

Chapter

2

Cost Terms, Concepts, and Classifications

LEARNING OBJECTIVES

After studying Chapter 2, you should be able to:

- L01** Identify and give examples of each of the three basic manufacturing cost categories.
- L02** Distinguish between product costs and period costs and give examples of each.
- L03** Prepare an income statement including calculation of the cost of goods sold.
- L04** Prepare a schedule of cost of goods manufactured.
- L05** Understand the differences between variable costs and fixed costs.
- L06** Understand the differences between direct and indirect costs.
- L07** Define and give examples of cost classifications used in making decisions: differential costs, opportunity costs, and sunk costs.
- L08** (Appendix 2A) Properly account for labor costs associated with idle time, overtime, and fringe benefits.
- L09** (Appendix 2B) Identify the four types of quality costs and explain how they interact.
- L010** (Appendix 2B) Prepare and interpret a quality cost report.



Costs Add Up

Understanding costs and how they behave is critical in business. **Labor Ready** is a company based in Tacoma, Washington, that was started in 1989 with an investment of \$50,000. The company fills temporary manual labor jobs throughout the United States, Canada, and the UK—issuing over 6 million paychecks each year to more than half a million laborers. For example, the food vendors at the new Seattle Mariners' Safeco Field hire Labor Ready workers to serve soft drinks and food at baseball games. Employers are charged about \$11 per hour for this service. Since Labor Ready pays its workers only about \$6.50 per hour and offers no fringe benefits and has no national competitors, this business would appear to be a gold mine generating about \$4.50 per hour in profit. However, the company must maintain 687 hiring offices, each employing a permanent staff of four to five persons. Those costs, together with payroll taxes, workmen's compensation insurance, and other administrative costs, result in a margin of only about 5%, or a little over 50¢ per hour. ■

Source: Catie Golding, "Short-Term Work, Long-Term Profits," *Washington CEO*, January 2000, pp. 10–12.

BUSINESS FOCUS



As explained in Chapter 1, the work of management focuses on (1) planning, which includes setting objectives and outlining how to attain these objectives; and (2) control, which includes the steps to take to ensure that objectives are realized. To carry out these planning and control responsibilities, managers need *information* about the organization. This information often relates to the *costs* of the organization.

In managerial accounting, the term *cost* is used in many different ways. The reason is that there are many types of costs, and these costs are classified differently according to the immediate needs of management. For example, managers may want cost data to prepare external financial reports, to prepare planning budgets, or to make decisions. Each different use of cost data demands a different classification and definition of costs. For example, the preparation of external financial reports requires the use of historical cost data, whereas decision making may require predictions about future costs.

In this chapter, we discuss many of the possible uses of cost data and how costs are defined and classified for each use. Our first task is to explain how costs are classified for the purpose of preparing external financial reports—particularly in manufacturing companies. To set the stage for this discussion, we begin the chapter by defining some terms commonly used in manufacturing.

General Cost Classifications

All types of organizations incur costs—business, nonbusiness, manufacturing, retail, and service. Generally, the kinds of costs that are incurred and the way in which these costs are classified depends on the type of organization. For this reason, we will consider in our discussion the cost characteristics of a variety of organizations—manufacturing, merchandising, and service.

Our initial focus in this chapter is on manufacturing companies, since their basic activities include most of the activities found in other types of business organizations. Manufacturing companies such as **Texas Instruments**, **Ford**, and **DuPont** are involved in acquiring raw materials, producing finished goods, marketing, distributing, billing, and almost every other business activity. Therefore, an understanding of costs in a manufacturing company can be very helpful in understanding costs in other types of organizations.

In this chapter, we develop cost concepts that apply to diverse organizations. For example, these cost concepts apply to fast-food outlets such as **Kentucky Fried Chicken**, **Pizza Hut**, and **Taco Bell**; movie studios such as **Disney**, **Paramount**, and **United Artists**; consulting firms such as **Accenture** and **McKinsey**; and your local hospital. The exact terms used in these industries may not be the same as those used in manufacturing, but the same basic concepts apply. With some slight modifications, these basic concepts also apply to merchandising companies such as **Wal-Mart**, **The Gap**, **7-Eleven**, **Nordstrom**, and **Tower Records** that resell finished goods acquired from manufacturers and other sources. With that in mind, let us begin our discussion of manufacturing costs.



