
_____ Opportunity cost	4. Cost used to compute inventory value according to GAAP.
_____ Outlay cost	5. Cost charged against revenue in a particular accounting period.
_____ Direct cost	6. Cost that can be directly related to a cost object.
_____ Expense	7. Past, present, or near-future cash flow.
_____ Cost	8. Lost benefit from the best forgone alternative.
_____ Variable cost	9. Cost that can more easily be attributed to time intervals.
_____ Full absorption cost	10. Cost that does not vary with the volume of activity.
_____ Product cost	11. Cost that is part of inventory.

(LO 2-1, 6) **2-30. Basic Concepts: Multiple Choice**

Michael's Machine Shop reports the following information for the quarter.

Sales price	$ 40
Fixed costs (for the quarter)	
Selling and administration	47,500
Production	142,500
Variable cost (per unit)	
Materials	12
Labor	9
Plant supervision	2
Selling and administrative	3
Number of units (for the quarter)	23,750 units

Required

Select the answer for each of the following costs.

a. Variable cost per unit.
1. $32
2. $21
3. $26
4. $23

b. Variable production cost per unit.
1. $32
2. $21
3. $26
4. $23

c. Full cost per unit.
1. $29
2. $34
3. $32
4. $36

d. Full absorption cost per unit.
1. $29
2. $34
3. $32
4. $36

e. Prime cost per unit.
1. $12
2. $21
3. $9
4. $11

f. Conversion cost per unit.
1. $11
2. $17
3. $19
4. $14

g. Contribution margin per unit.
1. $11
2. $14
3. $17
4. $19

h. Gross margin per unit.
1. $6
2. $17
3. $14
4. $11

2-31. Basic Concepts: Multiple Choice **(LO 2-1, 6)**

The following information is available for Henderson Components for the year just ended.

Sales price	$ 27
Fixed costs (for the year)	
Selling and administrative	450,000
Production	675,000
Variable cost (per unit)	
Materials	8
Labor	4
Plant supervision	1
Selling and administrative	5
Number of units (for the year)	225,000 units

Required

Select the answer for each of the following costs.

a. Variable cost per unit.
1. $12
2. $13
3. $16
4. $18

b. Variable production cost per unit.
1. $12
2. $13
3. $16
4. $18

c. Full cost per unit.
1. $13
2. $15
3. $16
4. $23

d. Full absorption cost per unit.
1. $13
2. $15
3. $16
4. $23

e. Prime cost per unit.
1. $8
2. $12
3. $13
4. $16

f. Conversion cost per unit.
1. $8
2. $10
3. $12
4. $16

g. Contribution margin per unit.
1. $9
2. $11
3. $14
4. $4

h. Gross margin per unit.
1. $9
2. $11
3. $14
4. $4

(LO 2-1, 5) **2-32. Basic Concepts**

For each of the following costs incurred in a manufacturing firm, indicate whether the costs are fixed (F) or variable (V) and whether they are period costs (P) or product costs (M) under full absorption costing.

a. Power to operate factory equipment.
b. Chief financial officer's salary.
c. Commissions paid to sales personnel.
d. Office supplies for the human resources manager.
e. Depreciation on pollution control equipment in the plant.

(LO 2-1, 2, 6) **2-33. Basic Concepts**

The following data apply to the provision of psychological testing services.

Sales price per unit (1 unit = 1 test plus feedback to client)	$ 900
Fixed costs (per month):	
Selling and administration	90,000
Production overhead (e.g., rent of testing facilities)	135,000
Variable costs (per test):	
Labor for oversight and feedback	360
Outsourced test analysis	60
Materials used in testing	15
Production overhead	30
Selling and administration (e.g., scheduling and billing)	45
Number of tests per month	1,500 tests

Required

Give the amount for each of the following (one unit = one test):

a. Variable production cost per unit.
b. Variable cost per unit.
c. Full cost per unit.
d. Full absorption cost per unit.
e. Prime cost per unit.
f. Conversion cost per unit.
g. Contribution margin per unit.
h. Gross margin per unit.
i. Suppose the number of units decreases to 1,250 tests per month, which is within the relevant range. Which parts of (*a*) through (*h*) will change? For each amount that will change, give the new amount for a volume of 1,250 tests.

(LO 2-1, 2, 6) **2-34. Basic Concepts**

Intercontinental, Inc., provides you with the following data for its single product.

Sales price per unit	$ 100
Fixed costs (per month):	
Selling, general, and administrative (SG&A)	1,200,000
Manufacturing overhead	4,200,000
Variable costs (per unit):	
Direct labor	16
Direct materials	24
Manufacturing overhead	20
SG&A	12
Number of units produced per month	300,000 units

Required

Give the amounts for each of the following:

a. Prime cost per unit.
b. Contribution margin per unit.
c. Gross margin per unit.
d. Conversion cost per unit.
e. Variable cost per unit.
f. Full absorption cost per unit.
g. Variable production cost per unit.
h. Full cost per unit.
i. Suppose the number of units increases to 400,000 units per month, which is within the relevant range. Which of amounts (*a*) through (*h*) will change? For each that will change, give the new amount for a volume of 400,000 units.

2-35. Cost Allocation—Ethical Issues **(LO 2-3)**

In one of its divisions, an aircraft components manufacturer produces experimental navigational equipment for spacecraft and for private transportation companies. Although the products are essentially identical, they carry different product numbers. The XNS-12 model is sold to a government agency on a cost-reimbursed basis. In other words, the price charged to the government is equal to the computed cost plus a fixed fee. The JEF-3 model is sold to the private transportation companies on a competitive basis. The product development cost, common to both models, must be allocated to the two products in order to determine the cost for setting the price of the XNS-12.

