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An Introduction to Cost Terms and Purposes

► Learning Objectives

1. Define and illustrate a cost object
2. Distinguish between direct costs and indirect costs
3. Explain variable costs and fixed costs
4. Interpret unit costs cautiously
5. Distinguish inventoriable costs from period costs
6. Explain why product costs are computed in different ways for different purposes
7. Describe a framework for cost accounting and cost management

What does the word cost mean to you?

Is it the price you pay for something of value? A cash outflow? Something that affects profitability? There are many different types of costs, and at different times organizations put more or less emphasis on them. When times are good companies often focus on selling as much as they can, with costs taking a backseat. But when times get tough, the emphasis usually shifts to costs and cutting them, as General Motors tried to do. Unfortunately, when times became really bad GM was unable to cut costs fast enough leading to Chapter 11 bankruptcy.

GM Collapses Under the Weight of its Fixed Costs¹

After nearly 80 years as the world's largest automaker, General Motors (GM) was forced to file for bankruptcy protection in 2009. Declining sales and the rise of Japanese competitors, such as Toyota and Honda, affected GM's viability given its high fixed costs—costs that did not decrease as the number of cars that GM made and sold declined.

A decade of belt-tightening brought GM's variable costs—costs such as material costs that vary with the number of cars that GM makes—in line with those of the Japanese. Unfortunately for GM, a large percentage of its operating costs were fixed because union contracts made it difficult for the company to close its factories or reduce pensions and health benefits owed to retired workers.

To cover its high fixed costs, GM needed to sell a lot of cars. Starting in 2001, it began offering sales incentives and rebates, which for a few years were somewhat successful. GM also expanded aggressively into China and Europe.

But in 2005, growth efforts slowed, and GM lost \$10.4 billion. As a result, GM embarked on a reorganization plan that closed more than a dozen plants, eliminated tens of thousands of jobs, slashed retirement plan benefits for its 40,000-plus salaried employees, and froze its pension program.

Despite these cuts, GM could not reduce its costs fast enough to keep up with the steadily declining market for new cars and trucks. In the United States, as gas prices rose above \$4 a gallon, GM's product

¹ Sources: Loomis, Carol. 2006. The tragedy of General Motors. *Fortune*, February 6; *New York Times*. 2009. Times topics: Automotive industry crisis. December 6. http://topics.nytimes.com/top/reference/timestopics/subjects/c/credit_crisis/auto_industry/index.html; Taylor, III, Alex. 2005. GM hits the skids. *Fortune*, April 4; Vlasic, Bill and Nick Bunkley. 2008. G.M. says U.S. cash is its best hope. *New York Times*, November 8.

mix was too heavily weighted toward gas-guzzling trucks, pickup trucks, and sport utility vehicles, all of which were experiencing sharp decreases in sales.

In late 2008, as the economic crisis worsened, GM announced plans to cut \$15 billion in costs and raise \$5 billion through the sale of assets, like its Hummer brand of off-road vehicles. “We’re cutting to the bone,” said Fritz Henderson, GM’s president. “But given the situation, we think that’s appropriate.”

It was appropriate, but it wasn’t enough. By November 2008, GM had lost more than \$18 billion for the year, and the government loaned the company \$20 billion to continue operations. Ultimately, its restructuring efforts fell short, and the weight of GM’s fixed costs drove the company into bankruptcy. In court papers, the company claimed \$82.3 billion in assets and \$172.8 billion in debt.

When it emerges from bankruptcy, GM will be a much smaller company with only four brands of cars (down from eight), more than 20,000 fewer hourly union workers, and as many as 20 additional shuttered factories.

As the story of General Motors illustrates, managers must understand costs in order to interpret and act on accounting information. Organizations as varied as the United Way, the Mayo Clinic, and Sony generate reports containing a variety of cost concepts and terms that managers need to run their businesses. Managers must understand these concepts and terms to effectively use the information provided. This chapter discusses cost concepts and terms that are the basis of accounting information used for internal and external reporting.

Costs and Cost Terminology

Accountants define **cost** as a resource sacrificed or forgone to achieve a specific objective. A cost (such as direct materials or advertising) is usually measured as the monetary amount that must be paid to acquire goods or services. An **actual cost** is the cost incurred (a historical or past cost), as distinguished from a **budgeted cost**, which is a predicted or forecasted cost (a future cost).

When you think of cost, you invariably think of it in the context of finding the cost of a particular thing. We call this thing a **cost object**, which is anything for which a measurement of costs is desired. Suppose that you were a manager at BMW’s Spartanburg, South Carolina, plant. BMW makes several different types of cars and sport activity vehicles (SAVs) at this plant. What cost objects can you think of? Now look at Exhibit 2-1.

You will see that BMW managers not only want to know the cost of various products, such as the BMW X5, but they also want to know the costs of things such as projects,



Learning Objective 1

Define and illustrate a cost object

... examples of cost objects are products, services, activities, processes, and customers

Exhibit 2-1**Examples of Cost Objects at BMW**

| Cost Object | Illustration |
|-------------|---|
| Product | A BMW X5 sports activity vehicle |
| Service | Telephone hotline providing information and assistance to BMW dealers |
| Project | R&D project on enhancing the DVD system in BMW cars |
| Customer | Herb Chambers Motors, the BMW dealer that purchases a broad range of BMW vehicles |
| Activity | Setting up machines for production or maintaining production equipment |
| Department | Environmental, health, and safety department |

services, and departments. Managers use their knowledge of these costs to guide decisions about, for example, product innovation, quality, and customer service.

Now think about whether a manager at BMW might want to know the *budgeted cost* of a cost object, or the *actual cost*. Managers almost always need to know both types of costs when making decisions. For example, comparing budgeted costs to actual costs helps managers evaluate how well they did and learn about how they can do better in the future.

How does a cost system determine the costs of various cost objects? Typically in two basic stages: accumulation, followed by assignment. **Cost accumulation** is the collection of cost data in some organized way by means of an accounting system. For example, at its Spartanburg plant, BMW collects (accumulates) costs in various categories such as different types of materials, different classifications of labor, and costs incurred for supervision. Managers and management accountants then *assign* these accumulated costs to designated cost objects, such as the different models of cars that BMW manufactures at the plant. BMW managers use this cost information in two main ways:

1. when *making* decisions, for instance, on how to price different models of cars or how much to invest in R&D and marketing and
2. for *implementing* decisions, by influencing and motivating employees to act and learn, for example, by rewarding employees for reducing costs.

Now that we know why it is useful to assign costs, we turn our attention to some concepts that will help us do it. Again, think of the different types of costs that we just discussed—materials, labor, and supervision. You are probably thinking that some costs, such as costs of materials, are easier to assign to a cost object than others, such as costs of supervision. As you will see, this is indeed the case.

Decision Point

What is a cost object?

Learning Objective 2

Distinguish between direct costs

. . . costs that are traced to the cost object

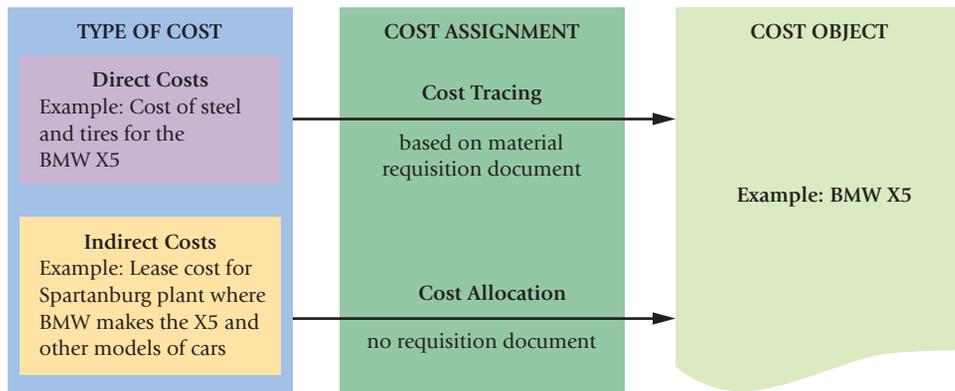
and indirect costs

. . . costs that are allocated to the cost object

Direct Costs and Indirect Costs

We now describe how costs are classified as direct and indirect costs and the methods used to assign these costs to cost objects.

- **Direct costs of a cost object** are related to the particular cost object and can be traced to it in an economically feasible (cost-effective) way. For example, the cost of steel or tires is a direct cost of BMW X5s. The cost of the steel or tires can be easily traced to or identified with the BMW X5. The workers on the BMW X5 line request materials from the warehouse and the material requisition document identifies the cost of the materials supplied to the X5. In a similar vein, individual workers record the time spent working on the X5 on time sheets. The cost of this labor can easily be traced to the X5 and is another example of a direct cost. The term **cost tracing** is used to describe the assignment of direct costs to a particular cost object.
- **Indirect costs of a cost object** are related to the particular cost object but cannot be traced to it in an economically feasible (cost-effective) way. For example, the salaries of plant administrators (including the plant manager) who oversee production of the many different types of cars produced at the Spartanburg plant are an indirect cost of the X5s. Plant administration costs are related to the cost object (X5s) because plant administration is necessary for managing the production of X5s. Plant administration costs are indirect costs because plant administrators also oversee the production of other

**Exhibit 2-2**

Cost Assignment to a Cost Object

products, such as the Z4 Roadster. Unlike the cost of steel or tires, there is no requisition of plant administration services and it is virtually impossible to trace plant administration costs to the X5 line. The term **cost allocation** is used to describe the assignment of indirect costs to a particular cost object. **Cost assignment** is a general term that encompasses both (1) tracing direct costs to a cost object and (2) allocating indirect costs to a cost object. Exhibit 2-2 depicts direct costs and indirect costs and both forms of cost assignment—cost tracing and cost allocation—using the example of the BMW X5.

Challenges in Cost Allocation

Consider the cost to lease the Spartanburg plant. This cost is an indirect cost of the X5—there is no separate lease agreement for the area of the plant where the X5 is made. But BMW *allocates* to the X5 a part of the lease cost of the building—for example, on the basis of an estimate of the percentage of the building's floor space occupied for the production of the X5 relative to the total floor space used to produce all models of cars.

Managers want to assign costs accurately to cost objects. Inaccurate product costs will mislead managers about the profitability of different products and could cause managers to unknowingly promote unprofitable products while deemphasizing profitable products. Generally, managers are more confident about the accuracy of direct costs of cost objects, such as the cost of steel and tires of the X5.

Identifying indirect costs of cost objects, on the other hand, can be more challenging. Consider the lease. An intuitive method is to allocate lease costs on the basis of the total floor space occupied by each car model. This approach measures the building resources used by each car model reasonably and accurately. The more floor space that a car model occupies, the greater the lease costs assigned to it. Accurately allocating other indirect costs, such as plant administration to the X5, however, is more difficult. For example, should these costs be allocated on the basis of the number of workers working on each car model or the number of cars produced of each model? How to measure the share of plant administration used by each car model is not clear-cut.

Factors Affecting Direct/Indirect Cost Classifications

Several factors affect the classification of a cost as direct or indirect:

- The materiality of the cost in question.** The smaller the amount of a cost—that is, the more immaterial the cost is—the less likely that it is economically feasible to trace that cost to a particular cost object. Consider a mail-order catalog company such as Lands' End. It would be economically feasible to trace the courier charge for delivering a package to an individual customer as a direct cost. In contrast, the cost of the invoice paper included in the package would be classified as an indirect cost. Why? Although the cost of the paper can be traced to each customer, it is not cost-effective to do so. The benefits of knowing that, say, exactly 0.5¢ worth of paper is included in each package do not exceed the data processing and administrative costs of tracing the cost to each package. The time of the sales administrator, who earns a salary of \$45,000 a year, is better spent organizing customer information to assist in focused marketing efforts than on tracking the cost of paper.

- **Available information-gathering technology.** Improvements in information-gathering technology make it possible to consider more and more costs as direct costs. Bar codes, for example, allow manufacturing plants to treat certain low-cost materials such as clips and screws, which were previously classified as indirect costs, as direct costs of products. At Dell, component parts such as the computer chip and the CD-ROM drive display a bar code that can be scanned at every point in the production process. Bar codes can be read into a manufacturing cost file by waving a “wand” in the same quick and efficient way supermarket checkout clerks enter the cost of each item purchased by a customer.
- **Design of operations.** Classifying a cost as direct is easier if a company’s facility (or some part of it) is used exclusively for a specific cost object, such as a specific product or a particular customer. For example, the cost of the General Chemicals facility dedicated to manufacturing soda ash is a direct cost of soda ash.

Decision Point

How do managers decide whether a cost is a direct or indirect cost?

Be aware that a specific cost may be both a direct cost of one cost object and an indirect cost of another cost object. *That is, the direct/indirect classification depends on the choice of the cost object.* For example, the salary of an assembly department supervisor at BMW is a direct cost if the cost object is the assembly department, but it is an indirect cost if the cost object is a product such as the BMW X5 SAV, because the assembly department assembles many different models. A useful rule to remember is that the broader the definition of the cost object—the assembly department rather than the X5 SAV—the higher the proportion of total costs that are direct costs and the more confidence a manager has in the accuracy of the resulting cost amounts.

Cost-Behavior Patterns: Variable Costs and Fixed Costs

Learning Objective 3

Explain variable costs and fixed costs

... the two basic ways in which costs behave

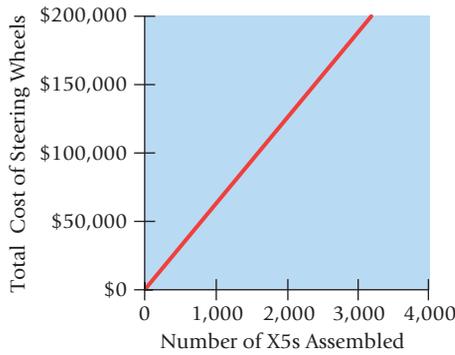
Costing systems record the cost of resources acquired, such as materials, labor, and equipment, and track how those resources are used to produce and sell products or services. Recording the costs of resources acquired and used allows managers to see how costs behave. Consider two basic types of cost-behavior patterns found in many accounting systems. A **variable cost** changes *in total* in proportion to changes in the related level of total activity or volume. A **fixed cost** remains unchanged *in total* for a given time period, despite wide changes in the related level of total activity or volume. Costs are defined as variable or fixed with respect to *a specific activity* and for *a given time period*. Surveys of practice repeatedly show that identifying a cost as variable or fixed provides valuable information for making many management decisions and is an important input when evaluating performance. To illustrate these two basic types of costs, again consider costs at the Spartanburg, South Carolina, plant of BMW.