2-1



LEARNING OBJECTIVE 1

Identify and give examples of each of the three basic manufacturing cost categories.

Manufacturing Costs

Most manufacturing companies divide manufacturing costs into three broad categories: direct materials, direct labor, and manufacturing overhead. A discussion of each of these categories follows.

Direct Materials The materials that go into the final product are called **raw materials**. This term is somewhat misleading, since it seems to imply unprocessed natural

resources like wood pulp or iron ore. Actually, raw materials refer to any materials that are used in the final product; and the finished product of one company can become the raw materials of another company. For example, the plastics produced by **Du Pont** are a raw material used by **Compaq Computer** in its personal computers. One study of 37 manufacturing industries found that materials costs averaged about 55% of sales revenues.¹

Direct materials are those materials that become an integral part of the finished product and that can be physically and conveniently traced to it. This would include, for example, the seats **Airbus** purchases from subcontractors to install in its commercial aircraft. Also included is the tiny electric motor **Panasonic** uses in its CD players to make the CD spin.

Sometimes it isn't worth the effort to trace the costs of relatively insignificant materials to the end products. Such minor items would include the solder used to make electrical connections in a **Sony** TV or the glue used to assemble an **Ethan Allen** chair. Materials such as solder and glue are called **indirect materials** and are included as part of manufacturing overhead, which is discussed later in this section.

Direct Labor The term **direct labor** is reserved for those labor costs that can be easily (i.e., physically and conveniently) traced to individual units of product. Direct labor is sometimes called *touch labor*, since direct labor workers typically touch the product while it is being made. The labor costs of assembly-line workers, for example, would be direct labor costs, as would the labor costs of carpenters, bricklayers, and machine operators.

Labor costs that cannot be physically traced to the creation of products, or that can be traced only at great cost and inconvenience, are termed **indirect labor** and treated as part of manufacturing overhead, along with indirect materials. Indirect labor includes the labor costs of janitors, supervisors, materials handlers, and night security guards. Although the efforts of these workers are essential to production, it would be either impractical or impossible to accurately trace their costs to specific units of product. Hence, such labor costs are treated as indirect labor.

In some industries, major shifts are taking place in the structure of labor costs. Sophisticated automated equipment, run and maintained by skilled indirect workers, is increasingly replacing direct labor. Indeed, in the study cited above of 37 manufacturing industries, direct labor averaged only about 10% of sales revenues. In a few companies, direct labor has become such a minor element of cost that it has disappeared altogether as a separate cost category. More is said in later chapters about this trend and about the impact it is having on cost systems. However, the vast majority of manufacturing and service companies throughout the world continue to recognize direct labor as a separate cost category.

Manufacturing Overhead **Manufacturing overhead**, the third element of manufacturing cost, includes all costs of manufacturing except direct materials and direct labor. Manufacturing overhead includes items such as indirect materials; indirect labor; maintenance and repairs on production equipment; and heat and light, property taxes, depreciation, and insurance on manufacturing facilities. A company also incurs costs for heat and light, property taxes, insurance, depreciation, and so forth, associated with its selling and administrative functions, but these costs are not included as part of manufacturing overhead. Only those costs associated with *operating the factory* are included in the manufacturing overhead category. Several studies have found that manufacturing overhead averages about 16% of sales revenues.²

Various names are used for manufacturing overhead, such as *indirect manufacturing cost*, *factory overhead*, and *factory burden*. All of these terms are synonyms for *manufacturing overhead*.

Manufacturing overhead combined with direct labor is called **conversion cost** (or sometimes *value-added cost*). This term stems from the fact that direct labor costs and

¹ Germain Boer and Debra Jeter, "What's New About Modern Manufacturing? Empirical Evidence on Manufacturing Cost Changes," *Journal of Management Accounting Research*, Fall 1993, pp. 61–83.

² J. Miller, A. DeMeyer, and J. Nakane, *Benchmarking Global Manufacturing* (Homewood, IL: Richard D. Irwin, 1992), Chapter 2. The Boer and Jeter article cited above contains a similar finding concerning the magnitude of manufacturing overhead.

overhead costs are incurred to convert materials into finished products. Direct labor combined with direct materials is called **prime cost**.