Required

a. How would you recommend the product development cost be allocated between the two products?
b. What incentives do managers have to allocate product development costs? Why?

2-36. Cost Allocation—Ethical Issues **(LO 2-3)**

Star Buck, a coffee shop manager, has two major product lines—drinks and pastries. If Star allocates common costs on any objective basis discussed in this chapter, the drinks are profitable, but the pastries are not. Star is concerned that her boss will pull the plug on pastries. Star's brother, who is struggling to make a go of his new business, supplies pastries to the coffee shop. Star decides to allocate all common costs to the drinks because "Drinks can afford to absorb these costs until we get the pastries line on its feet." After assigning all common costs to drinks, both the drinks and pastries product lines appear to be marginally profitable. Consequently, Star's manager decides to continue the pastries line.

Required

a. How would you recommend Star allocate the common costs between drinks and pastries?
b. You are the assistant manager and have been working with Star on the allocation problem. What should you do?

2-37. Prepare Statements for a Manufacturing Company **(LO 2-2, 4)**

The following balances are from the accounts of Tappan Parts.

	January 1 (Beginning)	December 31 (Ending)
Direct materials inventory	$ 962,000	$ 884,000
Work-in-process inventory	1,354,000	1,430,000
Finished goods inventory	312,000	364,000

Direct materials used during the year amount to $1,196,000 and the cost of goods sold for the year was $1,378,000.

Required

Find the following by completing a cost of goods sold statement.

a. Cost of direct materials purchased during the year.
b. Cost of goods manufactured during the year.
c. Total manufacturing costs incurred during the year.

(LO 2-2) **2-38. Prepare Statements for a Service Company**

Chuck's Brokerage Service (CBS) is a discount financial services firm offering clients investment advice, trading services, and a variety of mutual funds for investment. Chuck has collected the following information for October.

<>	A	B	C
1	Advertising and marketing	$ 270,000	
2	Brokerage commissions (revenues)	9,000,000	
3	Building rent and utilities	525,000	
4	Fees from clients for investment advice	4,500,000	
5	Labor cost for advice	2,400,000	
6	Managers' salaries	900,000	
7	Sales commissions to brokers	750,000	
8	Training programs for brokers	1,275,000	
9	Fees paid to execute trades	6,000,000	
10			

Required

Prepare an income statement for October for CBS.

(LO 2-2) **2-39. Prepare Statements for a Service Company**

Where2 Services is a small service firm that advises high school students on college opportunities. Joseph Kapp, the founder and president, has collected the following information for March.

<>	A	B	C
1	Advertising costs	$ 4,000	
2	Building rent and utilities	2,000	
3	Printing, fax, and computing costs	3,750	
4	Sales	16,000	
5	Training costs	500	
6	Travel expenses	2,500	
7	Wages for part-time employees	5,000	
8			

Required

Prepare an income statement for March for Where2 Services.

(LO 2-2) **2-40. Prepare Statements for a Service Company**

The following data are available for Remington Advisors for the month just ended.

Gross margin	$ 810,000
Operating profit	305,000
Revenues	1,700,000

Required

Find the following by completing a cost of goods sold statement.

a. Marketing and administrative costs.

b. Cost of services sold.

(LO 2-2)) **2-41. Prepare Statements for a Service Company**

Lead! Inc. offers executive coaching services to small business owners. Lead!'s operating profits average 20 percent of revenues and its marketing and administrative costs average 25 percent of the cost of services sold.

Required

Lead! Inc. expects revenues to be $600,000 for April. Prepare an income statement for April for Lead! Inc. assuming its expectations are met.

2-42. Prepare Statements for a Manufacturing Company (LO 2-2, 4)

The following balances are from the accounts of Crabtree Machining Company.

	January 1 (Beginning)	December 31 (Ending)
Direct materials inventory	$115,200	$141,600
Work-in-process inventory	139,200	134,400
Finished goods inventory	117,120	108,000

Direct materials purchased during the year amount to $717,600, and the cost of goods sold for the year was $2,606,880.

Required

Reconstruct a cost of goods sold statement and fill in the following missing data.

a. Cost of direct materials used during the year.

b. Cost of goods manufactured during the year.

c. Total manufacturing costs incurred during the year.

2-43. Basic Concepts (LO 2-1, 2)

eXcel

The following data refer to one year for Monroe Fabricators. Fill in the blanks.

Direct materials inventory, January 1	$ 7,800
Direct materials inventory, December 31	*a.* _____
Work-in-process inventory, January 1	8,100
Work-in-process inventory, December 31	11,400
Finished goods inventory, January 1	5,700
Finished goods inventory, December 31	900
Purchases of direct materials	48,300
Cost of goods manufactured during the year	163,350
Total manufacturing costs	*b.* _____
Cost of goods sold	168,150
Gross margin	147,750
Direct labor	*c.* _____
Direct materials used	43,800
Manufacturing overhead	41,400
Sales revenue	*d.* _____

2-44. Basic Concepts (LO 2-1, 2)

The following data refers to one month for Talmidge Company. Fill in the blanks.

<>	A	B	C
1	Direct materials inventory, March 1	$ 32,000	
2	Direct materials inventory, March 31	27,000	
3	Work-in-process inventory, March 1	10,000	
4	Work-in-process inventory, March 31	a. _____	
5	Finished goods inventory, March 1	64,000	
6	Finished goods inventory, March 31	14,000	
7	Purchases of direct materials	b. _____	
8	Cost of goods manufactured during the month	260,000	
9	Total manufacturing costs	254,000	
10	Cost of goods sold	c. _____	
11	Gross margin	170,000	
12	Direct labor	120,000	
13	Direct materials used	62,000	
14	Manufacturing overhead	d. _____	
15	Sales revenue	480,000	
16			

(LO 2-2) **2-45. Prepare Statements for a Merchandising Company**
The cost accountant for Angie's Apparel has compiled the following information for last month's operations.