1. **Variable Costs:** If BMW buys a steering wheel at \$60 for each of its BMW X5 vehicles, then the total cost of steering wheels is \$60 times the number of vehicles produced, as the following table illustrates.

| Number of X5s Produced (1) | Variable Cost per Steering Wheel (2) | Total Variable Cost of Steering Wheels (3) = (1) × (2) |
|-------------------------------|---|---|
| 1 | \$60 | \$ 60 |
| 1,000 | 60 | 60,000 |
| 3,000 | 60 | 180,000 |

The steering wheel cost is an example of a variable cost because *total cost* changes in proportion to changes in the number of vehicles produced. The cost per unit of a variable cost is constant. It is precisely because the variable cost per steering wheel in column 2 is the same for each steering wheel that the total variable cost of steering wheels in column 3 changes proportionately with the number of X5s produced in column 1. When considering how variable costs behave, always focus on *total costs*.

PANEL A: Variable Cost of Steering Wheels at \$60 per BMW X5 Assembled



PANEL B: Supervision Costs for the BMW X5 assembly line (in millions)

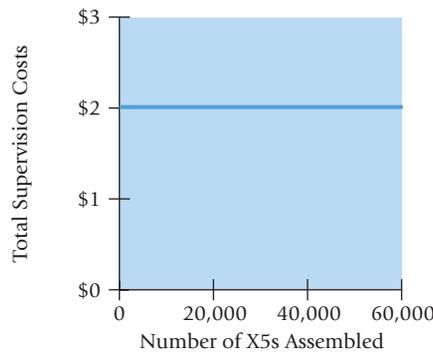


Exhibit 2-3
Graphs of Variable and Fixed Costs

Exhibit 2-3, Panel A, graphically illustrates the total variable cost of steering wheels. The cost is represented by a straight line that climbs from left to right. The phrases “strictly variable” and “proportionately variable” are sometimes used to describe the variable cost in Panel A.

Consider an example of a variable cost with respect to a different activity—the \$20 hourly wage paid to each worker to set up machines at the Spartanburg plant. Setup labor cost is a variable cost with respect to setup hours because setup cost changes in total in proportion to the number of setup hours used.

- Fixed Costs:** Suppose BMW incurs a total cost of \$2,000,000 per year for supervisors who work exclusively on the X5 line. These costs are unchanged in total over a designated range of the number of vehicles produced during a given time span (see Exhibit 2-3, Panel B). Fixed costs become smaller and smaller on a per unit basis as the number of vehicles assembled increases, as the following table shows.

| Annual Total Fixed Supervision Costs for BMW X5 Assembly Line | Number of X5s Produced | Fixed Supervision Cost per X5 |
|--|-------------------------------|--------------------------------------|
| (1) | (2) | (3) = (1) ÷ (2) |
| \$2,000,000 | 10,000 | \$200 |
| \$2,000,000 | 25,000 | 80 |
| \$2,000,000 | 50,000 | 40 |

It is precisely because *total* line supervision costs are fixed at \$2,000,000 that fixed supervision cost per X5 decreases as the number of X5s produced increases; the same fixed cost is spread over a larger number of X5s. Do not be misled by the change in fixed cost per unit. Just as in the case of variable costs, when considering fixed costs, always focus on *total costs*. Costs are fixed when total costs remain unchanged despite significant changes in the level of total activity or volume.

Why are some costs variable and other costs fixed? Recall that a cost is usually measured as the amount of money that must be paid to acquire goods and services. Total cost of steering wheels is a variable cost because BMW buys the steering wheels only when they are needed. As more X5s are produced, proportionately more steering wheels are acquired and proportionately more costs are incurred.

Contrast the description of variable costs with the \$2,000,000 of fixed costs per year incurred by BMW for supervision of the X5 assembly line. This level of supervision is acquired and put in place well before BMW uses it to produce X5s and before BMW even knows how many X5s it will produce. Suppose that BMW puts in place supervisors capable of supervising the production of 60,000 X5s each year. If the demand is for only 55,000 X5s, there will be idle capacity. Supervisors on the X5 line could have supervised the production of 60,000 X5s but will supervise only 55,000 X5s because of the lower demand. However, BMW must pay for the unused line supervision capacity because the cost of supervision cannot be reduced in the short run. If demand is even lower—say only 50,000 X5s—line supervision costs will still be the same \$2,000,000, and idle capacity will increase.

Unlike variable costs, fixed costs of resources (such as for line supervision) cannot be quickly and easily changed to match the resources needed or used. Over time, however, managers can take actions to reduce fixed costs. For example, if the X5 line needs to be run for fewer hours because of low demand for X5s, BMW may lay off supervisors or move them to another production line. Unlike variable costs that go away automatically if the resources are not used, reducing fixed costs requires active intervention on the part of managers.

Do not assume that individual cost items are inherently variable or fixed. Consider labor costs. Labor costs can be purely variable with respect to units produced when workers are paid on a piece-unit (piece-rate) basis. For example, some garment workers are paid on a per-shirt-sewed basis. In contrast, labor costs at a plant in the coming year are sometimes appropriately classified as fixed.

For instance, a labor union agreement might set annual salaries and conditions, contain a no-layoff clause, and severely restrict a company's flexibility to assign workers to any other plant that has demand for labor. Japanese companies have for a long time had a policy of lifetime employment for their workers. Although such a policy entails higher fixed labor costs, the benefits are increased loyalty and dedication to the company and higher productivity. As the General Motors example in the chapter opener (p. 26) illustrated, such a policy increases the risk of losses during economic downturns as revenues decrease, while fixed costs remain unchanged. The recent global economic crisis has made companies very wary of locking-in fixed costs. The Concepts in Action box on page 33 describes how a car-sharing service offers companies the opportunity to convert the fixed costs of owning corporate cars into variable costs by renting cars on an as-needed basis.

A particular cost item could be variable with respect to one level of activity and fixed with respect to another. Consider annual registration and license costs for a fleet of planes owned by an airline company. Registration and license costs would be a variable cost with respect to the number of planes owned. But registration and license costs for a particular plane are fixed with respect to the miles flown by that plane during a year.

To focus on key concepts, we have classified the behavior of costs as variable or fixed. Some costs have both fixed and variable elements and are called *mixed* or *semivariable* costs. For example, a company's telephone costs may have a fixed monthly payment and a charge per phone-minute used. We discuss mixed costs and techniques to separate out their fixed and variable components in Chapter 10.

Decision Point

How do managers decide whether a cost is a variable or a fixed cost?

Cost Drivers

A **cost driver** is a variable, such as the level of activity or volume that causally affects costs over a given time span. An *activity* is an event, task, or unit of work with a specified purpose—for example, designing products, setting up machines, or testing products. The level of activity or volume is a cost driver if there is a cause-and-effect relationship between a change in the level of activity or volume and a change in the level of total costs. For example, if product-design costs change with the number of parts in a product, the number of parts is a cost driver of product-design costs. Similarly, miles driven is often a cost driver of distribution costs.

The cost driver of a variable cost is the level of activity or volume whose change causes proportionate changes in the variable cost. For example, the number of vehicles assembled is the cost driver of the total cost of steering wheels. If setup workers are paid an hourly wage, the number of setup hours is the cost driver of total (variable) setup costs.

Costs that are fixed in the short run have no cost driver in the short run but may have a cost driver in the long run. Consider the costs of testing, say, 0.1% of the color printers produced at a Hewlett-Packard plant. These costs consist of equipment and staff costs of the testing department that are difficult to change and, hence, are fixed in the short run with respect to changes in the volume of production. In this case, volume of production is not a cost driver of testing costs in the short run. In the long run, however, Hewlett-Packard will increase or decrease the testing department's equipment and staff to the levels needed to support future production volumes. In the long run, volume of production is a cost driver of testing costs. Costing systems that identify the cost of each activity such as testing, design, or set up are called *activity-based costing systems*.

Concepts in Action

How Zipcar Helps Reduce Twitter's Transportation Costs



Soaring gas prices, high insurance costs, and hefty parking fees have forced many businesses to reexamine whether owning corporate cars is economical. In some cities, Zipcar has emerged as an attractive alternative. Zipcar provides an “on demand” option for urban individuals and businesses to rent a car by the week, the day, or even the hour. Zipcar members make a reservation by phone or Internet, go to the parking lot where the car is located (usually by walking or public transportation), use an electronic card or iPhone application that unlocks the car door via a wireless sensor, and then simply climb in and drive away. Rental fees begin around \$7 per hour and \$66 per day, and include gas, insurance, and some mileage (usually around 180 miles per day). Currently, business

customers account for 15% of Zipcar's revenues, but that number is expected to double in the coming years.

Let's think about what Zipcar means for companies. Many small businesses own a company car or two for getting to meetings, making deliveries, and running errands. Similarly, many large companies own a fleet of cars to shuttle visiting executives and clients back and forth from appointments, business lunches, and the airport. Traditionally, owning these cars has involved very high fixed costs, including buying the asset (car), costs of the maintenance department, and insurance for multiple drivers. Unfortunately, businesses had no other options.

Now, however, companies like Twitter can use Zipcar for on-demand mobility while reducing their transportation and overhead costs. Based in downtown San Francisco, Twitter managers use Zipcar's fleet of Mini Coopers and Toyota Priuses to meet venture capitalists and partners in Silicon Valley. “We would get in a Zipcar to drive down to San Jose to pitch investors or go across the city,” says Jack Dorsey, the micro-blogging service's co-founder. “Taxis are hard to find and unreliable here.” Twitter also uses Zipcar when traveling far away from its headquarters, like when visiting advertisers in New York and technology vendors in Boston, forgoing the traditional black sedans and long taxi rides from the airport.

From a business perspective, Zipcar allows companies to convert the fixed costs of owning a company car to variable costs. If business slows, or a car isn't required to visit a client, Zipcar customers are not saddled with the fixed costs of car ownership. Of course, if companies use Zipcar too frequently, they can end up paying more overall than they would have paid if they purchased and maintained the car themselves.

Along with cutting corporate spending, car sharing services like Zipcar reduce congestion on the road and promote environmental sustainability. Users report reducing their vehicle miles traveled by 44%, and surveys show CO₂ emissions are being cut by up to 50% per user. Beyond that, each shared car takes up to 20 cars off the road as members sell their cars or decide not to buy new ones—challenging the whole principle of owning a car. “The future of transportation will be a blend of things like Zipcar, public transportation, and private car ownership,” says Bill Ford, Ford's executive chairman. But the automaker isn't worried. “Not only do I not fear that, but I think it's a great opportunity for us to participate in the changing nature of car ownership.”

Sources: Keegan, Paul. 2009. Zipcar – the best new idea in business. *Fortune*, August 27. http://money.cnn.com/2009/08/26/news/companies/zipcar_car_rentals.fortune/; Olsen, Elizabeth. 2009. Car sharing reinvents the company wheels. *New York Times*, May 7. <http://www.nytimes.com/2009/05/07/business/businessspecial/07CAR.html>; Zipcar, Inc. Zipcar for business case studies. <http://www.zipcar.com/business/is-it/case-studies> (accessed October 8, 2009)

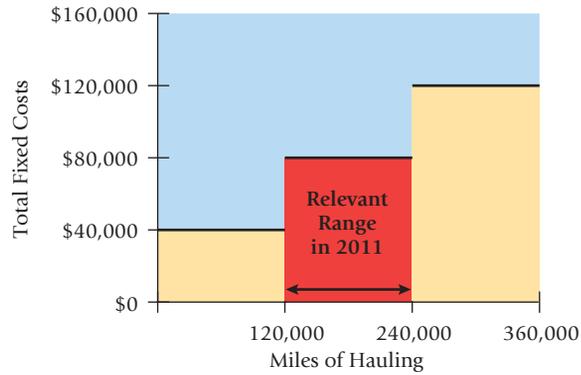
Relevant Range

Relevant range is the band of normal activity level or volume in which there is a specific relationship between the level of activity or volume and the cost in question. For example, a fixed cost is fixed only in relation to a given wide range of total activity or volume (at which the company is expected to operate) and only for a given time span (usually a particular budget period). Suppose that BMW contracts with Thomas Transport Company (TTC) to transport X5s to BMW dealers. TTC rents two trucks, and each truck has annual fixed rental costs of \$40,000. The maximum annual usage of each truck is 120,000 miles. In the current year (2011), the predicted combined total hauling of the two trucks is 170,000 miles.

Exhibit 2-4 shows how annual fixed costs behave at different levels of miles of hauling. Up to 120,000 miles, TTC can operate with one truck; from 120,001 to 240,000 miles, it operates with two trucks; from 240,001 to 360,000 miles, it operates with three trucks. This

Exhibit 2-4

Fixed-Cost Behavior at Thomas Transport Company



pattern will continue as TTC adds trucks to its fleet to provide more miles of hauling. Given the predicted 170,000-mile usage for 2011, the range from 120,001 to 240,000 miles hauled is the range in which TTC expects to operate, resulting in fixed rental costs of \$80,000. Within this relevant range, changes in miles hauled will not affect the annual fixed costs.

Fixed costs may change from one year to the next. For example, if the total rental fee of the two trucks is increased by \$2,000 for 2012, the total level of fixed costs will increase to \$82,000 (all else remaining the same). If that increase occurs, total rental costs will be fixed at this new level of \$82,000 for 2012 for miles hauled in the 120,001 to 240,000 range.

The basic assumption of the relevant range also applies to variable costs. That is, outside the relevant range, variable costs, such as direct materials, may not change proportionately with changes in production volume. For example, above a certain volume, direct material costs may increase at a lower rate because of price discounts on purchases greater than a certain quantity.

Relationships of Types of Costs

We have introduced two major classifications of costs: direct/indirect and variable/fixed. Costs may simultaneously be as follows:

- Direct and variable
- Direct and fixed
- Indirect and variable
- Indirect and fixed

Exhibit 2-5 shows examples of costs in each of these four cost classifications for the BMW X5.

Exhibit 2-5

Examples of Costs in Combinations of the Direct/Indirect and Variable/Fixed Cost Classifications for a Car Manufacturer

| | | Assignment of Costs to Cost Object | |
|-----------------------|----------------|--|--|
| | | Direct Costs | Indirect Costs |
| Cost-Behavior Pattern | Variable Costs | <ul style="list-style-type: none"> • Cost object: BMW X5s produced Example: Tires used in assembly of automobile | <ul style="list-style-type: none"> • Cost object: BMW X5s produced Example: Power costs at Spartanburg plant. Power usage is metered only to the plant, where multiple products are assembled. |
| | Fixed Costs | <ul style="list-style-type: none"> • Cost object: BMW X5s produced Example: Salary of supervisor on BMW X5 assembly line | <ul style="list-style-type: none"> • Cost object: BMW X5s produced Example: Annual lease costs at Spartanburg plant. Lease is for whole plant, where multiple products are produced. |

Total Costs and Unit Costs

The preceding section concentrated on the behavior patterns of total costs in relation to activity or volume levels. We now consider unit costs.