Nonmanufacturing Costs

Generally, nonmanufacturing costs are subclassified into two categories:

1. Marketing or selling costs.
2. Administrative costs.

Marketing or selling costs include all costs necessary to secure customer orders and get the finished product into the hands of the customer. These costs are often called *order-getting and order-filling costs*. Examples of marketing costs include advertising, shipping, sales travel, sales commissions, sales salaries, and costs of finished goods warehouses.

Administrative costs include all executive, organizational, and clerical costs associated with the *general management* of an organization rather than with manufacturing, marketing, or selling. Examples of administrative costs include executive compensation, general accounting, secretarial, public relations, and similar costs involved in the overall, general administration of the organization *as a whole*.

Nonmanufacturing costs are also called selling, general, and administrative (SG&A) costs.

IN BUSINESS



WHY IS TUITION SO HIGH?

Do you ever wonder why tuition costs are so high? Administrative costs can be crushing. *Forbes* magazine reports that an average of 2.5 administrators are employed for each faculty member in public colleges and 1.9 in private colleges. The worst case is Mississippi, which has four administrators for every teacher. The best case is Colorado, which “manages to get by with just under two administrators per teacher.” Much of the administrative work results from “the mandates that accompany federal money, such as affirmative action, and the personnel needed to monitor compliance with those mandates.”

Source: Peter Brimelow, “The Paper Chase,” *Forbes*, May 17, 1999, pp. 78–79.

Product Costs versus Period Costs

LEARNING OBJECTIVE 2

Distinguish between product costs and period costs and give examples of each.

In addition to the distinction between manufacturing and nonmanufacturing costs, there are other ways to look at costs. For instance, they can also be classified as either *product costs* or *period costs*. To understand the difference between product costs and period costs, we must first refresh our understanding of the matching principle from financial accounting.

Generally, costs are recognized as expenses on the income statement in the period that benefits from the cost. For example, if a company pays for liability insurance in advance for two years, the entire amount is not considered an expense of the year in which the payment is made. Instead, one-half of the cost would be recognized as an expense each year. The reason is that both years—not just the first year—benefit from the insurance payment. The unexpensed portion of the insurance payment is carried on the balance sheet as an asset called prepaid insurance. You should be familiar with this type of *accrual* from your financial accounting coursework.

The *matching principle* is based on the accrual concept and states that *costs incurred to generate a particular revenue should be recognized as expenses in the same period that the revenue is recognized*. This means that if a cost is incurred to acquire or make something that will eventually be sold, then the cost should be recognized as an expense only when the sale takes place—that is, when the benefit occurs. Such costs are called *product costs*.

Product Costs

For financial accounting purposes, **product costs** include all the costs that are involved in acquiring or making a product. In the case of manufactured goods, these costs consist of

direct materials, direct labor, and manufacturing overhead. Product costs are viewed as “attaching” to units of product as the goods are purchased or manufactured, and they remain attached as the goods go into inventory awaiting sale. So initially, product costs are assigned to an inventory account on the balance sheet. When the goods are sold, the costs are released from inventory as expenses (typically called cost of goods sold) and matched against sales revenue. Since product costs are initially assigned to inventories, they are also known as **inventoriable costs**.

We want to emphasize that product costs are not necessarily treated as expenses in the period in which they are incurred. Rather, as explained above, they are treated as expenses in the period in which the related products *are sold*. This means that a product cost such as direct materials or direct labor might be incurred during one period but not treated as an expense until a following period when the completed product is sold.

Period Costs

Period costs are all the costs that are not included in product costs. These costs are expensed on the income statement in the period in which they are incurred, using the usual rules of accrual accounting you have already learned in financial accounting. Period costs are not included as part of the cost of either purchased or manufactured goods. Sales commissions and office rent are good examples of period costs. Neither commissions nor office rent are included as part of the cost of purchased or manufactured goods. Rather, both items are treated as expenses on the income statement in the period in which they are incurred. Thus, they are said to be period costs.

As suggested above, *all selling and administrative expenses are considered to be period costs*. Advertising, executive salaries, sales commissions, public relations, and other nonmanufacturing costs discussed earlier would all be period costs. They will appear on the income statement as expenses in the period in which they are incurred.