Administrative costs	$ 42,000
Merchandise inventory, July 1	9,000
Merchandise inventory, July 31	7,500
Merchandise purchases	360,000
Sales commissions	27,000
Sales revenue	570,000
Store rent	9,000
Store utilities	16,500
Transportation-in costs	27,000

Required
Prepare an income statement with a supporting cost of goods sold statement.

(LO 2-2) **2-46. Prepare Statements for a Merchandising Company**
University Electronics has provided the following information for last year.

Sales revenue	$4,000,000
Store rent	220,000
Store utilities	135,000
Administrative costs	290,000
Sales commissions	650,000
Merchandise purchases	2,750,000
Transportation-in costs	105,000
Merchandise inventory, March 1	185,000
Merchandise inventory, February 28	210,000

Required
Prepare an income statement for last year with a supporting cost of goods sold statement.

(LO 2-5) **2-47. Cost Behavior and Forecasting**
Dayton, Inc., manufactured 30,000 units of product last month and identified the following costs associated with the manufacturing activity.

Variable costs:	
Direct materials used	$ 510,000
Direct labor	1,120,000
Indirect materials and supplies	120,000
Power to run plant equipment	140,000
Fixed costs:	
Supervisory salaries	470,000
Plant utilities (other than power to run plant equipment)	120,000
Depreciation on plant and equipment (straight-line, time basis)	67,500
Property taxes on building	98,500

Required
Unit variable costs and total fixed costs are expected to remain unchanged next month. Calculate the unit cost and the total cost if 36,000 units are produced next month.

(LO 2-5) **2-48. Cost Behavior and Forecasting**
Sophia's Restaurant served 5,000 meals last quarter. Sophia recorded the following costs with those meals.

Variable costs:	
Ingredients used	$14,000
Direct labor	10,500
Indirect materials and supplies	5,300
Utilities	1,700
Fixed costs:	
Managers' salaries	22,000
Rent	18,000
Depreciation on equipment (straight-line, time basis)	2,000
Other fixed costs	3,000

Required

Unit variable costs and total fixed costs are expected to remain unchanged next quarter. Calculate the unit cost and the total cost if 4,500 meals are served next quarter.

2-49. Cost Behavior and Forecasting (LO 2-5)

Refer to the data in Exercise 2-48.

Variable costs:	
Ingredients used	$14,000
Direct labor	10,500
Indirect materials and supplies	5,300
Utilities	1,700
Fixed costs:	
Managers' salaries	22,000
Rent	18,000
Depreciation on equipment (straight-line, time basis)	2,000
Other fixed costs	3,000

Required

Suppose that Sophia expects to serve 15 percent more meals in the next quarter. Unit variable costs are expected to remain unchanged. However, Sophia knows that if the restaurant serves over 5,500 meals in a quarter, she must hire an additional manager (part-time) at a cost of $6,450 for the quarter. Other fixed costs are expected to increase by 10 percent.

Calculate the unit cost and the total cost if 5,750 meals are served next quarter.

2-50. Components of Full Costs (LO 2-6)

Madrid Corporation has compiled the following information from the accounting system for the one product it sells.

Sales price	$900 per unit
Fixed costs (for the month)	
Marketing and administrative	$108,000
Manufacturing overhead	$162,000
Variable costs (per unit)	
Marketing and administrative	$18
Direct materials	$270
Manufacturing overhead	$60
Direct labor	$165
Units produced and sold (for the month)	1,800

Required

Determine each of the following unit costs:

a. Variable manufacturing cost.

b. Variable cost.

c. Full absorption cost.

d. Full cost.

(LO 2-6) **2-51. Components of Full Costs**
Refer to Exercise 2-50.

Required
Compute:

a. Product costs per unit.
b. Period costs for the period.

(LO 2-6) **2-52. Components of Full Costs**
Larcker Manufacturing's cost accountant has provided you with the following information for January operations.

Direct materials	$21 per unit
Fixed manufacturing overhead costs	$135,000
Sales price	$79 per unit
Variable manufacturing overhead	$12 per unit
Direct labor	$24 per unit
Fixed marketing and administrative costs	$117,000
Units produced and sold	30,000
Variable marketing and administrative costs	$5 per unit

Required
Determine each of the following unit costs:

a. Variable cost.
b. Variable manufacturing cost.
c. Full absorption cost.
d. Full cost.
e. Profit margin.
f. Gross margin.
g. Contribution margin.

(LO 2-7) **2-53. Gross Margin and Contribution Margin Income Statements**
Refer to Exercise 2-52.

Required
Prepare:

a. A gross margin income statement.
b. A contribution margin income statement.

(LO 2-7) **2-54. Gross Margin and Contribution Margin Income Statements**
The following data are from the accounting records of Niles Castings for year 2.

Units produced and sold	85,000
Total revenues and costs	
Sales revenue	$264,000
Direct materials costs	68,000
Direct labor costs	34,000
Variable manufacturing overhead	17,000
Fixed manufacturing overhead	44,000
Variable marketing and administrative costs	13,600
Fixed marketing and administrative costs	32,000

Required
Prepare:

a. A gross margin income statement.
b. A contribution margin income statement.

2-55. Gross Margin and Contribution Margin Income Statements (LO 2-7)

Alpine Coffee Roasters reports the following information for November.

Units produced and sold	36,000
Per unit revenue and costs:	
Sales revenue	$6.40
Direct materials costs	3.00
Direct labor costs	0.40
Variable manufacturing overhead	0.10
Fixed manufacturing overhead based on a volume of 36,000 units	1.25
Variable marketing and administrative costs	0.30
Fixed marketing and administrative costs based on a volume of 36,000 units	0.50

Required

Prepare:

a. A gross margin income statement.

b. A contribution margin income statement.