Unit Costs

Generally, the decision maker should think in terms of total costs rather than unit costs. In many decision contexts, however, calculating a unit cost is essential. Consider the booking agent who has to make the decision to book Paul McCartney to play at Shea Stadium. She estimates the cost of the event to be \$4,000,000. This knowledge is helpful for the decision, but it is not enough.

Before a decision can be reached, the booking agent also must predict the number of people who will attend. Without knowledge of both total cost and number of attendees, she cannot make an informed decision on a possible admission price to recover the cost of the event or even on whether to have the event at all. So she computes the unit cost of the event by dividing the total cost (\$4,000,000) by the expected number of people who will attend. If 50,000 people attend, the unit cost is \$80 ($\$4,000,000 \div 50,000$) per person; if 20,000 attend, the unit cost increases to \$200 ($\$4,000,000 \div 20,000$).

Unless the total cost is “unitized” (that is, averaged with respect to the level of activity or volume), the \$4,000,000 cost is difficult to interpret. The unit cost combines the total cost and the number of people in a handy, communicative way.

Accounting systems typically report both total-cost amounts and average-cost-per-unit amounts. A **unit cost**, also called an **average cost**, is calculated by dividing total cost by the related number of units. The units might be expressed in various ways. Examples are automobiles assembled, packages delivered, or hours worked. Suppose that, in 2011, its first year of operations, \$40,000,000 of manufacturing costs are incurred to produce 500,000 speaker systems at the Memphis plant of Tennessee Products. Then the unit cost is \$80:

$$\frac{\text{Total manufacturing costs}}{\text{Number of units manufactured}} = \frac{\$40,000,000}{500,000 \text{ units}} = \$80 \text{ per unit}$$

If 480,000 units are sold and 20,000 units remain in ending inventory, the unit-cost concept helps in the determination of total costs in the income statement and balance sheet and, hence, the financial results reported by Tennessee Products to shareholders, banks, and the government.

| | |
|---|---------------------|
| Cost of goods sold in the income statement, 480,000 units × \$80 per unit | \$38,400,000 |
| Ending inventory in the balance sheet, 20,000 units × \$80 per unit | <u>1,600,000</u> |
| Total manufacturing costs of 500,000 units | <u>\$40,000,000</u> |

Unit costs are found in all areas of the value chain—for example, unit cost of product design, of sales visits, and of customer-service calls. By summing unit costs throughout the value chain, managers calculate the unit cost of the different products or services they deliver and determine the profitability of each product or service. Managers use this information, for example, to decide the products in which they should invest more resources, such as R&D and marketing, and the prices they should charge.

Use Unit Costs Cautiously

Although unit costs are regularly used in financial reports and for making product mix and pricing decisions, *managers should think in terms of total costs rather than unit costs for many decisions*. Consider the manager of the Memphis plant of Tennessee Products. Assume the \$40,000,000 in costs in 2011 consist of \$10,000,000 of fixed costs and \$30,000,000 of variable costs (at \$60 variable cost per speaker system produced). Suppose the total fixed cost and the variable cost per speaker system in 2012 are expected to be unchanged from 2011. The budgeted costs for 2012 at different

Learning Objective 4

Interpret unit costs cautiously

... for many decisions, managers should use total costs, not unit costs

production levels, calculated on the basis of total variable costs, total fixed costs, and total costs, are as follows:

| Units Produced (1) | Variable Cost per Unit (2) | Total Variable Costs (3) = (1) × (2) | Total Fixed Costs (4) | Total Costs (5) = (3) + (4) | Unit Cost (6) = (5) ÷ (1) |
|-----------------------|----------------------------------|--|-----------------------------|--------------------------------|------------------------------|
| 100,000 | \$60 | \$ 6,000,000 | \$10,000,000 | \$16,000,000 | \$160.00 |
| 200,000 | \$60 | \$12,000,000 | \$10,000,000 | \$22,000,000 | \$110.00 |
| 500,000 | \$60 | \$30,000,000 | \$10,000,000 | \$40,000,000 | \$ 80.00 |
| 800,000 | \$60 | \$48,000,000 | \$10,000,000 | \$58,000,000 | \$ 72.50 |
| 1,000,000 | \$60 | \$60,000,000 | \$10,000,000 | \$70,000,000 | \$ 70.00 |

A plant manager who uses the 2011 unit cost of \$80 per unit will underestimate actual total costs if 2012 output is below the 2011 level of 500,000 units. If actual volume is 200,000 units due to, say, the presence of a new competitor, actual costs would be \$22,000,000. The unit cost of \$80 times 200,000 units equals \$16,000,000, which underestimates the actual total costs by \$6,000,000 (\$22,000,000 – \$16,000,000). *The unit cost of \$80 applies only when 500,000 units are produced.*

An overreliance on unit cost in this situation could lead to insufficient cash being available to pay costs if volume declines to 200,000 units. As the table indicates, for making this decision, managers should think in terms of total variable costs, total fixed costs, and total costs rather than unit cost. As a general rule, first calculate total costs, then compute a unit cost, if it is needed for a particular decision.

Decision Point

How should costs be estimated?

Business Sectors, Types of Inventory, Inventoriable Costs, and Period Costs

In this section, we describe the different sectors of the economy, the different types of inventory that companies hold, and some commonly used classifications of manufacturing costs.

Manufacturing-, Merchandising-, and Service-Sector Companies

We define three sectors of the economy and provide examples of companies in each sector.

1. **Manufacturing-sector companies** purchase materials and components and convert them into various finished goods. Examples are automotive companies such as Jaguar, cellular phone producers such as Nokia, food-processing companies such as Heinz, and computer companies such as Toshiba.
2. **Merchandising-sector companies** purchase and then sell tangible products without changing their basic form. This sector includes companies engaged in retailing (for example, bookstores such as Barnes and Noble or department stores such as Target), distribution (for example, a supplier of hospital products, such as Owens and Minor), or wholesaling (for example, a supplier of electronic components, such as Arrow Electronics).
3. **Service-sector companies** provide services (intangible products)—for example, legal advice or audits—to their customers. Examples are law firms such as Wachtell, Lipton, Rosen & Katz, accounting firms such as Ernst and Young, banks such as Barclays, mutual fund companies such as Fidelity, insurance companies such as Aetna, transportation companies such as Singapore Airlines, advertising agencies such as Saatchi & Saatchi, television stations such as Turner Broadcasting, Internet service providers such as Comcast, travel agencies such as American Express, and brokerage firms such as Merrill Lynch.

Learning Objective 5

Distinguish inventoriable costs

... assets when incurred, then cost of goods sold

from period costs

... expenses of the period when incurred

Types of Inventory

Manufacturing-sector companies purchase materials and components and convert them into various finished goods. These companies typically have one or more of the following three types of inventory:

1. **Direct materials inventory.** Direct materials in stock and awaiting use in the manufacturing process (for example, computer chips and components needed to manufacture cellular phones).
2. **Work-in-process inventory.** Goods partially worked on but not yet completed (for example, cellular phones at various stages of completion in the manufacturing process). This is also called **work in progress**.
3. **Finished goods inventory.** Goods (for example, cellular phones) completed but not yet sold.

Merchandising-sector companies purchase tangible products and then sell them without changing their basic form. They hold only one type of inventory, which is products in their original purchased form, called *merchandise inventory*. Service-sector companies provide only services or intangible products and so do not hold inventories of tangible products.

Commonly Used Classifications of Manufacturing Costs

Three terms commonly used when describing manufacturing costs are direct material costs, direct manufacturing labor costs, and indirect manufacturing costs. These terms build on the direct versus indirect cost distinction we had described earlier, in the context of manufacturing costs.

1. **Direct material costs** are the acquisition costs of all materials that eventually become part of the cost object (work in process and then finished goods) and can be traced to the cost object in an economically feasible way. Acquisition costs of direct materials include freight-in (inward delivery) charges, sales taxes, and custom duties. Examples of direct material costs are the steel and tires used to make the BMW X5, and the computer chips used to make cellular phones.
2. **Direct manufacturing labor costs** include the compensation of all manufacturing labor that can be traced to the cost object (work in process and then finished goods) in an economically feasible way. Examples include wages and fringe benefits paid to machine operators and assembly-line workers who convert direct materials purchased to finished goods.
3. **Indirect manufacturing costs** are all manufacturing costs that are related to the cost object (work in process and then finished goods) but cannot be traced to that cost object in an economically feasible way. Examples include supplies, indirect materials such as lubricants, indirect manufacturing labor such as plant maintenance and cleaning labor, plant rent, plant insurance, property taxes on the plant, plant depreciation, and the compensation of plant managers. This cost category is also referred to as **manufacturing overhead costs** or **factory overhead costs**. We use *indirect manufacturing costs* and *manufacturing overhead costs* interchangeably in this book.

We now describe the distinction between inventoriable costs and period costs.

Inventoriable Costs

Inventoriable costs are all costs of a product that are considered as assets in the balance sheet when they are incurred and that become cost of goods sold only when the product is sold. For manufacturing-sector companies, all manufacturing costs are inventoriable costs. Consider Cellular Products, a manufacturer of cellular phones. Costs of direct materials, such as computer chips, issued to production (from direct material inventory), direct manufacturing labor costs, and manufacturing overhead costs create new assets, starting as work in process and becoming finished goods (the cellular phones). Hence,

manufacturing costs are included in work-in-process inventory and in finished goods inventory (they are “inventoried”) to accumulate the costs of creating these assets.

When the cellular phones are sold, the cost of manufacturing them is matched against **revenues**, which are inflows of assets (usually cash or accounts receivable) received for products or services provided to customers. The cost of goods sold includes all manufacturing costs (direct materials, direct manufacturing labor, and manufacturing overhead costs) incurred to produce them. The cellular phones may be sold during a different accounting period than the period in which they were manufactured. Thus, inventorying manufacturing costs in the balance sheet during the accounting period when goods are manufactured and expensing the manufacturing costs in a later income statement when the goods are sold matches revenues and expenses.

For merchandising-sector companies such as Wal-Mart, inventoriable costs are the costs of purchasing the goods that are resold in their same form. These costs comprise the costs of the goods themselves plus any incoming freight, insurance, and handling costs for those goods. Service-sector companies provide only services or intangible products. The absence of inventories of tangible products for sale means there are no inventoriable costs.

Period Costs

Period costs are all costs in the income statement other than cost of goods sold. Period costs, such as marketing, distribution and customer service costs, are treated as expenses of the accounting period in which they are incurred because they are expected to benefit revenues in that period and are not expected to benefit revenues in future periods. Some costs such as R&D costs are treated as period costs because, although these costs may benefit revenues in a future period if the R&D efforts are successful, it is highly uncertain if and when these benefits will occur. Expensing period costs as they are incurred best matches expenses to revenues.

For manufacturing-sector companies, period costs in the income statement are all nonmanufacturing costs (for example, design costs and costs of shipping products to customers). For merchandising-sector companies, period costs in the income statement are all costs not related to the cost of goods purchased for resale. Examples of these period costs are labor costs of sales floor personnel and advertising costs. Because there are no inventoriable costs for service-sector companies, all costs in the income statement are period costs.

Exhibit 2-5 showed examples of inventoriable costs in direct/indirect and variable/fixed cost classifications for a car manufacturer. Exhibit 2-6 shows examples of period costs in direct/indirect and variable/fixed cost classifications at a bank.

Exhibit 2-6

Examples of Period Costs in Combinations of the Direct/Indirect and Variable/Fixed Cost Classifications at a Bank

| | | Assignment of Costs to Cost Object | |
|-----------------------|----------------|---|---|
| | | Direct Costs | Indirect Costs |
| Cost-Behavior Pattern | Variable Costs | <ul style="list-style-type: none"> • Cost object: Number of mortgage loans Example: Fees paid to property appraisal company for each mortgage loan | <ul style="list-style-type: none"> • Cost object: Number of mortgage loans Example: Postage paid to deliver mortgage-loan documents to lawyers/homeowners |
| | Fixed Costs | <ul style="list-style-type: none"> • Cost object: Number of mortgage loans Example: Salary paid to executives in mortgage loan department to develop new mortgage-loan products | <ul style="list-style-type: none"> • Cost object: Number of mortgage loans Example: Cost to the bank of sponsoring annual golf tournament |

Illustrating the Flow of Inventoriable Costs and Period Costs

We illustrate the flow of inventoriable costs and period costs through the income statement of a manufacturing company, for which the distinction between inventoriable costs and period costs is most detailed.

Manufacturing-Sector Example

Follow the flow of costs for Cellular Products in Exhibit 2-7 and Exhibit 2-8. Exhibit 2-7 visually highlights the differences in the flow of inventoriable and period costs for a manufacturing-sector company. Note how, as described in the previous section, inventoriable costs go through the balance sheet accounts of work-in-process inventory and finished goods inventory before entering cost of goods sold in the income statement. Period costs are expensed directly in the income statement. Exhibit 2-8 takes the visual presentation in Exhibit 2-7 and shows how inventoriable costs and period expenses would appear in the income statement and schedule of cost of goods manufactured of a manufacturing company.

We start by tracking the flow of direct materials shown on the left of Exhibit 2-7 and in Panel B of Exhibit 2-8.

Step 1: Cost of direct materials used in 2011. Note how the arrows in Exhibit 2-7 for beginning inventory, \$11,000 (all numbers in thousands), and direct material purchases, \$73,000, “fill up” the direct material inventory box and how direct material used, \$76,000 “empties out” direct material inventory leaving an ending inventory of direct materials of \$8,000 that becomes the beginning inventory for the next year.