Exhibit 2–1 (page 40) contains a summary of the cost terms that we have introduced so far.

DISSECTING THE VALUE CHAIN

United Colors of Benetton, an Italian apparel company headquartered in Ponzano, is unusual in that it is involved in all activities in the “value chain” from clothing design through manufacturing, distribution, and ultimate sale to customers in Benetton retail outlets. Most companies are involved in only one or two of these activities. Looking at this company allows us to see how costs are distributed across the entire value chain. A recent income statement from the company contained the following data:

	Millions of Euros	Percent of Revenues
Revenue	<u>2,125</u>	100.0%
Cost of sales	<u>1,199</u>	56.4
Selling, general, and administrative expenses:		
Payroll and related cost	126	5.9
Distribution and transport	45	2.1
Sales commissions	102	4.8
Advertising and promotion	125	5.9
Depreciation and amortization	62	2.9
Other expenses	<u>141</u>	6.6
Total selling, general, and administrative expenses	<u>601</u>	28.3%

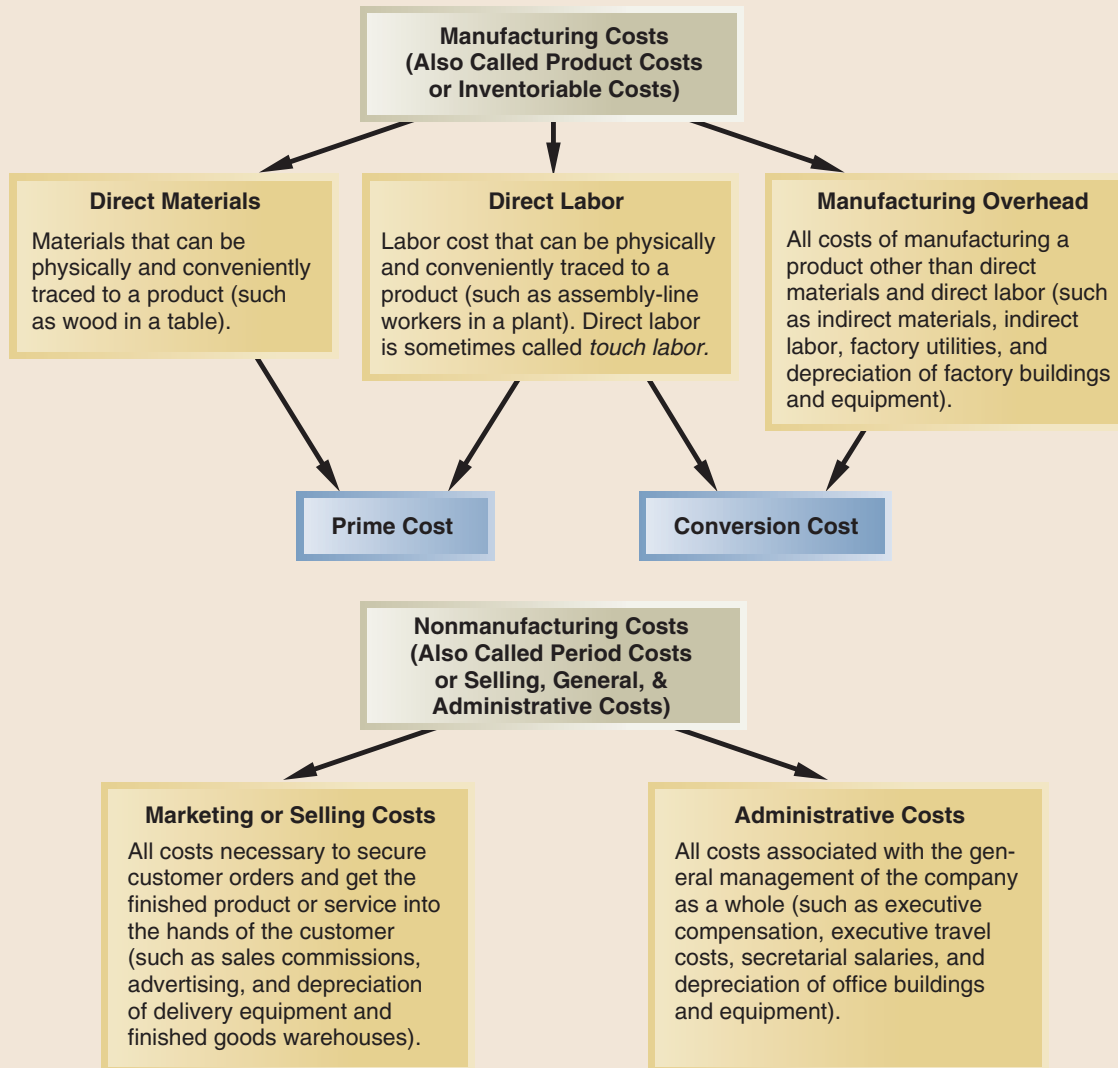
Even though this company spends large sums on advertising and runs its own shops, the cost of sales is still quite high in relation to the revenue—56.4% of revenue. And despite the company’s lavish advertising campaigns, advertising and promotion costs amounted to only 5.9% of revenue. (Note: One U.S. dollar was worth about 1.1218 euros at the time of this financial report.)