2-56. Value Income Statement (LO 2-7)

Ralph's Restaurant has the following information for year 2, when several new employees were added to the waitstaff.

Sales revenue	$1,000,000
Cost of food served[a]	350,000
Employee wages and salaries[b]	250,000
Manager salaries[c]	100,000
Building costs (rent, utilities, etc.)[d]	150,000

[a] 5 percent of this cost was for food that was not used by the expiration date, and 10 percent was for food that was incorrectly prepared because of errors in orders taken.

[b] 15 percent of this cost was for time spent by cooks to reprepare orders that were incorrectly prepared because of errors in orders taken.

[c] 20 percent of this cost was time taken to address customer complaints about incorrect orders.

[d] 80 percent of the building was used.

Required

a. Using the traditional income statement format, prepare a value income statement.

b. What value would there be to Ralph from preparing the same information in year 3?

2-57. Value Income Statement (LO 2-7)

DeLuxe Limo Service has the following information for March.

<>	A	B	C
1			
2	Sales revenue	$ 250,000	
3	Variable costs of operations, excluding labor costs[a]	75,000	
4	Employee wages and salaries[b]	100,000	
5	Manager salaries[c]	20,000	
6	Fixed cost of automobiles[d]	25,000	
7	Building costs (rent, utilities, etc.)[e]	12,500	
8			
9	[a]5 percent of this cost was wasted due to poor directions given to limo drivers.		
10	[b]5 percent of this cost was for time spent by limo drivers because of poor directions.		
11	[c]10 percent of this cost was time taken to address customer complaints.		
12	[d]The limos have 40 percent unused capacity.		
13	[e]The building has 10 percent unused capacity.		
14			

Required

a. Using the traditional income statement format, prepare a value income statement.

b. What value would there be to the managers at DeLuxe from preparing the same information in April?

PROBLEMS

connect All applicable Problems are included in Connect.

(LO 2-2, 6) eXcel

2-58. Cost Concepts

The following information comes from the accounting records for Chelsea, Inc., for May.

Direct materials inventory, May 1	$ 9,000
Direct materials inventory, May 31	7,500
Work-in-process inventory, May 1	4,500
Work-in-process inventory, May 31	3,000
Finished goods inventory, May 1	27,000
Finished goods inventory, May 31	36,000
Direct materials purchased during May	120,000
Direct labor costs, May	96,000
Manufacturing overhead, May	126,000

Required

Compute for the month of May:

a. Total prime costs.

b. Total conversion costs.

c. Total manufacturing costs.

d. Cost of goods manufactured.

e. Cost of goods sold.

(LO 2-2, 6)

2-59. Cost Concepts

The controller at Lawrence Components asks for your help in sorting out some cost information. She is called to a meeting but hands you the following information for April.

Prime costs, April	$ 98,000
Total manufacturing costs, April	178,000
Cost of goods manufactured, April	180,000
Cost of goods sold, April	142,000
Direct materials inventory, April 30	10,000
Work-in-process inventory, April 1	6,000
Finished goods inventory, April 30	48,000
Direct materials purchased, April	56,000
Direct labor costs, April	40,000

Required

Compute:

a. Direct materials used, April.

b. Direct materials inventory, April 1.

c. Conversion costs, April.

d. Work-in-process inventory, April 30.

e. Manufacturing overhead, April.

f. Finished goods inventory, April 1.

2-60. Cost Concepts (LO 2-2, 6)

Columbia Products produced and sold 900 units of the company's only product in March. You have collected the following information from the accounting records.

Sales price (per unit)	$ 448
Manufacturing costs:	
Fixed overhead (for the month)	50,400
Direct labor (per unit)	35
Direct materials (per unit)	112
Variable overhead (per unit)	70
Marketing and administrative costs:	
Fixed costs (for the month)	67,500
Variable costs (per unit)	14

Required

a. Compute:
1. Variable manufacturing cost per unit.
2. Full cost per unit.
3. Variable cost per unit.
4. Full absorption cost per unit.
5. Prime cost per unit.
6. Conversion cost per unit.
7. Profit margin per unit.
8. Contribution margin per unit.
9. Gross margin per unit.

b. If the number of units produced increases from 900 to 1,200, which is within the relevant range, cost per unit will decrease (you can check this by redoing requirement *[a]* above). Therefore, we should recommend that Columbia Products increase its production to reduce its costs. Do you agree? Explain.

2-61. Prepare Statements for a Manufacturing Company (LO 2-2, 4)

Yolo Windows, a manufacturer of windows for commercial buildings, reports the following account information for last year (all costs are in thousands of dollars).

Information on January 1 (Beginning):	
Direct materials inventory	$ 36
Work-in-process inventory	48
Finished goods inventory	656

Information for the year:	
Administrative costs	$ 1,440
Direct labor	4,240
Direct materials purchases	3,280
Factory and machine depreciation	4,640
Factory supervision	840
Factory utilities	360
Indirect factory labor	1,120
Indirect materials and supplies	280
Marketing costs	600
Property taxes on factory	112
Sales revenue	18,160

Information on December 31 (Ending):	
Direct materials inventory	$ 32
Work-in-process inventory	56
Finished goods inventory	588

Required

Prepare an income statement with a supporting cost of goods sold statement.

(LO 2-2, 4) **2-62. Prepare Statements for a Manufacturing Company**

Mesa Designs produces a variety of hardware products, primarily for the do-it-yourself (DIY) market. As part of your job interview as a summer intern at Mesa, the cost accountant provides you with the following (fictitious) data for the year (in $000).