The cost of direct materials used is calculated in Exhibit 2-8, Panel B (light blue shaded area) as follows:

| | |
|---|-----------------|
| Beginning inventory of direct materials, January 1, 2011 | \$11,000 |
| + Purchases of direct materials in 2011 | 73,000 |
| – Ending inventory of direct materials, December 31, 2011 | <u>8,000</u> |
| = Direct materials used in 2011 | <u>\$76,000</u> |

Exhibit 2-7 Flow of Revenue and Costs for a Manufacturing-Sector Company, Cellular Products (in thousands)

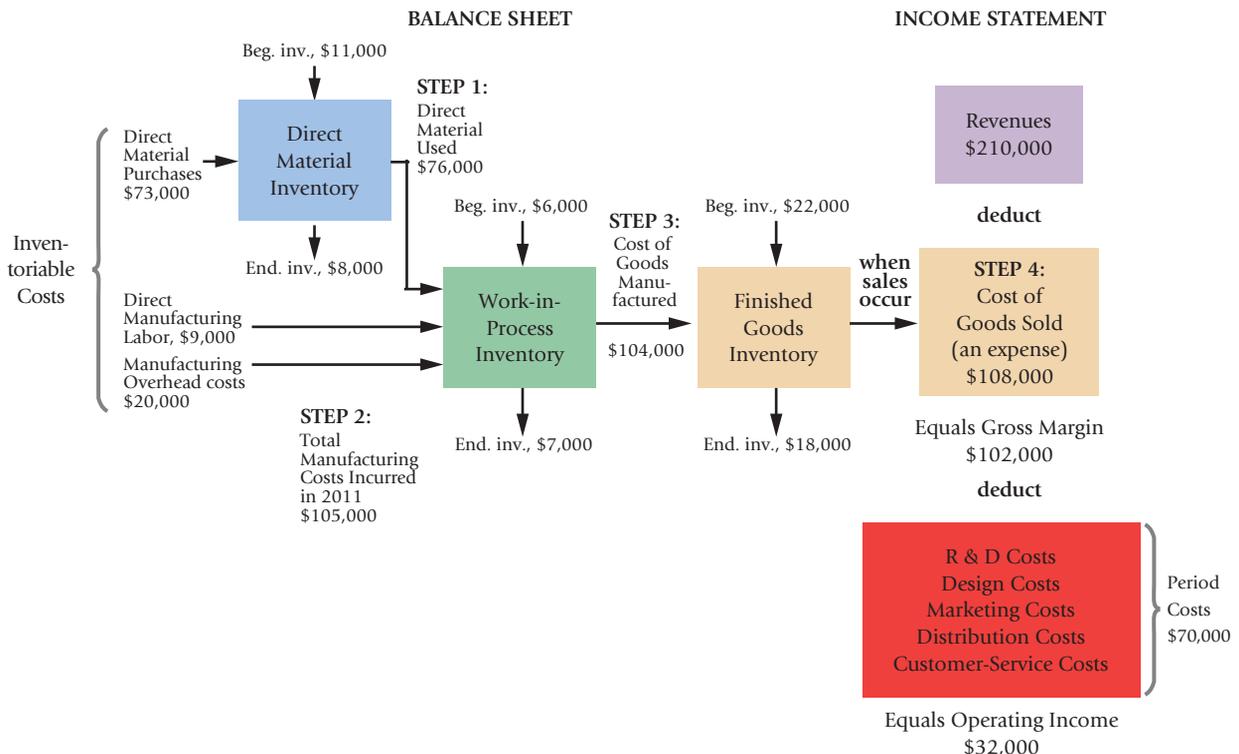


Exhibit 2-8

Income Statement and Schedule of Cost of Goods Manufactured of a Manufacturing-Sector Company, Cellular Products

| | | Home | Insert | Page Layout | Formulas | Data | Review | View |
|----|---|------|----------------|------------------|----------|------|--------|------|
| | | A | B | C | D | | | |
| 1 | PANEL A: INCOME STATEMENT | | | | | | | |
| 2 | Cellular Products | | | | | | | |
| 3 | Income Statement | | | | | | | |
| 4 | For the Year Ended December 31, 2011 (in thousands) | | | | | | | |
| 5 | Revenues | | | \$210,000 | | | | |
| 6 | Cost of goods sold: | | | | | | | |
| 7 | Beginning finished goods inventory, January 1, 2009 | | \$ 22,000 | | | | | |
| 8 | Cost of goods manufactured (see Panel B) | | <u>104,000</u> | | | | | |
| 9 | Cost of goods available for sale | | 126,000 | | | | | |
| 10 | Ending finished goods inventory, December 31, 2009 | | <u>18,000</u> | | | | | |
| 11 | Cost of goods sold | | | <u>108,000</u> | | | | |
| 12 | Gross margin (or gross profit) | | | 102,000 | | | | |
| 13 | Operating costs: | | | | | | | |
| 14 | R&D, design, mktg., dist., and cust.-service cost | | 70,000 | | | | | |
| 15 | Total operating costs | | | <u>70,000</u> | | | | |
| 16 | Operating income | | | <u>\$ 32,000</u> | | | | |
| 17 | | | | | | | | |
| 18 | PANEL B: COST OF GOODS MANUFACTURED | | | | | | | |
| 19 | Cellular Products | | | | | | | |
| 20 | Schedule of Cost of Goods Manufactured^a | | | | | | | |
| 21 | For the Year Ended December 31, 2009 (in thousands) | | | | | | | |
| 22 | Direct materials: | | | | | | | |
| 23 | Beginning inventory, January 1, 2009 | | \$11,000 | | | | | |
| 24 | Purchases of direct materials | | <u>73,000</u> | | | | | |
| 25 | Cost of direct materials available for use | | 84,000 | | | | | |
| 26 | Ending inventory, December 31, 2009 | | <u>8,000</u> | | | | | |
| 27 | Direct materials used | | | \$ 76,000 | | | | |
| 28 | Direct manufacturing labor | | | 9,000 | | | | |
| 29 | Manufacturing overhead costs: | | | | | | | |
| 30 | Indirect manufacturing labor | | \$ 7,000 | | | | | |
| 31 | Supplies | | 2,000 | | | | | |
| 32 | Heat, light, and power | | 5,000 | | | | | |
| 33 | Depreciation—plant building | | 2,000 | | | | | |
| 34 | Depreciation—plant equipment | | 3,000 | | | | | |
| 35 | Miscellaneous | | <u>1,000</u> | | | | | |
| 36 | Total manufacturing overhead costs | | | <u>20,000</u> | | | | |
| 37 | Manufacturing costs incurred during 2009 | | | 105,000 | | | | |
| 38 | Beginning work-in-process inventory, January 1, 2009 | | | <u>6,000</u> | | | | |
| 39 | Total manufacturing costs to account for | | | 111,000 | | | | |
| 40 | Ending work-in-process inventory, December 31, 2009 | | | <u>7,000</u> | | | | |
| 41 | Cost of goods manufactured (to income statement) | | | <u>\$104,000</u> | | | | |
| 42 | ^a Note that this schedule can become a schedule of cost of goods manufactured and sold simply by including the beginning and ending finished goods inventory figures in the supporting schedule rather than in the body of the income statement. | | | | | | | |

STEP 4

STEP 1

STEP 2

STEP 3

Step 2: Total manufacturing costs incurred in 2011. Total manufacturing costs refers to all direct manufacturing costs and manufacturing overhead costs incurred during 2011 for all goods worked on during the year. Cellular Products classifies its manufacturing costs into the three categories described earlier.

| | |
|---|------------------|
| (i) Direct materials used in 2011 (shaded light blue in Exhibit 2-8, Panel B) | \$ 76,000 |
| (ii) Direct manufacturing labor in 2011 (shaded blue in Exhibit 2-8, Panel B) | 9,000 |
| (iii) Manufacturing overhead costs in 2011 (shaded dark blue in Exhibit 2-8, Panel B) | <u>20,000</u> |
| Total manufacturing costs incurred in 2011 | <u>\$105,000</u> |

Note how in Exhibit 2-7, these costs increase work-in-process inventory.

Step 3: Cost of goods manufactured in 2011. Cost of goods manufactured refers to the cost of goods brought to completion, whether they were started before or during the current accounting period.

Note how the work-in-process inventory box in Exhibit 2-7 has a very similar structure to the direct material inventory box described in Step 1. Beginning work-in-process inventory of \$6,000 and total manufacturing costs incurred in 2011 of \$105,000 “fill-up” the work-in-process inventory box. Some of the manufacturing costs incurred during 2011 are held back as the cost of the ending work-in-process inventory. The ending work-in-process inventory of \$7,000 becomes the beginning inventory for the next year, and the cost of goods manufactured during 2011 of \$104,000 “empties out” the work-in-process inventory while “filling up” the finished goods inventory box.

The cost of goods manufactured in 2011 (shaded green) is calculated in Exhibit 2-8, Panel B as follows:

| | |
|---|------------------|
| Beginning work-in-process inventory, January 1, 2011 | \$ 6,000 |
| + Total manufacturing costs incurred in 2011 | <u>105,000</u> |
| = Total manufacturing costs to account for | 111,000 |
| – Ending work-in-process inventory, December 31, 2011 | <u>7,000</u> |
| = Cost of goods manufactured in 2011 | <u>\$104,000</u> |

Step 4: Cost of goods sold in 2011. The cost of goods sold is the cost of finished goods inventory sold to customers during the current accounting period. Looking at the finished goods inventory box in Exhibit 2-7, we see that the beginning inventory of finished goods of \$22,000 and cost of goods manufactured in 2011 of \$104,000 “fill up” the finished goods inventory box. The ending inventory of finished goods of \$18,000 becomes the beginning inventory for the next year, and the cost of goods sold during 2011 of \$108,000 “empties out” the finished goods inventory.

This cost of goods sold is an expense that is matched against revenues. The cost of goods sold for Cellular Products (shaded brown) is computed in Exhibit 2-8, Panel A, as follows:

| | |
|---|------------------|
| Beginning inventory of finished goods, January 1, 2011 | \$ 22,000 |
| + Cost of goods manufactured in 2011 | <u>104,000</u> |
| – Ending inventory of finished goods, December 31, 2011 | <u>18,000</u> |
| = Cost of goods sold in 2011 | <u>\$108,000</u> |

Exhibit 2-9 shows related general ledger T-accounts for Cellular Products’ manufacturing cost flow. Note how the cost of goods manufactured (\$104,000) is the cost of all goods completed during the accounting period. These costs are all inventoriable costs. Goods completed during the period are transferred to finished goods inventory. These costs become cost of goods sold in the accounting period when the goods are sold. Also note that the direct materials, direct manufacturing labor, and manufacturing overhead costs of the units in work-in-process inventory (\$7,000) and finished goods inventory (\$18,000) as of December 31, 2011, will appear as an asset in the balance sheet. These costs will become expenses next year when these units are sold.

Exhibit 2-9

General Ledger T-Accounts for Cellular Products' Manufacturing Cost Flow (in thousands)

| Work-in-Process Inventory | | Finished Goods Inventory | | Cost of Goods Sold | |
|---------------------------|--------|----------------------------|---------|--------------------|---------|
| Bal. Jan. 1, 2011 | 6,000 | Bal. Jan. 1, 2011 | 22,000 | | |
| Direct materials used | 76,000 | Cost of goods manufactured | 104,000 | Cost of goods sold | 108,000 |
| Direct manuf. labor | 9,000 | Bal. Dec. 31, 2011 | 18,000 | | |
| Indirect manuf. costs | 20,000 | | | | |
| Bal. Dec. 31, 2011 | 7,000 | | | | |

We are now in a position to prepare Cellular Products' income statement for 2011. The income statement of Cellular Products is shown on the right-hand side of Exhibit 2-7 and in Exhibit 2-8, Panel A. Revenues of Cellular Products are (in thousands) \$210,000. Inventoriable costs expensed during 2011 equal cost of goods sold of \$108,000.

$$\text{Gross margin} = \text{Revenues} - \text{Cost of goods sold} = \$210,000 - \$108,000 = \$102,000.$$

The \$70,000 of operating costs comprising R&D, design, marketing, distribution, and customer-service costs are period costs of Cellular Products. These period costs include, for example, salaries of salespersons, depreciation on computers and other equipment used in marketing, and the cost of leasing warehouse space for distribution. **Operating income** equals total revenues from operations minus cost of goods sold and operating (period) costs (excluding interest expense and income taxes) or equivalently, gross margin minus period costs. The operating income of Cellular Products is \$32,000 (gross margin, \$102,000 – period costs, \$70,000). Those of you familiar with financial accounting will note that period costs are typically called selling, general, and administrative expenses in the income statement.

Newcomers to cost accounting frequently assume that indirect costs such as rent, telephone, and depreciation are always costs of the period in which they are incurred and are not associated with inventories. When these costs are incurred in marketing or in corporate headquarters, they are period costs. However, when these costs are incurred in manufacturing, they are manufacturing overhead costs and are inventoriable.

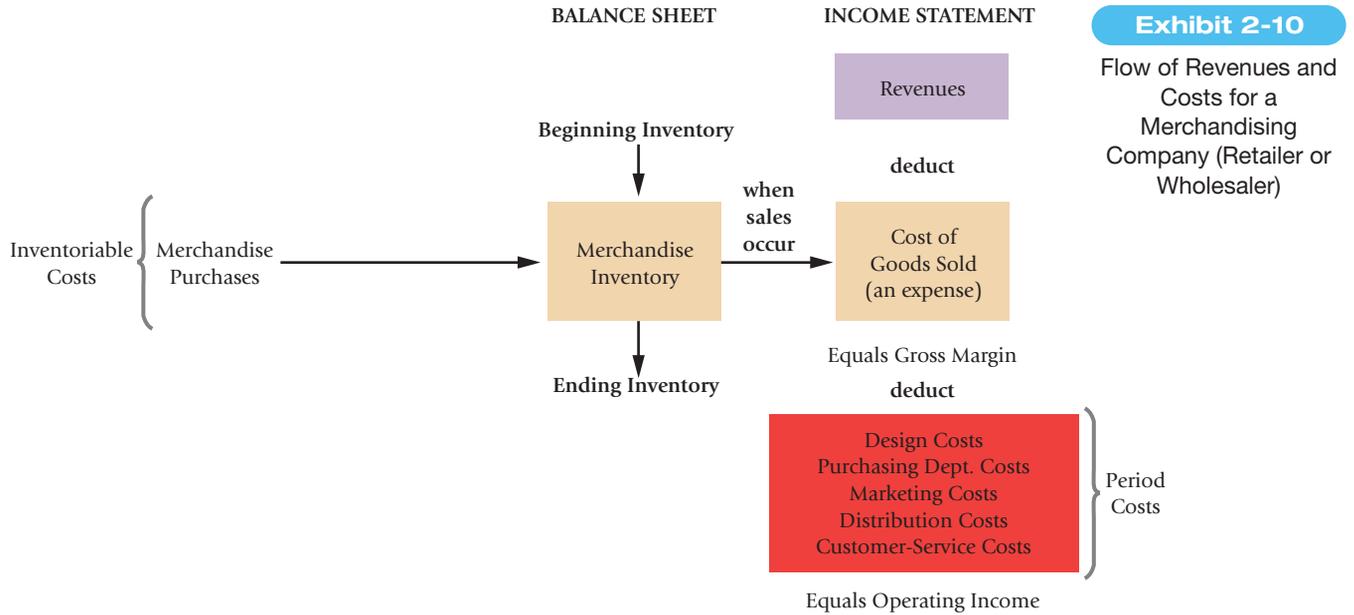
Recap of Inventoriable Costs and Period Costs

Exhibit 2-7 highlights the differences between inventoriable costs and period costs for a manufacturing company. The manufacturing costs of finished goods include direct materials, other direct manufacturing costs such as direct manufacturing labor, and manufacturing overhead costs such as supervision, production control, and machine maintenance. All these costs are inventoriable: They are assigned to work-in-process inventory until the goods are completed and then to finished goods inventory until the goods are sold. All nonmanufacturing costs, such as R&D, design, and distribution costs, are period costs.