IN BUSINESS



EXHIBIT 2-1

Summary of Cost Terms



IN BUSINESS



BLOATED SALES AND ADMINISTRATIVE EXPENSES

Selling and administrative expenses tend to creep up during economic booms—creating problems when the economy falls into recession. Ron Nicol, a partner at the [Boston Consulting Group](#), found that selling and administrative expenses at America's 1000 largest companies grew at an average rate of 1.7% per year between 1985 and 1996 and then exploded to an average of 10% growth per year between 1997 and 2000. If companies had maintained their historical balance between sales revenues on the one hand and selling and administrative expenses on the other hand, Nicol calculates that selling and administrative expenses would have been about \$500 million lower in the year 2000 for the average company on his list.

Source: Jon E. Hilsenrath, "The Outlook: Corporate Dieting Is Far from Over," *The Wall Street Journal*, July 9, 2001, p. A1.

Cost Classifications on Financial Statements

In your prior accounting training, you learned that companies prepare periodic financial reports for creditors, stockholders, and others to show the financial condition of the company and the company's earnings performance over some specified time interval. The reports you studied were probably those of merchandising companies, such as retail stores, which simply purchase goods from suppliers for resale to customers.

The financial statements prepared by a *manufacturing* company are more complex than the statements prepared by a merchandising company because a manufacturing company must produce its goods as well as market them. The production process involves many costs that do not exist in a merchandising company, and these costs must be accounted for on the manufacturing company's financial statements. In this section, we focus our attention on how this accounting is carried out in the balance sheet and income statement.



2-2

The Balance Sheet

The balance sheet, or statement of financial position, of a manufacturing company is similar to that of a merchandising company. However, the inventory accounts differ between the two types of companies. A merchandising company has only one class of inventory—goods purchased from suppliers that are awaiting resale to customers. In contrast, manufacturing companies have three classes of inventories—*raw materials*, *work in process*, and *finished goods*. **Raw materials** are the materials that are used to make a product. **Work in process** consists of units of product that are only partially complete and will require further work before they are ready for sale to a customer. **Finished goods** consist of units of product that have been completed but have not yet been sold to customers. The overall inventory figure is usually broken down into these three classes of inventories in a footnote to the financial statements.

We will use two companies—Graham Manufacturing and Reston Bookstore—to illustrate the concepts discussed in this section. Graham Manufacturing is located in Portsmouth, New Hampshire, and makes precision brass fittings for yachts. Reston Bookstore is a small bookstore in Reston, Virginia, specializing in books about the Civil War.

The footnotes to Graham Manufacturing's Annual Report reveal the following information concerning its inventories:

GRAHAM MANUFACTURING CORPORATION Inventory Accounts		
	Beginning Balance	Ending Balance
Raw Materials	\$ 60,000	\$ 50,000
Work in Process	90,000	60,000
Finished Goods	125,000	175,000
Total inventory accounts	<u>\$275,000</u>	<u>\$285,000</u>

Graham Manufacturing's raw materials inventory consists largely of brass rods and brass blocks. The work in process inventory consists of partially completed brass fittings. The finished goods inventory consists of brass fittings that are ready to be sold to customers.