<>	A	B	C	D
1	Inventory information:			
2		1/1/00	12/31/00	
3	Direct materials	$ 96	$ 110	
4	Work-in-process	152	136	
5	Finished goods	1,974	2,026	
6				
7	Other information:	For the year '00		
8	Administrative costs	$ 4,200		
9	Depreciation (Factory)	5,560		
10	Depreciation (Machines)	9,240		
11	Direct labor	13,000		
12	Direct materials purchased	10,300		
13	Indirect labor (Factory)	3,340		
14	Indirect materials (Factory)	960		
15	Property taxes (Factory)	370		
16	Selling costs	2,140		
17	Sales revenue	60,220		
18	Utilities (Factory)	1,060		
19				

Required

Prepare the income statement with a supporting cost of goods sold statement.

(LO 2-2, 4) **2-63. Prepare Statements for a Manufacturing Company**

The administrative offices and manufacturing plant of Billings Tool & Die share the same building. The following information (in $000s) appears in the accounting records for last year.

Administrative costs	$ 9,600
Building and machine depreciation (75% of this amount is for factory)	5,400
Building utilities (90% of this amount is for factory)	7,500
Direct labor	5,040
Direct materials inventory, December 31	84
Direct materials inventory, January 1	72
Direct materials purchases	21,900
Factory supervision	2,940
Finished goods inventory, December 31	390
Finished goods inventory, January 1	324
Indirect factory labor	5,472
Indirect materials and supplies	4,110
Marketing costs	5,226
Property taxes on building (80% of this amount is for factory)	5,040
Sales revenue	77,820
Work-in-process inventory, December 31	174
Work-in-process inventory, January 1	192

Required

Prepare an income statement with a supporting cost of goods sold statement.

(LO 2-3) **2-64. Cost Allocation with Cost Flow Diagram**

Coastal Computer operates two retail outlets in Oakview, one on Main Street and the other in Lakeland Mall. The stores share the use of a central accounting department. The cost of the accounting department for last year was $180,000. The following are the operating results for the two stores for the year.

	Main Street	Lakeland Mall
Sales revenue	$1,000,000	$2,000,000
Number of computers sold	2,000	1,600

Required

a. Allocate the cost of the central accounting department to the two stores based on:
1. Number of computers sold.
2. Store revenue.

b. Draw a cost flow diagram to illustrate your answer to requirement (*a*), part (2).

2-65. Cost Allocation with Cost Flow Diagram **(LO 2-3)**

Wayne Casting, Inc., produces a product made from a metal alloy. Wayne buys the alloy from two different suppliers, Chillicothe Metals and Ames Supply, in approximately equal amounts because of supply constraints at both vendors. The material from Chillicothe is less expensive to buy but more difficult to use, resulting in greater waste. The metal alloy is highly toxic and any waste requires costly handling to avoid environmental accidents. Last year the cost of handling the waste totaled $300,000. Additional data from last year's operations are shown as follows.

	Chillicothe Metals	Ames Supply
Amount of material purchased (tons)	130	120
Amount of waste (tons)	12.8	2.2
Cost of purchases	$624,000	$876,000

Required

a. Allocate the cost of the waste handling to the two suppliers based on:
1. Amount of material purchased.
2. Amount of waste.
3. Cost of material purchased.

b. Draw a cost flow diagram to illustrate your answer to requirement (*a*), part (1).

2-66. Cost Allocation with Cost Flow Diagram **(LO 2-3)**

The library at Pacific Business School (PBS) serves both undergraduate and graduate programs. The dean of PBS is interested in evaluating the profitability of the degree programs and has asked the head of the library, Rex Gilmore, to allocate the annual library cost of $4,035,000 to the two programs.

Rex believes that two cost drivers explain most of the costs—number of students and credit hours. Using information from a previous analysis, he split the annual library budget as follows.

<>	A	B	C	D
1	Costs driven by number of students			
2	Library management	$ 950,000		
3	Acquisitions	1,300,000		
4		$ 2,250,000		
5				
6	Costs driven by number of credit hours			
7	Computer support	$ 135,000		
8	Building maintenance	496,000		
9	Library staff	788,000		
10	Utilities and supplies	366,000		
11		$ 1,785,000		
12	Total library costs	$ 4,035,000		
13				
14				
15	Data on students and credit hours	Undergraduate	Graduate	
16	Number of students	900	600	
17	Number of credit hours	13,500	16,500	
18				

Required

a. Allocate the cost of the library to the two programs (undergraduate and graduate).

b. Draw a cost flow diagram to illustrate your answer to requirement (*a*).

(LO 2-3)

2-67. Cost Allocation and Pricing

Greenfield Consultants conducts analyses of public policy issues. The company has two units: Government (with various U.S. government agencies as the only clients) and Corporate (with several corporations as clients). Government business is charged based on the total costs (direct and indirect) plus a 15 percent fee (profit). Corporate clients are charged a fixed fee negotiated at the beginning of the project.

During the planning process for the following year, the controller has estimated costs for the two units.

	Corporate	Government	Total
Direct costs	$500,000	2,000,000	$2,500,000
Direct contract hours worked	1,000	2,000	3,000

The controller expects indirect costs to total $4.5 million next year. Revenues from Corporate clients are expected to be $1.2 million.

Required

a. Suppose Greenfield chooses to allocate indirect cost based on direct cost.
1. What cost would be allocated to the two units (Corporate and Government)?
2. What total revenue would they expect to collect next year?

b. Suppose Greenfield chooses to allocate indirect cost based on direct contract hours worked.
1. What cost would be allocated to the two units (Corporate and Government)?
2. What total revenue would they expect to collect next year?