Inventoriable costs and period costs flow through the income statement at a merchandising company similar to the way costs flow at a manufacturing company. At a merchandising company, however, the flow of costs is much simpler to understand and track. Exhibit 2-10 shows the inventoriable costs and period costs for a retailer or wholesaler who buys goods for resale. The only inventoriable cost is the cost of merchandise. (This corresponds to the cost of finished goods manufactured for a manufacturing company.) Purchased goods are held as merchandise inventory, the cost of which is shown as an asset in the balance sheet. As the goods are sold, their costs are shown in the income statement as cost of goods sold. A retailer or wholesaler also has a variety of marketing, distribution, and customer-service costs, which are period costs. In the income statement, period costs are deducted from revenues without ever having been included as part of inventory.

Decision Point

What are the differences in the accounting for inventoriable versus period costs?



Prime Costs and Conversion Costs

Two terms used to describe cost classifications in manufacturing costing systems are prime costs and conversion costs. **Prime costs** are all direct manufacturing costs. For Cellular Products,

$$\begin{aligned} \text{Prime costs} &= \text{Direct material costs} + \text{Direct manufacturing labor costs} = \\ & \$76,000 + \$9,000 = \$85,000 \end{aligned}$$

As we have already discussed, the greater the proportion of prime costs in a company’s cost structure, the more confident managers can be about the accuracy of the costs of products. As information-gathering technology improves, companies can add more and more direct-cost categories. For example, power costs might be metered in specific areas of a plant and identified as a direct cost of specific products. Furthermore, if a production line were dedicated to the manufacture of a specific product, the depreciation on the production equipment would be a direct manufacturing cost and would be included in prime costs. Computer software companies often have a “purchased technology” direct manufacturing cost item. This item, which represents payments to suppliers who develop software algorithms for a product, is also included in prime costs. **Conversion costs** are all manufacturing costs other than direct material costs. Conversion costs represent all manufacturing costs incurred to convert direct materials into finished goods. For Cellular Products,

$$\text{Conversion costs} = \begin{matrix} \text{Direct manufacturing} \\ \text{labor costs} \end{matrix} + \begin{matrix} \text{Manufacturing} \\ \text{overhead costs} \end{matrix} = \$9,000 + \$20,000 = \$29,000$$

Note that direct manufacturing labor costs are a part of both prime costs and conversion costs.

Some manufacturing operations, such as computer-integrated manufacturing (CIM) plants, have very few workers. The workers’ roles are to monitor the manufacturing process and to maintain the equipment that produces multiple products. Costing systems in CIM plants do not have a direct manufacturing labor cost category because direct manufacturing labor cost is relatively small and because it is difficult to trace this cost to products. In CIM plants, the only prime cost is direct material costs, and conversion costs consist only of manufacturing overhead costs.

Measuring Costs Requires Judgment

Measuring costs requires judgment. That's because there are alternative ways in which costs can be defined and classified. Different companies or sometimes even different sub-units within the same company may define and classify costs differently. Be careful to define and understand the ways costs are measured in a company or situation. We first illustrate this point with respect to labor cost measurement.

Measuring Labor Costs

Consider labor costs for software programming at companies such as Apple where programmers work on different software applications for products like the iMac, the iPod, and the iPhone. Although labor cost classifications vary among companies, many companies use multiple labor cost categories:

- Direct programming labor costs that can be traced to individual products
- Overhead (examples of prominent labor components of overhead follow):
 - Indirect labor compensation for
 - Office staff
 - Office security
 - Rework labor (time spent by direct laborers correcting software errors)
 - Overtime premium paid to software programmers (explained next)
 - Idle time (explained next)
 - Managers', department heads', and supervisors' salaries
 - Payroll fringe costs, for example, health care premiums and pension costs (explained later)

Note how *indirect labor costs* are commonly divided into many subclassifications, for example, office staff and idle time, to retain information on different categories of indirect labor. Note also that managers' salaries usually are not classified as indirect labor costs. Instead, the compensation of supervisors, department heads, and all others who are regarded as management is placed in a separate classification of labor-related overhead.

Overtime Premium and Idle Time

The purpose of classifying costs in detail is to associate an individual cost with a specific cause or reason for why it was incurred. Two classes of indirect labor—overtime premium and idle time—need special mention. **Overtime premium** is the wage rate paid to workers (for both direct labor and indirect labor) in *excess* of their straight-time wage rates. Overtime premium is usually considered to be a part of indirect costs or overhead. Consider the example of George Flexner, a junior software programmer who writes software for multiple products. He is paid \$20 per hour for straight-time and \$30 per hour (time and a half) for overtime. His overtime premium is \$10 per overtime hour. If he works 44 hours, including 4 overtime hours, in one week, his gross compensation would be classified as follows:

| | |
|--|--------------|
| Direct programming labor: 44 hours × \$20 per hour | \$880 |
| Overtime premium: 4 hours × \$10 per hour | <u>40</u> |
| Total compensation for 44 hours | <u>\$920</u> |

In this example, why is the overtime premium of direct programming labor usually considered an overhead cost rather than a direct cost? After all, it can be traced to specific products that George worked on while working overtime. Overtime premium is generally not considered a direct cost because the particular job that George worked on during the overtime hours is a matter of chance. For example, assume that George worked on two products for 5 hours each on a specific workday of 10 hours, including 2 overtime hours. Should the product George worked on during hours 9 and 10 be assigned the overtime premium? Or should the premium be prorated over both products? Prorating the overtime premium does not “penalize”—add to the cost of—a particular product solely because it happened to be worked on during the overtime hours. *Instead, the overtime premium is considered to be attributable to the heavy overall volume of work. Its cost is regarded as part of overhead, which is borne by both products.*

Sometimes overtime is not random. For example, a launch deadline for a particular product may clearly be the sole source of overtime. In such instances, the overtime premium is regarded as a direct cost of that product.

Another subclassification of indirect labor is the idle time of both direct and indirect labor. **Idle time** is wages paid for unproductive time caused by lack of orders, machine or computer breakdowns, work delays, poor scheduling, and the like. For example, if George had no work for 3 hours during that week while waiting to receive code from another colleague, George's earnings would be classified as follows:

| | |
|--|--------------|
| Direct programming labor: 41 hours × \$20/hour | \$820 |
| Idle time (overhead): 3 hours × \$20/hour | 60 |
| Overtime premium (overhead): 4 hours × \$10/hour | 40 |
| Total earnings for 44 hours | <u>\$920</u> |

Clearly, the idle time is not related to a particular product, nor, as we have already discussed, is the overtime premium. Both overtime premium and idle time are considered overhead costs.

Benefits of Defining Accounting Terms

Managers, accountants, suppliers, and others will avoid many problems if they thoroughly understand and agree on the classifications and meanings of the cost terms introduced in this chapter and later in this book.

Consider the classification of programming labor *payroll fringe costs* (for example, employer payments for employee benefits such as Social Security, life insurance, health insurance, and pensions). Consider, for example, a software programmer, who is paid a wage of \$20 an hour with fringe benefits totaling, say, \$5 per hour. Some companies classify the \$20 as a direct programming labor cost of the product for which the software is being written and the \$5 as overhead cost. Other companies classify the entire \$25 as direct programming labor cost. The latter approach is preferable because the stated wage and the fringe benefit costs together are a fundamental part of acquiring direct software programming labor services.

Caution: In every situation, pinpoint clearly what direct labor includes and what direct labor excludes. Achieving clarity may prevent disputes regarding cost-reimbursement contracts, income tax payments, and labor union matters. Consider that some countries such as Costa Rica and Mauritius offer substantial income tax savings to foreign companies that generate employment within their borders. In some cases, to qualify for the tax benefits, the direct labor costs must at least equal a specified percentage of the total costs.

When direct labor costs are not precisely defined, disputes have arisen as to whether payroll fringe costs should be included as part of direct labor costs when calculating the direct labor percentage for qualifying for such tax benefits. Companies have sought to classify payroll fringe costs as part of direct labor costs to make direct labor costs a higher percentage of total costs. Tax authorities have argued that payroll fringe costs are part of overhead. In addition to fringe benefits, other debated items are compensation for training time, idle time, vacations, sick leave, and overtime premium. To prevent disputes, contracts and laws should be as specific as possible regarding definitions and measurements.

Different Meanings of Product Costs

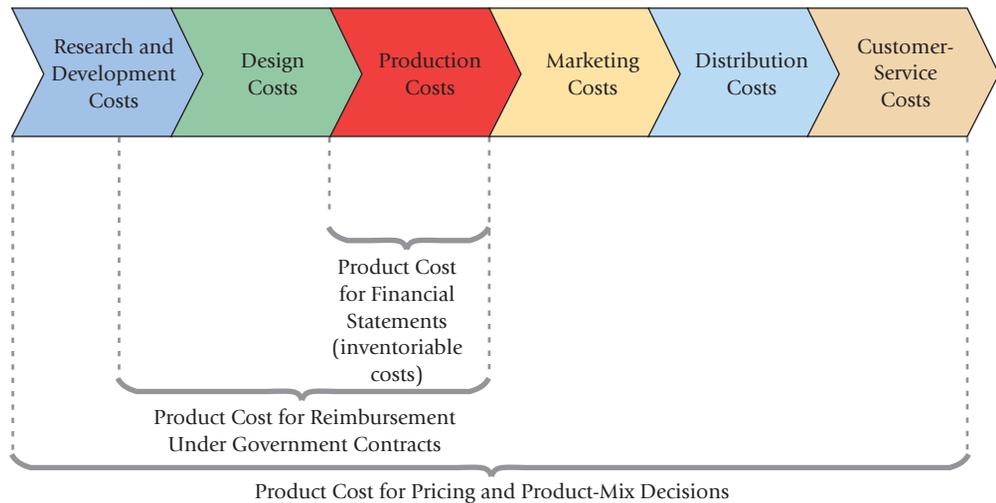
Many cost terms found in practice have ambiguous meanings. Consider the term *product cost*. A **product cost** is the sum of the costs assigned to a product for a specific purpose. Different purposes can result in different measures of product cost, as the brackets on the value chain in Exhibit 2-11 illustrate:

- **Pricing and product-mix decisions.** For the purposes of making decisions about pricing and which products provide the most profits, the manager is interested in the overall (total) profitability of different products and, consequently, assigns costs incurred in all business functions of the value chain to the different products.
- **Contracting with government agencies.** Government contracts often reimburse contractors on the basis of the “cost of a product” plus a prespecified margin of profit. Because of the cost-plus profit margin nature of the contract, government agencies provide detailed guidelines on the cost items they will allow and disallow

Learning Objective 6

Explain why product costs are computed in different ways for different purposes

... examples are pricing and product-mix decisions, government contracts, and financial statements

Exhibit 2-11**Different Product Costs for Different Purposes**

when calculating the cost of a product. For example, some government agencies explicitly exclude marketing, distribution, and customer-service costs from the product costs that qualify for reimbursement, and they may only partially reimburse R&D costs. These agencies want to reimburse contractors for only those costs most closely related to delivering products under the contract. The second bracket in Exhibit 2-11 shows how the product-cost calculations for a specific contract may allow for all design and production costs but only part of R&D costs.

- **Preparing financial statements for external reporting under generally accepted accounting principles (GAAP).** Under GAAP, only manufacturing costs can be assigned to inventories in the financial statements. For purposes of calculating inventory costs, product costs include only inventoriable (manufacturing) costs.

Decision Point

Why do managers assign different costs to the same cost object?

As Exhibit 2-11 illustrates, product-cost measures range from a narrow set of costs for financial statements—a set that includes only inventoriable costs—to a broader set of costs for reimbursement under a government contract to a still broader set of costs for pricing and product-mix decisions.

This section focused on how different purposes result in the inclusion of different cost items of the value chain of business functions when product costs are calculated. The same caution about the need to be clear and precise about cost concepts and their measurement applies to each cost classification introduced in this chapter. Exhibit 2-12 summarizes the key cost classifications.

Using the five-step process described in Chapter 1, think about how these different classifications of costs are helpful to managers when making decisions and evaluating performance.

1. *Identify the problem and uncertainties.* Consider a decision about how much to price a product. This decision often depends on how much it costs to make the product.
2. *Obtain information.* Managers identify direct and indirect costs of a product in each business function. Managers also gather other information about customers, competitors, and prices of substitute products.

Exhibit 2-12**Alternative Classifications of Costs**

1. Business function
 - a. Research and development
 - b. Design of products and processes
 - c. Production
 - d. Marketing
 - e. Distribution
 - f. Customer service
2. Assignment to a cost object
 - a. Direct cost
 - b. Indirect cost
3. Behavior pattern in relation to the level of activity or volume
 - a. Variable cost
 - b. Fixed cost
4. Aggregate or average
 - a. Total cost
 - b. Unit cost
5. Assets or expenses
 - a. Inventoriable cost
 - b. Period cost

3. *Make predictions about the future.* Managers estimate what it will cost to make the product in the future. This requires predictions about the quantity of product that managers expect to sell and an understanding of fixed and variable costs.
4. *Make decisions by choosing among alternatives.* Managers choose a price to charge based on a thorough understanding of costs and other information.
5. *Implement the decision, evaluate performance, and learn.* Managers control costs and learn by comparing actual total and unit costs against predicted amounts.

The next section describes how the basic concepts introduced in this chapter lead to a framework for understanding cost accounting and cost management that can then be applied to the study of many topics, such as strategy evaluation, quality, and investment decisions.

A Framework for Cost Accounting and Cost Management

Three features of cost accounting and cost management across a wide range of applications are as follows:

1. Calculating the cost of products, services, and other cost objects
2. Obtaining information for planning and control and performance evaluation
3. Analyzing the relevant information for making decisions

We develop these ideas in Chapters 3 through 12. The ideas also form the foundation for the study of various topics later in the book.

Calculating the Cost of Products, Services, and Other Cost Objects

We have already seen the different purposes and measures of product costs. Whatever the purpose, the costing system traces direct costs and allocates indirect costs to products. Chapters 4 and 5 describe systems, such as activity-based costing systems, used to calculate total costs and unit costs of products and services. The chapters also discuss how managers use this information to formulate strategy and make pricing, product-mix, and cost-management decisions.

Obtaining Information for Planning and Control and Performance Evaluation

Budgeting is the most commonly used tool for planning and control. A budget forces managers to look ahead, to translate strategy into plans, to coordinate and communicate within the organization, and to provide a benchmark for evaluating performance. Budgeting often plays a major role in affecting behavior and decisions because managers strive to meet budget targets. Chapter 6 describes budgeting systems.

At the end of a reporting period, managers compare actual results to planned performance. The manager's tasks are to understand why differences (called variances) between actual and planned performances arise and to use the information provided by these variances as feedback to promote learning and future improvement. Managers also use variances as well as nonfinancial measures, such as defect rates and customer satisfaction ratings, to control and evaluate the performance of various departments, divisions, and managers. Chapters 7 and 8 discuss variance analysis. Chapter 9 describes planning, control, and inventory-costing issues relating to capacity. Chapters 6, 7, 8, and 9 focus on the management accountant's role in implementing strategy.