In contrast, the inventory account at Reston Bookstore consists entirely of the costs of books the company has purchased from publishers for resale to the public. In merchandising companies like Reston, these inventories may be called *merchandise inventory*. The beginning and ending balances in this account appear as follows:

RESTON BOOKSTORE Inventory Account		
	Beginning Balance	Ending Balance
Merchandise Inventory	<u>\$100,000</u>	<u>\$150,000</u>

LEARNING OBJECTIVE 3

Prepare an income statement including calculation of the cost of goods sold.

The Income Statement

Exhibit 2–2 compares the income statements of Reston Bookstore and Graham Manufacturing. For purposes of illustration, these statements contain more detail about cost of goods sold than you will generally find in published financial statements.

At first glance, the income statements of merchandising and manufacturing companies like Reston Bookstore and Graham Manufacturing are very similar. The only apparent difference is in the labels of some of the entries in the computation of the cost of goods sold. In the exhibit, the computation of cost of goods sold relies on the following basic equation for inventory accounts:

Basic Equation for Inventory Accounts

$$\text{Beginning balance} + \text{Additions to inventory} = \text{Ending balance} + \text{Withdrawals from inventory}$$

The logic underlying this equation, which applies to any inventory account, is illustrated in Exhibit 2–3. At the beginning of the period, the inventory contains a beginning

EXHIBIT 2–2

Comparative Income Statements: Merchandising and Manufacturing Companies

		MERCHANDISING COMPANY Reston Bookstore		
The cost of merchandise inventory purchased from outside suppliers during the period.	}	→	Sales	\$1,000,000
			Cost of goods sold:	
			Beginning merchandise inventory	\$100,000
			Add: Purchases	<u>650,000</u>
			Goods available for sale	750,000
			Deduct: Ending merchandise inventory	<u>150,000</u>
				600,000
			Gross margin	400,000
			Less operating expenses:	
			Selling expense	100,000
Administrative expense	<u>200,000</u>			
	300,000			
	Net operating income	<u>\$ 100,000</u>		
		MANUFACTURING COMPANY Graham Manufacturing		
The manufacturing costs associated with the goods that were finished during the period. (See Exhibit 2–4 for details.)	}	→	Sales	\$1,500,000
			Cost of goods sold:	
			Beginning finished goods inventory	\$125,000
			Add: Cost of goods manufactured	<u>850,000</u>
			Goods available for sale	975,000
			Deduct: Ending finished goods inventory	<u>175,000</u>
				800,000
			Gross margin	700,000
			Less operating expenses:	
			Selling expense	250,000
Administrative expense	<u>300,000</u>			
	550,000			
	Net operating income	<u>\$ 150,000</u>		

balance. During the period, additions are made to the inventory through purchases or other means. The sum of the beginning balance and the additions to the account is the total amount of inventory available. During the period, withdrawals are made from inventory. Whatever is left at the end of the period after these withdrawals is the ending balance.

These concepts are applied to determine the cost of goods sold for a merchandising company like Reston Bookstore as follows:

Cost of Goods Sold in a Merchandising Company

$$\begin{array}{l} \text{Beginning} \\ \text{merchandise} \\ \text{inventory} \end{array} + \text{Purchases} = \begin{array}{l} \text{Ending} \\ \text{merchandise} \\ \text{inventory} \end{array} + \begin{array}{l} \text{Cost of} \\ \text{goods sold} \end{array}$$

or

$$\begin{array}{l} \text{Cost of} \\ \text{goods sold} \end{array} = \begin{array}{l} \text{Beginning} \\ \text{merchandise} \\ \text{inventory} \end{array} + \text{Purchases} - \begin{array}{l} \text{Ending} \\ \text{merchandise} \\ \text{inventory} \end{array}$$

To determine the cost of goods sold in a merchandising company like Reston Bookstore, we only need to know the beginning and ending balances in the Merchandise Inventory account and the purchases. Total purchases can be easily determined in a merchandising company by simply adding together all purchases from suppliers.