(LO 2-3)

2-68. Cost Allocation and Pricing

Consider the Business Application, "Indirect Costs and Allocating Costs to Contracts."

Required

a. How should Greenfield Consultants allocate indirect costs to units? Why?

b. What ethical issues arise for the controller at Greenfield related to cost allocation?

(LO 2-1, 6)

2-69. Find the Unknown Information

After a computer failure, you are trying to reconstruct some financial results for the year that just ended. While you know that backups are available, it will take too long to get the information you want. You have been able to collect the following information.

Direct materials inventory, January 1 (Beginning)	$16,000
Direct materials inventory, December 31 (Ending)	12,000
Work-in-process inventory, January 1 (Beginning)	21,200
Work-in-process inventory, December 31 (Ending)	10,000
Finished goods inventory, December 31 (Ending)	14,080
Manufacturing overhead	23,040
Cost of goods manufactured during this year	88,800
Total manufacturing costs	77,600
Cost of goods sold	87,040
Direct labor	12,160
Average sales price per unit	8
Gross margin percentage	37.5%

Required

Find the following:

a. Finished goods inventory, January 1.

b. Direct materials used for the year.

c. Sales revenue.

2-70. Find the Unknown Information (LO 2-1, 6)

Just before class starts, you realize that you have mistakenly recycled the second page of your cost accounting homework assignment. Fortunately, you still have the first page of the printout from your spreadsheet (shown as follows) and you remember that you were able to determine the items on the recycled page from this information.

<>	A	B	C
1	Direct materials inventory, January 1	$ 2,520	
2	Direct materials inventory, December 31	2,088	
3	Work-in-process inventory, January 1	5,440	
4	Work-in-process inventory, December 31	6,110	
5	Finished goods inventory, January 1	22,320	
6	Finished goods inventory, December 31	38,770	
7	Cost of goods manufactured during this year	611,650	
8	Total manufacturing costs	612,320	
9	Direct labor	270,400	
10	Manufacturing overhead	225,000	
11	Average selling price per unit	18	
12	Gross margin percentage (as a percentage of sales)	38%	
13			

Required

Find the following:

a. Cost of goods sold.

b. Direct materials used.

c. Purchases of direct materials.

d. Sales revenue.

2-71. Cost Allocation and Regulated Prices (LO 2-3)

The City of Imperial Falls contracts with Evergreen Waste Collection to provide solid waste collection to households and businesses. Until recently, Evergreen had an exclusive franchise to provide this service in Imperial Falls, which meant that other waste collection firms could not operate legally in the city. The price per pound of waste collected was regulated at 20 percent above the average total cost of collection.

Cost data for the most recent year of operations for Evergreen are as follows.

Administrative cost	$ 400,000
Operating costs—trucks	1,280,000
Other collection costs	320,000

Data on customers for the most recent year are as follows.

	Households	Businesses
Number of customers	12,000	3,000
Waste collected (tons)	4,000	12,000

The City Council of Imperial Falls is considering allowing other private waste haulers to collect waste from businesses but not from households. Service to businesses from other waste collection firms would not be subject to price regulation. Based on information from neighboring cities, the price that other private waste collection firms will charge is estimated to be $0.04 per pound (= $80 per ton).

Evergreen's CEO has approached the city council with a proposal to change the way costs are allocated to households and businesses, which will result in different rates for households and businesses. She proposes that administrative costs and truck operating costs be allocated based on the number of customers and the other collection costs be allocated based on pounds collected. The

total costs allocated to households would then be divided by the estimated number of pounds collected from households to determine the cost of collection. The rate would then be 20 percent above the cost. The rate for businesses would be determined using the same calculation.

Required

a. Based on cost data from the most recent year, what is the price per pound charged by Evergreen for waste collection under the current system (the same rate for both types of customers)?

b. Based on cost and waste data from the most recent year, what would be the price per pound charged to households and to businesses by Evergreen for waste collection if the CEO's proposal were accepted?

c. As a staff member to one of the council members, would you support the proposal to change the way costs are allocated? Explain.

(LO 2-1, 2, 6) **2-72. Reconstruct Financial Statements**

Koufax Materials Corporation produces plastic products for home appliances and electronics. The financial department has produced the following information for the year ended December 31.

	A	B
1	Administrative salaries	$ 2,625,000
2	Depreciation on the administrative building	1,142,000
3	Depreciation on the manufacturing plant	1,750,000
4	Direct labor	4,692,500
5	Direct materials inventory, January 1	1,069,200
6	Direct materials inventory, December 31	1,235,000
7	Direct materials purchased during the year	8,956,000
8	Distribution costs	657,000
9	Finished goods inventory, January 1	1,642,000
10	Finished goods inventory, December 31	1,369,500
11	Indirect labor	542,000
12	Insurance (on manufacturing plant)	53,200
13	Legal fees	496,300
14	Maintenance (on the manufacturing plant)	215,400
15	Manufacturing plant utilities	784,100
16	Marketing costs	749,250
17	Other manufacturing plant costs	630,880
18	Sales revenue	22,654,920
19	Taxes (on manufacturing plant and property)	215,600
20	Work-in-process inventory, January 1	403,250
21	Work-in-process inventory, December 31	396,700
22		
23		
24		

Required

Prepare a cost of goods manufactured and sold statement and an income statement.

(LO 2-1, 6) **2-73. Reconstruct Financial Statements**

San Ysidro Company manufactures hiking equipment. The company's administrative and manufacturing operations share the company's only building. Eighty percent of the building is used for manufacturing, and the remainder is used for administrative activities. Indirect labor is 8 percent of direct labor.

The cost accountant at San Ysidro has compiled the following information for the year ended December 31.