Analyzing the Relevant Information for Making Decisions

When making decisions about strategy design and strategy implementation, managers must understand which revenues and costs to consider and which ones to ignore. Management accountants help managers identify what information is relevant and what information is

Learning Objective 7

Describe a framework for cost accounting and cost management

... three features that help managers make decisions

irrelevant. Consider a decision about whether to buy a product from an outside vendor or to make it in-house. The costing system indicates that it costs \$25 per unit to make the product in-house. A vendor offers the product for \$22 per unit. At first glance, it seems it will cost less for the company to buy the product rather than make it. Suppose, however, that of the \$25 to make the product in-house, \$5 consists of plant lease costs that the company has already paid under the lease contract. Furthermore, if the product is bought, the plant will remain idle. That is, there is no opportunity to profit by putting the plant to some alternative use. Under these conditions, it will cost less to make the product than to buy it. That's because making the product costs only an *additional* \$20 per unit ($\$25 - \5), compared with an *additional* \$22 per unit if it is bought. The \$5 per unit of lease cost is irrelevant to the decision because it is a *past* (or *sunk*) cost that has already been incurred regardless of whether the product is made or bought. Analyzing relevant information is a key aspect of making decisions.

When making strategic decisions about which products and how much to produce, managers must know how revenues and costs vary with changes in output levels. For this purpose, managers need to distinguish fixed costs from variable costs. Chapter 3 analyzes how operating income changes with changes in units sold and how managers use this information to make decisions such as how much to spend on advertising. Chapter 10 describes methods to estimate the fixed and variable components of costs. Chapter 11 applies the concept of relevance to decision making in many different situations and describes methods managers use to maximize income given the resource constraints they face. Chapter 12 describes how management accountants help managers determine prices and manage costs across the value chain and over a product's life cycle.

Later chapters in the book discuss topics such as strategy evaluation, customer profitability, quality, just-in-time systems, investment decisions, transfer pricing, and performance evaluation. Each of these topics invariably has product costing, planning and control, and decision-making perspectives. A command of the first 12 chapters will help you master these topics. For example, Chapter 13 on strategy describes the balanced scorecard, a set of financial and nonfinancial measures used to implement strategy that builds on the planning and control functions. The section on strategic analysis of operating income builds on ideas of product costing and variance analysis. The section on downsizing and managing capacity builds on ideas of relevant revenues and relevant costs.

Decision Point

What are the three key features of cost accounting and cost management?

Problem for Self-Study

Foxwood Company is a metal- and woodcutting manufacturer, selling products to the home construction market. Consider the following data for 2011:

| | |
|--|-----------|
| Sandpaper | \$ 2,000 |
| Materials-handling costs | 70,000 |
| Lubricants and coolants | 5,000 |
| Miscellaneous indirect manufacturing labor | 40,000 |
| Direct manufacturing labor | 300,000 |
| Direct materials inventory Jan. 1, 2011 | 40,000 |
| Direct materials inventory Dec. 31, 2011 | 50,000 |
| Finished goods inventory Jan. 1, 2011 | 100,000 |
| Finished goods inventory Dec. 31, 2011 | 150,000 |
| Work-in-process inventory Jan. 1, 2011 | 10,000 |
| Work-in-process inventory Dec. 31, 2011 | 14,000 |
| Plant-leasing costs | 54,000 |
| Depreciation—plant equipment | 36,000 |
| Property taxes on plant equipment | 4,000 |
| Fire insurance on plant equipment | 3,000 |
| Direct materials purchased | 460,000 |
| Revenues | 1,360,000 |
| Marketing promotions | 60,000 |
| Marketing salaries | 100,000 |
| Distribution costs | 70,000 |
| Customer-service costs | 100,000 |

1. Prepare an income statement with a separate supporting schedule of cost of goods manufactured. For all manufacturing items, classify costs as direct costs or indirect costs and indicate by V or F whether each is basically a variable cost or a fixed cost (when the cost object is a product unit). If in doubt, decide on the basis of whether the total cost will change substantially over a wide range of units produced.
2. Suppose that both the direct material costs and the plant-leasing costs are for the production of 900,000 units. What is the direct material cost of each unit produced? What is the plant-leasing cost per unit? Assume that the plant-leasing cost is a fixed cost.
3. Suppose Foxwood Company manufactures 1,000,000 units next year. Repeat the computation in requirement 2 for direct materials and plant-leasing costs. Assume the implied cost-behavior patterns persist.
4. As a management consultant, explain concisely to the company president why the unit cost for direct materials did not change in requirements 2 and 3 but the unit cost for plant-leasing costs did change.

Required

Solution

1.

| | | |
|---|----------------|-------------------|
| Foxwood Company | | |
| Income Statement | | |
| For the Year Ended December 31, 2011 | | |
| Revenues | | \$1,360,000 |
| Cost of goods sold | | |
| Beginning finished goods inventory January 1, 2011 | \$ 100,000 | |
| Cost of goods manufactured (see the following schedule) | <u>960,000</u> | |
| Cost of goods available for sale | 1,060,000 | |
| Deduct ending finished goods inventory | | |
| December 31, 2011 | <u>150,000</u> | <u>910,000</u> |
| Gross margin (or gross profit) | | 450,000 |
| Operating costs | | |
| Marketing promotions | 60,000 | |
| Marketing salaries | 100,000 | |
| Distribution costs | 70,000 | |
| Customer-service costs | <u>100,000</u> | <u>330,000</u> |
| Operating income | | <u>\$ 120,000</u> |

| | | |
|--|------------------|-------------------|
| Foxwood Company | | |
| Schedule of Cost of Goods Manufactured | | |
| For the Year Ended December 31, 2011 | | |
| Direct materials | | |
| Beginning inventory, January 1, 2011 | | \$ 40,000 |
| Purchases of direct materials | | <u>460,000</u> |
| Cost of direct materials available for use | | 500,000 |
| Ending inventory, December 31, 2011 | | <u>50,000</u> |
| Direct materials used | | 450,000 (V) |
| Direct manufacturing labor | | 300,000 (V) |
| Indirect manufacturing costs | | |
| Sandpaper | \$ 2,000 (V) | |
| Materials-handling costs | 70,000 (V) | |
| Lubricants and coolants | 5,000 (V) | |
| Miscellaneous indirect manufacturing labor | 40,000 (V) | |
| Plant-leasing costs | 54,000 (F) | |
| Depreciation—plant equipment | 36,000 (F) | |
| Property taxes on plant equipment | 4,000 (F) | |
| Fire insurance on plant equipment | <u>3,000 (F)</u> | <u>214,000</u> |
| Manufacturing costs incurred during 2011 | | 964,000 |
| Beginning work-in-process inventory, January 1, 2011 | | <u>10,000</u> |
| Total manufacturing costs to account for | | 974,000 |
| Ending work-in-process inventory, December 31, 2011 | | <u>14,000</u> |
| Cost of goods manufactured (to income statement) | | <u>\$ 960,000</u> |

2. Direct material unit cost = Direct materials used \div Units produced
 $= \$450,000 \div 900,000 \text{ units} = \0.50 per unit
 Plant-leasing unit cost = Plant-leasing costs \div Units produced
 $= \$54,000 \div 900,000 \text{ units} = \0.06 per unit
3. The direct material costs are variable, so they would increase in total from \$450,000 to \$500,000 (1,000,000 units \times \$0.50 per unit). However, their unit cost would be unaffected: $\$500,000 \div 1,000,000 \text{ units} = \0.50 per unit .
 In contrast, the plant-leasing costs of \$54,000 are fixed, so they would not increase in total. However, the plant-leasing cost per unit would decline from \$0.060 to \$0.054: $\$54,000 \div 1,000,000 \text{ units} = \0.054 per unit .
4. The explanation would begin with the answer to requirement 3. As a consultant, you should stress that the unitizing (averaging) of costs that have different behavior patterns can be misleading. A common error is to assume that a total unit cost, which is often a sum of variable unit cost and fixed unit cost, is an indicator that total costs change in proportion to changes in production levels. The next chapter demonstrates the necessity for distinguishing between cost-behavior patterns. You must be wary, especially about average fixed cost per unit. Too often, unit fixed cost is erroneously regarded as being indistinguishable from unit variable cost.

Decision Points

The following question-and-answer format summarizes the chapter's learning objectives. Each decision presents a key question related to a learning objective. The guidelines are the answer to that question.

Decision

Guidelines

1. What is a cost object? A cost object is anything for which a separate measurement of cost is needed. Examples include a product, a service, a project, a customer, a brand category, an activity, and a department.
2. How do managers decide whether a cost is a direct or an indirect cost? A direct cost is any cost that is related to a particular cost object and can be traced to that cost object in an economically feasible way. Indirect costs are related to the particular cost object but cannot be traced to it in an economically feasible way. The same cost can be direct for one cost object and indirect for another cost object. This book uses *cost tracing* to describe the assignment of direct costs to a cost object and *cost allocation* to describe the assignment of indirect costs to a cost object.
3. How do managers decide whether a cost is a variable or a fixed cost? A variable cost changes *in total* in proportion to changes in the related level of total activity or volume. A fixed cost remains unchanged *in total* for a given time period despite wide changes in the related level of total activity or volume.
4. How should costs be estimated? In general, focus on total costs, not unit costs. When making total cost estimates, think of variable costs as an amount per unit and fixed costs as a total amount. The unit cost of a cost object should be interpreted cautiously when it includes a fixed-cost component.
5. What are the differences in the accounting for inventoriable versus period costs? Inventoriable costs are all costs of a product that are regarded as an asset in the accounting period when they are incurred and become cost of goods sold in the accounting period when the product is sold. Period costs are expensed in the accounting period in which they are incurred and are all of the costs in an income statement other than cost of goods sold.

6. Why do managers assign different costs to the same cost objects? Managers can assign different costs to the same cost object depending on the purpose. For example, for the external reporting purpose in a manufacturing company, the inventoriable cost of a product includes only manufacturing costs. In contrast, costs from all business functions of the value chain often are assigned to a product for pricing and product-mix decisions.
7. What are the three key features of cost accounting and cost management? Three features of cost accounting and cost management are (1) calculating the cost of products, services, and other cost objects; (2) obtaining information for planning and control and performance evaluation; and (3) analyzing relevant information for making decisions.

Terms to Learn

This chapter contains more basic terms than any other in this book. Do not proceed before you check your understanding of the following terms. Both the chapter and the Glossary at the end of the book contain definitions.

| | | |
|---------------------------------------|--|--|
| actual cost (p. 27) | direct manufacturing labor costs (p. 37) | merchandising-sector companies (p. 36) |
| average cost (p. 35) | direct material costs (p. 37) | operating income (p. 42) |
| budgeted cost (p. 27) | direct materials inventory (p. 37) | overtime premium (p. 44) |
| conversion costs (p. 43) | factory overhead costs (p. 37) | period costs (p. 38) |
| cost (p. 27) | finished goods inventory (p. 37) | prime costs (p. 43) |
| cost accumulation (p. 28) | fixed cost (p. 30) | product cost (p. 45) |
| cost allocation (p. 29) | idle time (p. 45) | relevant range (p. 33) |
| cost assignment (p. 29) | indirect costs of a cost object (p. 28) | revenues (p. 38) |
| cost driver (p. 32) | indirect manufacturing costs (p. 37) | service-sector companies (p. 36) |
| cost object (p. 27) | inventoriable costs (p. 37) | unit cost (p. 35) |
| cost of goods manufactured (p. 41) | manufacturing overhead costs (p. 37) | variable cost (p. 30) |
| cost tracing (p. 28) | manufacturing-sector companies (p. 36) | work-in-process inventory (p. 37) |
| direct costs of a cost object (p. 28) | | work in progress (p. 37) |

Assignment Material

Questions



- 2-1** Define cost object and give three examples.
- 2-2** Define direct costs and indirect costs.
- 2-3** Why do managers consider direct costs to be more accurate than indirect costs?
- 2-4** Name three factors that will affect the classification of a cost as direct or indirect.
- 2-5** Define variable cost and fixed cost. Give an example of each.
- 2-6** What is a cost driver? Give one example.
- 2-7** What is the relevant range? What role does the relevant-range concept play in explaining how costs behave?
- 2-8** Explain why unit costs must often be interpreted with caution.
- 2-9** Describe how manufacturing-, merchandising-, and service-sector companies differ from each other.
- 2-10** What are three different types of inventory that manufacturing companies hold?
- 2-11** Distinguish between inventoriable costs and period costs.
- 2-12** Define the following: direct material costs, direct manufacturing-labor costs, manufacturing overhead costs, prime costs, and conversion costs.
- 2-13** Describe the overtime-premium and idle-time categories of indirect labor.
- 2-14** Define product cost. Describe three different purposes for computing product costs.
- 2-15** What are three common features of cost accounting and cost management?



Exercises

2-16 Computing and interpreting manufacturing unit costs. Minnesota Office Products (MOP) produces three different paper products at its Vaasa lumber plant: Supreme, Deluxe, and Regular. Each product has its own dedicated production line at the plant. It currently uses the following three-part classification for its manufacturing costs: direct materials, direct manufacturing labor, and manufacturing overhead costs. Total manufacturing overhead costs of the plant in July 2011 are \$150 million (\$15 million of which are fixed). This total amount is allocated to each product line on the basis of the direct manufacturing labor costs of each line. Summary data (in millions) for July 2011 are as follows:

| | Supreme | Deluxe | Regular |
|----------------------------------|---------|--------|---------|
| Direct material costs | \$ 89 | \$ 57 | \$ 60 |
| Direct manufacturing labor costs | \$ 16 | \$ 26 | \$ 8 |
| Manufacturing overhead costs | \$ 48 | \$ 78 | \$ 24 |
| Units produced | 125 | 150 | 140 |

Required

1. Compute the manufacturing cost per unit for each product produced in July 2011.
2. Suppose that in August 2011, production was 150 million units of Supreme, 190 million units of Deluxe, and 220 million units of Regular. Why might the July 2011 information on manufacturing cost per unit be misleading when predicting total manufacturing costs in August 2011?

2-17 Direct, indirect, fixed, and variable costs. Best Breads manufactures two types of bread, which are sold as wholesale products to various specialty retail bakeries. Each loaf of bread requires a three-step process. The first step is mixing. The mixing department combines all of the necessary ingredients to create the dough and processes it through high speed mixers. The dough is then left to rise before baking. The second step is baking, which is an entirely automated process. The baking department molds the dough into its final shape and bakes each loaf of bread in a high temperature oven. The final step is finishing, which is an entirely manual process. The finishing department coats each loaf of bread with a special glaze, allows the bread to cool, and then carefully packages each loaf in a specialty carton for sale in retail bakeries.

Required

1. Costs involved in the process are listed next. For each cost, indicate whether it is a direct variable, direct fixed, indirect variable, or indirect fixed cost, assuming "units of production of each kind of bread" is the cost object.