The cost of goods sold for a manufacturing company like Graham Manufacturing is determined as follows:

Cost of Goods Sold in a Manufacturing Company

$$\begin{array}{l} \text{Beginning finished} \\ \text{goods inventory} \end{array} + \begin{array}{l} \text{Cost of goods} \\ \text{manufactured} \end{array} = \begin{array}{l} \text{Ending finished} \\ \text{goods inventory} \end{array} + \begin{array}{l} \text{Cost of} \\ \text{goods sold} \end{array}$$

or

$$\begin{array}{l} \text{Cost of} \\ \text{goods sold} \end{array} = \begin{array}{l} \text{Beginning finished} \\ \text{goods inventory} \end{array} + \begin{array}{l} \text{Cost of goods} \\ \text{manufactured} \end{array} - \begin{array}{l} \text{Ending finished} \\ \text{goods inventory} \end{array}$$

To determine the cost of goods sold in a manufacturing company like Graham Manufacturing, we need to know the *cost of goods manufactured* and the beginning and ending balances in the Finished Goods inventory account. The **cost of goods manufactured** consists of the manufacturing costs associated with goods that were *finished* during the period. The cost of goods manufactured figure for Graham Manufacturing is derived in Exhibit 2–4, which contains a *schedule of cost of goods manufactured*.

Schedule of Cost of Goods Manufactured

At first glance, the **schedule of cost of goods manufactured** in Exhibit 2–4 (page 44) appears complex and perhaps even intimidating. However, it is all quite logical. The schedule

LEARNING OBJECTIVE 4

Prepare a schedule of cost of goods manufactured.