<>	A	B	C
1	Administrative salaries	$ 192,000	
2	Attorney fees to settle zoning dispute	22,960	
3	Building depreciation (manufacturing portion only)	181,440	
4	Cost of goods manufactured	2,776,760	
5	Direct materials inventory, December 31	248,000	
6	Direct materials purchased during the year	1,008,000	
7	Direct materials used	1,069,880	
8	Distribution costs	4,480	
9	Finished goods inventory, January 1	224,000	
10	Finished goods inventory, December 31	252,000	
11	Insurance (on plant machinery)	53,200	
12	Maintenance (on plant machinery)	33,880	
13	Marketing costs	103,600	
14	Other plant costs	82,160	
15	Plant utilities	104,160	
16	Sales revenue	4,550,000	
17	Taxes on manufacturing property	38,800	
18	Total (direct and indirect) labor	1,209,600	
19	Work-in-process inventory, January 1	72,520	
20	Work-in-process inventory, December 31	68,880	
21			

Required

Prepare a cost of goods manufactured and sold statement and an income statement.

2-74. Reconstruct Financial Statements **(LO 2-1, 6)**

Westlake, Inc., produces metal fittings for the aerospace industry. The administrative and manufacturing operations occupy the same 200,000-square-foot building. The manufacturing plant uses 150,000 square feet. Depreciation is assigned based on building use. Indirect labor represents 15 percent of the total manufacturing plant labor.

The financial information for the year just ended is shown as follows.

	A	B
1	(Thousands of Dollars)	
2		
3	Administrative costs	$ 160
4	Total building depreciation	400
5	Direct materials inventory, January 1	15
6	Direct materials inventory, December 31	20
7	Direct materials purchased during the year	1,570
8	Finished goods inventory, December 31	80
9	Indirect labor	180
10	Maintenance on plant machinery	140
11	Marketing costs	120
12	Operating profit	960
13	Other plant overhead	83
14	Plant supervision and administration	155
15	Plant supplies and indirect materials	67
16	Sales revenue	5,000
17	Taxes on manufacturing property	117
18	Work-in-process inventory, January 1	80
19	Work-in-process inventory, December 31	110
20		

Required

Prepare a cost of goods manufactured and sold statement and an income statement.

(LO 2-2) **2-75. Finding Unknowns**

Mary's Mugs produces and sells various types of ceramic mugs. The business began operations on January 1, year 1, and its costs incurred during the year include the following.

Variable costs (based on mugs produced):	
Direct materials cost	$ 6,000
Direct manufacturing labor costs	27,000
Indirect manufacturing costs	5,400
Administration and marketing	3,375
Fixed costs:	
Administration and marketing costs	18,000
Indirect manufacturing costs	6,000

On December 31, year 1, direct materials inventory consisted of 3,750 pounds of material. Production in that year was 20,000 mugs. All prices and unit variable costs remained constant during the year. Sales revenue for year 1 was $73,312. Finished goods inventory was $6,105 on December 31, year 1. Each finished mug requires 0.4 pounds of material.

Required

Compute the following:

a. Direct materials inventory cost, December 31, year 1.

b. Finished goods ending inventory in units on December 31, year 1.

c. Selling price per unit.

d. Operating profit for year 1.

(LO 2-2) **2-76. Finding Unknowns**

BS&T Partners has developed a new hubcap with the model name Spinnin' Wheel. Production and sales started August 3. As of August 2, there were no direct materials in inventory. Data for the month of August include the following.

Direct labor cost per unit[a]	$6.25
Direct labor-hours worked, August	
Direct labor wage rate per direct labor-hour	$20.00
Direct materials cost per unit[a]	$5.00
Direct materials cost per pound of direct material	$10.00
Direct materials inventory (cost), August 31	$3,500
Direct materials inventory (pounds), August 31	
Finished goods inventory (cost), August 31	$10,800
Finished goods inventory (units), August 31	
Manufacturing overhead cost per unit[a]	$15.75
Operating profit, August	$55,200
Production (units), August	
Sales revenue, August	$414,000
Sales (units), August	
Sales price per unit	
Selling, general, and administrative costs per unit[b]	$12.00

[a] Unit cost based on units produced in August.

[b] Unit cost based on units sold in August.

Required

Complete the table.

INTEGRATIVE CASE

2-77. Analyze the Impact of a Decision on Income Statements (LO 2-2)

You were appointed the manager of Drive Systems Division (DSD) at Tunes2Go, a manufacturer of portable music devices using the latest developments in hard drive technology, on December 15 last year. DSD manufactures the drive assembly, M-24, for the company's most popular product. Your bonus is determined as a percentage of your division's operating profits before taxes.

One of your first major investment decisions was to invest $3 million in automated testing equipment for the M-24. The equipment was installed and in operation on January 1 of this year.

This morning, J. Bradley Finch III, the assistant manager of the division (and, not coincidentally, the grandson of the company founder and son of the current CEO) told you about an offer by Pan-Pacific Electronics. Pan-Pacific wants to rent to DSD a new testing machine that could be installed on December 31 (only two weeks from now) for an annual rental charge of $690,000. The new equipment would enable you to increase your division's annual revenue by 7 percent. This new, more efficient machine would also decrease fixed cash expenditures by 6 percent.

Without the new machine, operating revenues and costs for the year are estimated to be as follows. Sales revenue and fixed and variable operating costs are all cash.

Sales revenue	$4,800,000
Variable operating costs	600,000
Fixed operating costs	2,250,000
Equipment depreciation	450,000
Other depreciation	375,000

If you rent the new testing equipment, DSD will have to write off the cost of the automated testing equipment this year because it has no salvage value. Equipment depreciation shown in the income statement is for this automated testing equipment. Equipment losses are included in the bonus and operating profit computation.