Costs:

| | |
|--------------------------------------|--|
| Yeast | Mixing department manager |
| Flour | Materials handlers in each department |
| Packaging materials | Custodian in factory |
| Depreciation on ovens | Night guard in factory |
| Depreciation on mixing machines | Machinist (running the mixing machine) |
| Rent on factory building | Machine maintenance personnel in each department |
| Fire insurance on factory building | Maintenance supplies for factory |
| Factory utilities | Cleaning supplies for factory |
| Finishing department hourly laborers | |

2. If the cost object were the "mixing department" rather than units of production of each kind of bread, which preceding costs would now be direct instead of indirect costs?

2-18 Classification of costs, service sector. Consumer Focus is a marketing research firm that organizes focus groups for consumer-product companies. Each focus group has eight individuals who are paid \$50 per session to provide comments on new products. These focus groups meet in hotels and are led by a trained, independent, marketing specialist hired by Consumer Focus. Each specialist is paid a fixed retainer to conduct a minimum number of sessions and a per session fee of \$2,000. A Consumer Focus staff member attends each session to ensure that all the logistical aspects run smoothly.

Classify each cost item (A–H) as follows:

Required

- Direct or indirect (D or I) costs with respect to each individual focus group.
- Variable or fixed (V or F) costs with respect to how the total costs of Consumer Focus change as the number of focus groups conducted changes. (If in doubt, select on the basis of whether the total costs will change substantially if there is a large change in the number of groups conducted.)

You will have two answers (D or I; V or F) for each of the following items:

| Cost Item | D or I | V or F |
|--|--------|--------|
| A. Payment to individuals in each focus group to provide comments on new products | | |
| B. Annual subscription of Consumer Focus to <i>Consumer Reports</i> magazine | | |
| C. Phone calls made by Consumer Focus staff member to confirm individuals will attend a focus group session (Records of individual calls are not kept.) | | |
| D. Retainer paid to focus group leader to conduct 20 focus groups per year on new medical products | | |
| E. Meals provided to participants in each focus group | | |
| F. Lease payment by Consumer Focus for corporate office | | |
| G. Cost of tapes used to record comments made by individuals in a focus group session (These tapes are sent to the company whose products are being tested.) | | |
| H. Gasoline costs of Consumer Focus staff for company-owned vehicles (Staff members submit monthly bills with no mileage breakdowns.) | | |

2-19 Classification of costs, merchandising sector. Home Entertainment Center (HEC) operates a large store in San Francisco. The store has both a video section and a music (compact disks and tapes) section. HEC reports revenues for the video section separately from the music section.

Classify each cost item (A–H) as follows:

Required

- Direct or indirect (D or I) costs with respect to the total number of videos sold.
- Variable or fixed (V or F) costs with respect to how the total costs of the video section change as the total number of videos sold changes. (If in doubt, select on the basis of whether the total costs will change substantially if there is a large change in the total number of videos sold.)

You will have two answers (D or I; V or F) for each of the following items:

| Cost Item | D or I | V or F |
|---|--------|--------|
| A. Annual retainer paid to a video distributor | | |
| B. Electricity costs of the HEC store (single bill covers entire store) | | |
| C. Costs of videos purchased for sale to customers | | |
| D. Subscription to <i>Video Trends</i> magazine | | |
| E. Leasing of computer software used for financial budgeting at the HEC store | | |
| F. Cost of popcorn provided free to all customers of the HEC store | | |
| G. Earthquake insurance policy for the HEC store | | |
| H. Freight-in costs of videos purchased by HEC | | |

2-20 Classification of costs, manufacturing sector. The Fremont, California, plant of New United Motor Manufacturing, Inc. (NUMMI), a joint venture of General Motors and Toyota, assembles two types of cars (Corollas and Geo Prisms). Separate assembly lines are used for each type of car.

Classify each cost item (A–H) as follows:

Required

- Direct or indirect (D or I) costs with respect to the total number of cars of each type assembled (Corolla or Geo Prism).
- Variable or fixed (V or F) costs with respect to how the total costs of the plant change as the total number of cars of each type assembled changes. (If in doubt, select on the basis of whether the total costs will change substantially if there is a large change in the total number of cars of each type assembled.)

You will have two answers (D or I; V or F) for each of the following items:

| Cost Item | D or I V or F |
|---|---------------|
| A. Cost of tires used on Geo Prisms | |
| B. Salary of public relations manager for NUMMI plant | |
| C. Annual awards dinner for Corolla suppliers | |
| D. Salary of engineer who monitors design changes on Geo Prism | |
| E. Freight costs of Corolla engines shipped from Toyota City, Japan, to Fremont, California | |
| F. Electricity costs for NUMMI plant (single bill covers entire plant) | |
| G. Wages paid to temporary assembly-line workers hired in periods of high production (paid on hourly basis) | |
| H. Annual fire-insurance policy cost for NUMMI plant | |

2-21 Variable costs, fixed costs, total costs. Bridget Ashton is getting ready to open a small restaurant. She is on a tight budget and must choose between the following long-distance phone plans:

Plan A: Pay 10 cents per minute of long-distance calling.

Plan B: Pay a fixed monthly fee of \$15 for up to 240 long-distance minutes, and 8 cents per minute thereafter (if she uses fewer than 240 minutes in any month, she still pays \$15 for the month).

Plan C: Pay a fixed monthly fee of \$22 for up to 510 long-distance minutes and 5 cents per minute thereafter (if she uses fewer than 510 minutes, she still pays \$22 for the month).

Required

1. Draw a graph of the total monthly costs of the three plans for different levels of monthly long-distance calling.
2. Which plan should Ashton choose if she expects to make 100 minutes of long-distance calls? 240 minutes? 540 minutes?

2-22 Variable costs and fixed costs. Consolidated Minerals (CM) owns the rights to extract minerals from beach sands on Fraser Island. CM has costs in three areas:

- a. Payment to a mining subcontractor who charges \$80 per ton of beach sand mined and returned to the beach (after being processed on the mainland to extract three minerals: ilmenite, rutile, and zircon).
- b. Payment of a government mining and environmental tax of \$50 per ton of beach sand mined.
- c. Payment to a barge operator. This operator charges \$150,000 per month to transport each batch of beach sand—up to 100 tons per batch per day—to the mainland and then return to Fraser Island (that is, 0 to 100 tons per day = \$150,000 per month; 101 to 200 tons per day = \$300,000 per month, and so on).

Each barge operates 25 days per month. The \$150,000 monthly charge must be paid even if fewer than 100 tons are transported on any day and even if CM requires fewer than 25 days of barge transportation in that month.

CM is currently mining 180 tons of beach sands per day for 25 days per month.

Required

1. What is the variable cost per ton of beach sand mined? What is the fixed cost to CM per month?
2. Plot a graph of the variable costs and another graph of the fixed costs of CM. Your graphs should be similar to Exhibit 2-3, Panel A (p. 31), and Exhibit 2-4 (p. 34). Is the concept of relevant range applicable to your graphs? Explain.
3. What is the unit cost per ton of beach sand mined (a) if 180 tons are mined each day and (b) if 220 tons are mined each day? Explain the difference in the unit-cost figures.

2-23 Variable costs, fixed costs, relevant range. Sweetum Candies manufactures jaw-breaker candies in a fully automated process. The machine that produces candies was purchased recently and can make 4,100 per month. The machine costs \$9,000 and is depreciated using straight line depreciation over 10 years assuming zero residual value. Rent for the factory space and warehouse, and other fixed manufacturing overhead costs total \$1,200 per month.

Sweetum currently makes and sells 3,800 jaw-breakers per month. Sweetum buys just enough materials each month to make the jaw-breakers it needs to sell. Materials cost 30 cents per jawbreaker.

Next year Sweetum expects demand to increase by 100%. At this volume of materials purchased, it will get a 10% discount on price. Rent and other fixed manufacturing overhead costs will remain the same.

Required

1. What is Sweetum's current annual relevant range of output?
2. What is Sweetum's current annual fixed manufacturing cost within the relevant range? What is the annual variable manufacturing cost?
3. What will Sweetum's relevant range of output be next year? How if at all, will total annual fixed and variable manufacturing costs change next year? Assume that if it needs to Sweetum could buy an identical machine at the same cost as the one it already has.

2-24 Cost drivers and value chain. Helner Cell Phones (HCP) is developing a new touch screen smartphone to compete in the cellular phone industry. The phones will be sold at wholesale prices to cell phone companies, which will in turn sell them in retail stores to the final customer. HCP has undertaken the following activities in its value chain to bring its product to market:

- Identify customer needs (What do smartphone users want?)
- Perform market research on competing brands
- Design a prototype of the HCP smartphone
- Market the new design to cell phone companies
- Manufacture the HCP smartphone
- Process orders from cell phone companies
- Package the HCP smartphones
- Deliver the HCP smartphones to the cell phone companies
- Provide online assistance to cell phone users for use of the HCP smartphone
- Make design changes to the smartphone based on customer feedback

During the process of product development, production, marketing, distribution, and customer service, HCP has kept track of the following cost drivers:

- Number of smartphones shipped by HCP
- Number of design changes
- Number of deliveries made to cell phone companies
- Engineering hours spent on initial product design
- Hours spent researching competing market brands
- Customer-service hours
- Number of smartphone orders processed
- Number of cell phone companies purchasing the HCP smartphone
- Machine hours required to run the production equipment
- Number of surveys returned and processed from competing smartphone users

1. Identify each value chain activity listed at the beginning of the exercise with one of the following value-chain categories:
 - a. Design of products and processes
 - b. Production
 - c. Marketing
 - d. Distribution
 - e. Customer Service
2. Use the list of preceding cost drivers to find one or more reasonable cost drivers for each of the activities in HCP's value chain.

Required

2-25 Cost drivers and functions. The list of representative cost drivers in the right column of this table are randomized with respect to the list of functions in the left column. That is, they do not match.

| Function | Representative Cost Driver |
|-----------------------------|--|
| 1. Accounting | A. Number of invoices sent |
| 2. Human resources | B. Number of purchase orders |
| 3. Data processing | C. Number of research scientists |
| 4. Research and development | D. Hours of computer processing unit (CPU) |
| 5. Purchasing | E. Number of employees |
| 6. Distribution | F. Number of transactions processed |
| 7. Billing | G. Number of deliveries made |

1. Match each function with its representative cost driver.
2. Give a second example of a cost driver for each function.

Required

2-26 Total costs and unit costs. A student association has hired a band and a caterer for a graduation party. The band will charge a fixed fee of \$1,000 for an evening of music, and the caterer will charge a fixed fee of \$600 for the party setup and an additional \$9 per person who attends. Snacks and soft drinks will be provided by the caterer for the duration of the party. Students attending the party will pay \$5 each at the door.

1. Draw a graph depicting the fixed cost, the variable cost, and the total cost to the student association for different attendance levels.
2. Suppose 100 people attend the party. What is the total cost to the student association? What is the cost per person?

Required

- Suppose 500 people attend the party. What is the total cost to the student association and the cost per attendee?
- Draw a graph depicting the cost per attendee for different attendance levels. As president of the student association, you want to request a grant to cover some of the party costs. Will you use the per attendee cost numbers to make your case? Why or why not?

2-27 Total and unit cost, decision making. Gayle's Glassworks makes glass flanges for scientific use. Materials cost \$1 per flange, and the glass blowers are paid a wage rate of \$28 per hour. A glass blower blows 10 flanges per hour. Fixed manufacturing costs for flanges are \$28,000 per period. Period (nonmanufacturing) costs associated with flanges are \$10,000 per period, and are fixed.

Required

- Graph the fixed, variable, and total manufacturing cost for flanges, using units (number of flanges) on the x-axis.
- Assume Gayle's Glassworks manufactures and sells 5,000 flanges this period. Its competitor, Flora's Flasks, sells flanges for \$10 each. Can Gayle sell below Flora's price and still make a profit on the flanges?
- How would your answer to requirement 2 differ if Gayle's Glassworks made and sold 10,000 flanges this period? Why? What does this indicate about the use of unit cost in decision making?

2-28 Inventoriable costs versus period costs. Each of the following cost items pertains to one of these companies: General Electric (a manufacturing-sector company), Safeway (a merchandising-sector company), and Google (a service-sector company):

- Perrier mineral water purchased by Safeway for sale to its customers
- Electricity used to provide lighting for assembly-line workers at a General Electric refrigerator-assembly plant
- Depreciation on Google's computer equipment used to update directories of Web sites
- Electricity used to provide lighting for Safeway's store aisles
- Depreciation on General Electric's computer equipment used for quality testing of refrigerator components during the assembly process
- Salaries of Safeway's marketing personnel planning local-newspaper advertising campaigns
- Perrier mineral water purchased by Google for consumption by its software engineers
- Salaries of Google's marketing personnel selling banner advertising

Required

- Distinguish between manufacturing-, merchandising-, and service-sector companies.
- Distinguish between inventoriable costs and period costs.
- Classify each of the cost items (a–h) as an inventoriable cost or a period cost. Explain your answers.



Problems

2-29 Computing cost of goods purchased and cost of goods sold. The following data are for Marvin Department Store. The account balances (in thousands) are for 2011.

| | |
|---|-----------|
| Marketing, distribution, and customer-service costs | \$ 37,000 |
| Merchandise inventory, January 1, 2011 | 27,000 |
| Utilities | 17,000 |
| General and administrative costs | 43,000 |
| Merchandise inventory, December 31, 2011 | 34,000 |
| Purchases | 155,000 |
| Miscellaneous costs | 4,000 |
| Transportation-in | 7,000 |
| Purchase returns and allowances | 4,000 |
| Purchase discounts | 6,000 |
| Revenues | 280,000 |

Required

- Compute (a) the cost of goods purchased and (b) the cost of goods sold.
- Prepare the income statement for 2011.