Because the new machine will be installed on a company holiday, there will be no effect on operations from the changeover. Ignore any possible tax effects. Assume that the data given in your expected income statement are the actual amounts for this year and next year if the current equipment is kept.

Required

a. Assume the new testing equipment is rented and installed on December 31. What will be the impact on this year's divisional operating profit?

b. Assume the new testing equipment is rented and installed on December 31. What will be the impact on next year's divisional operating profit?

c. Would you rent the new equipment? Why or why not?

SOLUTIONS TO SELF-STUDY QUESTIONS

1.

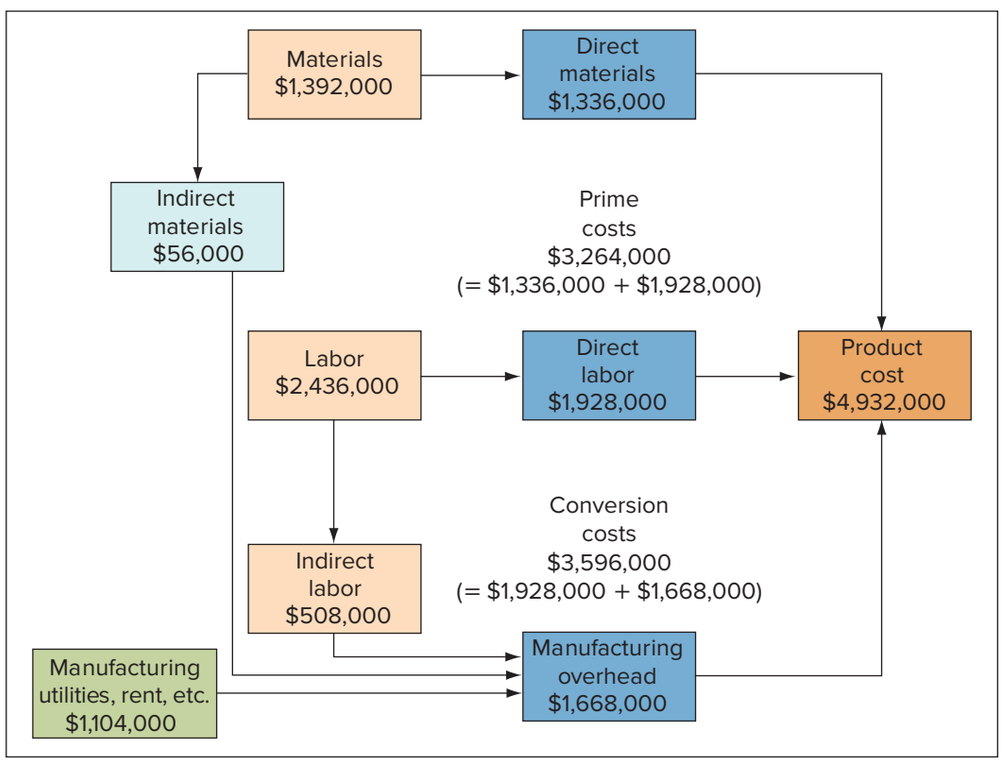
PACIFIC PARTS
Income Statement

Sales revenue	$8,144,000
Cost of goods sold (see following statement)	4,956,000
Gross margin	$3,188,000
Less	
Marketing costs	1,088,000
Administrative costs	1,216,000
Operating profit	$ 884,000

PACIFIC PARTS
Statement of Cost of Goods Manufactured and Sold

Beginning work-in-process inventory, January 1			$ 540,000
Manufacturing costs during the year			
Direct materials			
Beginning inventory, January 1	$ 408,000		
Add purchases	1,252,000		
Direct materials available	$ 1,660,000		
Less ending inventory, December 31	324,000		
Direct materials put into production		$1,336,000	
Direct labor		1,928,000	
Manufacturing overhead			
Supervisory and indirect labor	$ 508,000		
Supplies and indirect materials	56,000		
Heat, light, and power—plant	348,000		
Plant maintenance and repairs	296,000		
Depreciation—manufacturing	412,000		
Miscellaneous manufacturing costs	48,000		
Total manufacturing overhead		$1,668,000	
Total manufacturing costs incurred during the year			$4,932,000
Total cost of work-in-process during the year			$5,472,000
Less ending work-in-process inventory, December 31			568,000
Cost of goods manufactured during the year			$4,904,000
Beginning finished goods inventory, January 1			640,000
Finished goods inventory available for sale			$5,544,000
Less ending finished goods inventory, December 31			588,000
Cost of goods manufactured and sold			$4,956,000

2.



3. Fixed manufacturing = $7.50 (= $12,000 ÷ 1,600)
   Fixed marketing and administration = $8.75 (= $14,000 ÷ 1,600)
4. Gross margin = Sales price − Full absorption cost = Sales price − (Variable manufacturing + Fixed manufacturing) = $45 − ($23 + $6) = $16
   Contribution margin = Sales price − Variable costs
   = Sales price − (Variable manufacturing + Variable marketing and administrative)
   = $45 − ($23 + $3) = $19
   Operating profit = Sales price − Full cost to make and sell product
   = Sales price − (Variable manufacturing + Fixed manufacturing + Variable marketing and administrative + Fixed marketing and administrative)
   = $45 − ($23 + $6 + $3 + $7)
   = $6
   (*Note:* The gross margin does not change from Exhibit 2.12 because marketing and administrative costs are subtracted after gross margin.)
5. Gross margin = $45 − ($23 + $5) = $17
   Contribution margin = $45 − ($23 + $4) = $18
   Operating profit = $45 − ($23 + $5 + $4 + $7) = $6
   (*Note:* The contribution margin does not change from Exhibit 2.13; however, the gross margin changes from Exhibit 2.12.)

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