2-30 Cost of goods purchased, cost of goods sold, and income statement. The following data are for Montgomery Retail Outlet Stores. The account balances (in thousands) are for 2011.

| | |
|--|-----------|
| Marketing and advertising costs | \$ 24,000 |
| Merchandise inventory, January 1, 2011 | 45,000 |
| Shipping of merchandise to customers | 2,000 |

| | |
|--|----------|
| Building depreciation | \$ 4,200 |
| Purchases | 260,000 |
| General and administrative costs | 32,000 |
| Merchandise inventory, December 31, 2011 | 52,000 |
| Merchandise freight-in | 10,000 |
| Purchase returns and allowances | 11,000 |
| Purchase discounts | 9,000 |
| Revenues | 320,000 |

1. Compute (a) the cost of goods purchased and (b) the cost of goods sold.
2. Prepare the income statement for 2011.

Required

2-31 Flow of Inventoriable Costs. Renka's Heaters selected data for October 2011 are presented here (in millions):

| | |
|--|--------|
| Direct materials inventory 10/1/2011 | \$ 105 |
| Direct materials purchased | 365 |
| Direct materials used | 385 |
| Total manufacturing overhead costs | 450 |
| Variable manufacturing overhead costs | 265 |
| Total manufacturing costs incurred during October 2011 | 1,610 |
| Work-in-process inventory 10/1/2011 | 230 |
| Cost of goods manufactured | 1,660 |
| Finished goods inventory 10/1/2011 | 130 |
| Cost of goods sold | 1,770 |

Calculate the following costs:

1. Direct materials inventory 10/31/2011
2. Fixed manufacturing overhead costs for October 2011
3. Direct manufacturing labor costs for October 2011
4. Work-in-process inventory 10/31/2011
5. Cost of finished goods available for sale in October 2011
6. Finished goods inventory 10/31/2011

Required

2-32 Cost of finished goods manufactured, income statement, manufacturing company. Consider the following account balances (in thousands) for the Canseco Company:

|  Home Insert Page Layout Formulas Data Review View | | | |
|---|---|---------------------|---------------|
| | A | B | C |
| 1 | Canseco Company | Beginning of | End of |
| 2 | | 2011 | 2011 |
| 3 | Direct materials inventory | \$22,000 | \$26,000 |
| 4 | Work-in-process inventory | 21,000 | 20,000 |
| 5 | Finished goods inventory | 18,000 | 23,000 |
| 6 | Purchases of direct materials | | 75,000 |
| 7 | Direct manufacturing labor | | 25,000 |
| 8 | Indirect manufacturing labor | | 15,000 |
| 9 | Plant insurance | | 9,000 |
| 10 | Depreciation—plant, building, and equipment | | 11,000 |
| 11 | Repairs and maintenance—plant | | 4,000 |
| 12 | Marketing, distribution, and customer-service costs | | 93,000 |
| 13 | General and administrative costs | | 29,000 |

1. Prepare a schedule for the cost of goods manufactured for 2011.
2. Revenues for 2011 were \$300 million. Prepare the income statement for 2011.

Required

2-33 Cost of goods manufactured, income statement, manufacturing company. Consider the following account balances (in thousands) for the Piedmont Corporation:

| Piedmont Corporation | Beginning of 2011 | End of 2011 |
|---|------------------------------|------------------------|
| Direct materials inventory | 65,000 | 34,000 |
| Work-in-process inventory | 83,000 | 72,000 |
| Finished goods inventory | 123,000 | 102,000 |
| Purchases of direct materials | | 128,000 |
| Direct manufacturing labor | | 106,000 |
| Indirect manufacturing labor | | 48,000 |
| Indirect materials | | 14,000 |
| Plant insurance | | 2,000 |
| Depreciation—plant, building, and equipment | | 21,000 |
| Plant utilities | | 12,000 |
| Repairs and maintenance—plant | | 8,000 |
| Equipment leasing costs | | 32,000 |
| Marketing, distribution, and customer-service costs | | 62,000 |
| General and administrative costs | | 34,000 |

Required

1. Prepare a schedule for the cost of goods manufactured for 2011.
2. Revenues for 2011 were \$600 million. Prepare the income statement for 2011.

2-34 Income statement and schedule of cost of goods manufactured. The Howell Corporation has the following account balances (in millions):

| For Specific Date | | For Year 2011 | |
|---|------|---|-------|
| Direct materials inventory, Jan. 1, 2011 | \$15 | Purchases of direct materials | \$325 |
| Work-in-process inventory, Jan. 1, 2011 | 10 | Direct manufacturing labor | 100 |
| Finished goods inventory, Jan. 1, 2011 | 70 | Depreciation—plant and equipment | 80 |
| Direct materials inventory, Dec. 31, 2011 | 20 | Plant supervisory salaries | 5 |
| Work-in-process inventory, Dec. 31, 2011 | 5 | Miscellaneous plant overhead | 35 |
| Finished goods inventory, Dec. 31, 2011 | 55 | Revenues | 950 |
| | | Marketing, distribution, and customer-service costs | 240 |
| | | Plant supplies used | 10 |
| | | Plant utilities | 30 |
| | | Indirect manufacturing labor | 60 |

Required

Prepare an income statement and a supporting schedule of cost of goods manufactured for the year ended December 31, 2011. (For additional questions regarding these facts, see the next problem.)

2-35 Interpretation of statements (continuation of 2-34).

Required

1. How would the answer to Problem 2-34 be modified if you were asked for a schedule of cost of goods manufactured and sold instead of a schedule of cost of goods manufactured? Be specific.
2. Would the sales manager's salary (included in marketing, distribution, and customer-service costs) be accounted for any differently if the Howell Corporation were a merchandising-sector company instead of a manufacturing-sector company? Using the flow of manufacturing costs outlined in Exhibit 2-9 (p. 42), describe how the wages of an assembler in the plant would be accounted for in this manufacturing company.
3. Plant supervisory salaries are usually regarded as manufacturing overhead costs. When might some of these costs be regarded as direct manufacturing costs? Give an example.
4. Suppose that both the direct materials used and the plant and equipment depreciation are related to the manufacture of 1 million units of product. What is the unit cost for the direct materials assigned to those units? What is the unit cost for plant and equipment depreciation? Assume that yearly plant and equipment depreciation is computed on a straight-line basis.
5. Assume that the implied cost-behavior patterns in requirement 4 persist. That is, direct material costs behave as a variable cost, and plant and equipment depreciation behaves as a fixed cost. Repeat the

computations in requirement 4, assuming that the costs are being predicted for the manufacture of 1.2 million units of product. How would the total costs be affected?

- As a management accountant, explain concisely to the president why the unit costs differed in requirements 4 and 5.

2-36 Income statement and schedule of cost of goods manufactured. The following items (in millions) pertain to Calendar Corporation:

| For Specific Date | | For Year 2011 | |
|---|------|---|------|
| Work-in-process inventory, Jan. 1, 2011 | \$18 | Plant utilities | \$ 9 |
| Direct materials inventory, Dec. 31, 2011 | 8 | Indirect manufacturing labor | 27 |
| Finished goods inventory, Dec. 31, 2011 | 11 | Depreciation—plant and equipment | 6 |
| Accounts payable, Dec. 31, 2011 | 24 | Revenues | 355 |
| Accounts receivable, Jan. 1, 2011 | 52 | Miscellaneous manufacturing overhead | 15 |
| Work-in-process inventory, Dec. 31, 2011 | 3 | Marketing, distribution, and customer-service costs | 94 |
| Finished goods inventory, Jan 1, 2011 | 47 | Direct materials purchased | 84 |
| Accounts receivable, Dec. 31, 2011 | 38 | Direct manufacturing labor | 42 |
| Accounts payable, Jan. 1, 2011 | 49 | Plant supplies used | 4 |
| Direct materials inventory, Jan. 1, 2011 | 32 | Property taxes on plant | 2 |

Calendar's manufacturing costing system uses a three-part classification of direct materials, direct manufacturing labor, and manufacturing overhead costs.

Prepare an income statement and a supporting schedule of cost of goods manufactured. (For additional questions regarding these facts, see the next problem.)

Required

2-37 Terminology, interpretation of statements (continuation of 2-36).

- Calculate total prime costs and total conversion costs.
- Calculate total inventoriable costs and period costs.
- Design costs and R&D costs are not considered product costs for financial statement purposes. When might some of these costs be regarded as product costs? Give an example.
- Suppose that both the direct materials used and the depreciation on plant and equipment are related to the manufacture of 2 million units of product. Determine the unit cost for the direct materials assigned to those units and the unit cost for depreciation on plant and equipment. Assume that yearly depreciation is computed on a straight-line basis.
- Assume that the implied cost-behavior patterns in requirement 4 persist. That is, direct material costs behave as a variable cost and depreciation on plant and equipment behaves as a fixed cost. Repeat the computations in requirement 4, assuming that the costs are being predicted for the manufacture of 3 million units of product. Determine the effect on total costs.
- Assume that depreciation on the equipment (but not the plant) is computed based on the number of units produced because the equipment deteriorates with units produced. The depreciation rate on equipment is \$1 per unit. Calculate the depreciation on equipment assuming (a) 2 million units of product are produced and (b) 3 million units of product are produced.

2-38 Labor cost, overtime, and idle time. Jim Anderson works in the production department of Midwest Steelworks as a machine operator. Jim, a long-time employee of Midwest, is paid on an hourly basis at a rate of \$20 per hour. Jim works five 8-hour shifts per week Monday–Friday (40 hours). Any time Jim works over and above these 40 hours is considered overtime for which he is paid at a rate of time and a half (\$30 per hour). If the overtime falls on weekends, Jim is paid at a rate of double time (\$40 per hour). Jim is also paid an additional \$20 per hour for any holidays worked, even if it is part of his regular 40 hours.

Jim is paid his regular wages even if the machines are down (not operating) due to regular machine maintenance, slow order periods, or unexpected mechanical problems. These hours are considered "idle time."

During December Jim worked the following hours:

| | Hours worked including machine downtime | Machine downtime |
|--------|--|------------------|
| Week 1 | 44 | 3.5 |
| Week 2 | 43 | 6.4 |
| Week 3 | 48 | 5.8 |
| Week 4 | 46 | 2 |

Included in the total hours worked are two company holidays (Christmas Eve and Christmas Day) during Week 4. All overtime worked by Jim was Monday–Friday, except for the hours worked in Week 3. All of the Week 3 overtime hours were worked on a Saturday.

Required

1. Calculate (a) direct manufacturing labor, (b) idle time, (c) overtime and holiday premium, and (d) total earnings for Jim in December.
2. Is idle time and overtime premium a direct or indirect cost of the products that Jim worked on in December? Explain.

2-39 Missing records, computing inventory costs. Ron Williams recently took over as the controller of Johnson Brothers Manufacturing. Last month, the previous controller left the company with little notice and left the accounting records in disarray. Ron needs the ending inventory balances to report first quarter numbers.

For the previous month (March 2011) Ron was able to piece together the following information:

| | |
|---|-------------------------------|
| Direct materials purchased | \$ 240,000 |
| Work-in-process inventory, 3/1/2011 | \$ 70,000 |
| Direct materials inventory, 3/1/2011 | \$ 25,000 |
| Finished goods inventory, 3/1/2011 | \$ 320,000 |
| Conversion Costs | \$ 660,000 |
| Total manufacturing costs added during the period | \$ 840,000 |
| Cost of goods manufactured | 4 times direct materials used |
| Gross margin as a percentage of revenues | 20% |
| Revenues | \$1,037,500 |

Required

Calculate the cost of:

1. Finished goods inventory, 3/31/2011
2. Work-in-process inventory, 3/31/2011
3. Direct materials inventory, 3/31/2011

2-40 Comprehensive problem on unit costs, product costs. Denver Office Equipment manufactures and sells metal shelving. It began operations on January 1, 2011. Costs incurred for 2011 are as follows (V stands for variable; F stands for fixed):

| | |
|---|-------------|
| Direct materials used | \$147,600 V |
| Direct manufacturing labor costs | 38,400 V |
| Plant energy costs | 2,000 V |
| Indirect manufacturing labor costs | 14,000 V |
| Indirect manufacturing labor costs | 19,000 F |
| Other indirect manufacturing costs | 11,000 V |
| Other indirect manufacturing costs | 14,000 F |
| Marketing, distribution, and customer-service costs | 128,000 V |
| Marketing, distribution, and customer-service costs | 48,000 F |
| Administrative costs | 56,000 F |

Variable manufacturing costs are variable with respect to units produced. Variable marketing, distribution, and customer-service costs are variable with respect to units sold.

Inventory data are as follows:

| | Beginning: January 1, 2011 | Ending: December 31, 2011 |
|------------------|----------------------------|---------------------------|
| Direct materials | 0 lb | 2,400 lbs |
| Work in process | 0 units | 0 units |
| Finished goods | 0 units | ? units |

Production in 2011 was 123,000 units. Two pounds of direct materials are used to make one unit of finished product.

Revenues in 2011 were \$594,000. The selling price per unit and the purchase price per pound of direct materials were stable throughout the year. The company's ending inventory of finished goods is carried at the average unit manufacturing cost for 2011. Finished-goods inventory at December 31, 2011, was \$26,000.

1. Calculate direct materials inventory, total cost, December 31, 2011.
2. Calculate finished-goods inventory, total units, December 31, 2011.
3. Calculate selling price in 2011.
4. Calculate operating income for 2011.

Required

2-41 Cost Classification; Ethics. Scott Hewitt, the new Plant Manager of Old World Manufacturing Plant Number 7, has just reviewed a draft of his year-end financial statements. Hewitt receives a year-end bonus of 10% of the plant's operating income before tax. The year-end income statement provided by the plant's controller was disappointing to say the least. After reviewing the numbers, Hewitt demanded that his controller go back and "work the numbers" again. Hewitt insisted that if he didn't see a better operating income number the next time around he would be forced to look for a new controller.

Old World Manufacturing classifies all costs directly related to the manufacturing of its product as product costs. These costs are inventoried and later expensed as costs of goods sold when the product is sold. All other expenses, including finished goods warehousing costs of \$3,250,000 are classified as period expenses. Hewitt had suggested that warehousing costs be included as product costs because they are "definitely related to our product." The company produced 200,000 units during the period and sold 180,000 units.

As the controller reworked the numbers he discovered that if he included warehousing costs as product costs, he could improve operating income by \$325,000. He was also sure these new numbers would make Hewitt happy.

1. Show numerically how operating income would improve by \$325,000 just by classifying the preceding costs as product costs instead of period expenses?
2. Is Hewitt correct in his justification that these costs "are definitely related to our product."
3. By how much will Hewitt profit personally if the controller makes the adjustments in requirement 1.
4. What should the plant controller do?

Required

Collaborative Learning Problem

2-42 Finding unknown amounts. An auditor for the Internal Revenue Service is trying to reconstruct some partially destroyed records of two taxpayers. For each of the cases in the accompanying list, find the unknowns designated by the letters A through D.

| | Case 1 | Case 2 |
|----------------------------------|----------------|----------|
| | (in thousands) | |
| Accounts receivable, 12/31 | \$ 6,000 | \$ 2,100 |
| Cost of goods sold | A | 20,000 |
| Accounts payable, 1/1 | 3,000 | 1,700 |
| Accounts payable, 12/31 | 1,800 | 1,500 |
| Finished goods inventory, 12/31 | B | 5,300 |
| Gross margin | 11,300 | C |
| Work-in-process inventory, 1/1 | 0 | 800 |
| Work-in-process inventory, 12/31 | 0 | 3,000 |
| Finished goods inventory, 1/1 | 4,000 | 4,000 |
| Direct materials used | 8,000 | 12,000 |
| Direct manufacturing labor | 3,000 | 5,000 |
| Manufacturing overhead costs | 7,000 | D |
| Purchases of direct materials | 9,000 | 7,000 |
| Revenues | 32,000 | 31,800 |
| Accounts receivable, 1/1 | 2,000 | 1,400 |