EXHIBIT 2-4

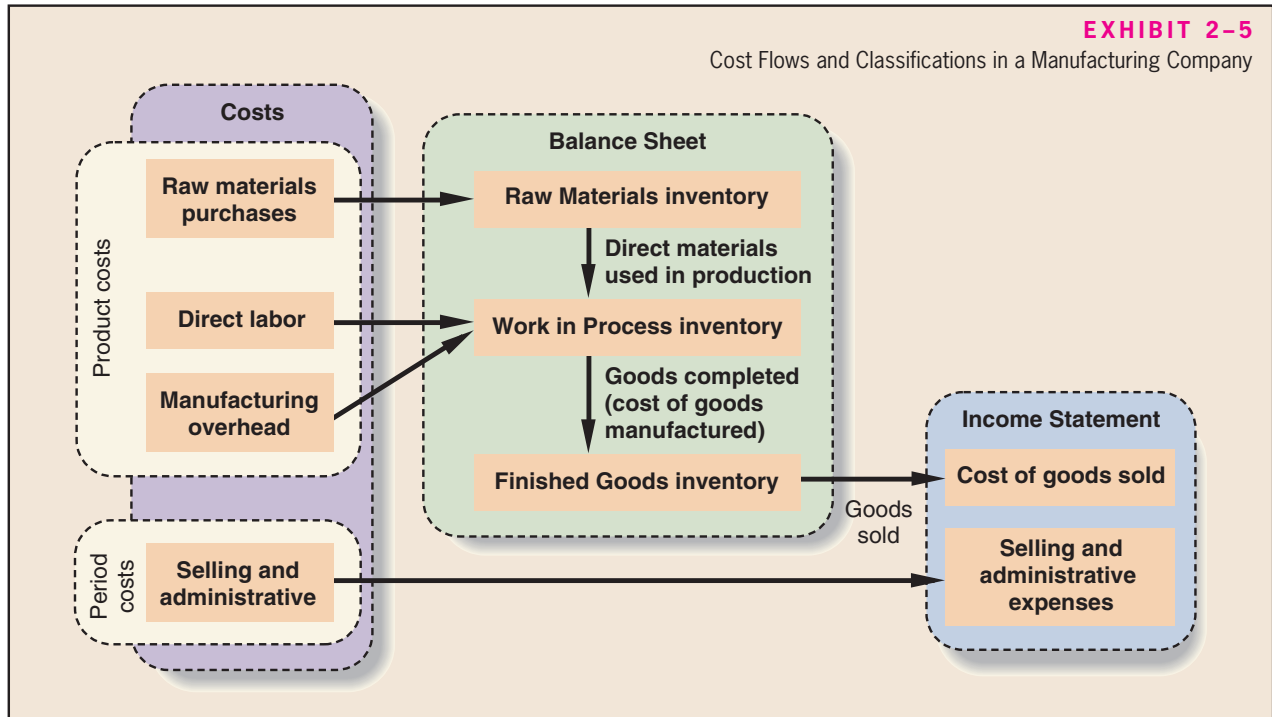
Schedule of Cost of Goods Manufactured

Direct materials:			
Beginning raw materials inventory*	\$ 60,000		
Add: Purchases of raw materials	400,000		
Raw materials available for use	460,000		
Deduct: Ending raw materials inventory	50,000		
Raw materials used in production		\$410,000	Direct materials
Direct labor		60,000	Direct labor
Manufacturing overhead:*			
Insurance, factory	6,000		
Indirect labor	100,000		
Machine rental	50,000		
Utilities, factory	75,000		
Supplies	21,000		
Depreciation, factory	90,000		
Property taxes, factory	8,000		
Total overhead costs		350,000	Manufacturing overhead
Total manufacturing costs:		820,000	
Add: Beginning work in process inventory		90,000	
		910,000	
Deduct: Ending work in process inventory		60,000	
Cost of goods manufactured (see Exhibit 2-2)		\$850,000	Cost of goods manufactured

*We assume in this example that the Raw Materials inventory account contains only direct materials and that indirect materials are carried in a separate Supplies account. Using a Supplies account for indirect materials is a common practice among companies. In Chapter 3, we discuss the procedure to be followed if *both* direct and indirect materials are carried in a single account.

[†]In Chapter 3 we will see that the manufacturing overhead section of the schedule of cost of goods manufactured can be considerably simplified by using what is called a *predetermined manufacturing overhead rate*.

of cost of goods manufactured contains the three elements of product costs that we discussed earlier—direct materials, direct labor, and manufacturing overhead. The direct materials cost is not simply the cost of materials purchased during the period—rather it is the cost of materials *used* during the period. The purchases of raw materials are added to the beginning balance to determine the cost of the materials available for use. The ending materials inventory is deducted from this amount to arrive at the cost of the materials used in production. The sum of the three cost elements—materials, direct labor, and manufacturing overhead—is the total manufacturing cost. This is *not* the same thing, however, as the cost of goods manufactured for the period. The subtle distinction between the total manufacturing cost and the cost of goods manufactured is very easy to miss. Some of the materials, direct labor, and manufacturing overhead costs incurred during the period relate to goods that are not yet completed. As stated above, the *cost of goods manufactured* consists of the manufacturing costs associated with the goods that were *finished* during the period. Consequently, adjustments need to be made to the total manufacturing cost of the period for the partially completed goods that were in process at the beginning and at the end of the period. The costs that relate to goods that are not yet completed are shown in the work in process inventory figures at the bottom of the schedule. Note that the beginning work in process inventory must be added to the manufacturing costs of the period, and the ending work in process inventory must be deducted, to arrive at the cost of goods manufactured.



Product Cost Flows

Earlier in the chapter, we defined product costs as those costs that are incurred to either purchase or manufacture goods. For manufactured goods, these costs consist of direct materials, direct labor, and manufacturing overhead. It will be helpful at this point to look briefly at the flow of costs in a manufacturing company. This will help us understand how product costs move through the various accounts and how they affect the balance sheet and the income statement.

Exhibit 2–5 illustrates the flow of costs in a manufacturing company. Raw materials purchases are recorded in the Raw Materials inventory account. When raw materials are used in production, their costs are transferred to the Work in Process inventory account as direct materials. Notice that direct labor cost and manufacturing overhead cost are added directly to Work in Process. Work in Process can be viewed most simply as products on an assembly line. The direct materials, direct labor, and manufacturing overhead costs added to Work in Process in Exhibit 2–5 are the costs needed to complete these products as they move along this assembly line.

Notice from the exhibit that as goods are completed, their costs are transferred from Work in Process to Finished Goods. Here the goods await sale to customers. As goods are sold, their costs are transferred from Finished Goods to Cost of Goods Sold. At this point the various material, labor, and overhead costs required to make the product are finally recorded as expenses. Until that point, these costs are in inventory accounts on the balance sheet.

Inventoriable Costs

As stated earlier, product costs are often called inventoriable costs. The reason is that these costs go directly into inventory accounts as they are incurred (first into Work in Process and then into Finished Goods), rather than going into expense accounts. Thus, they are termed *inventoriable costs*. This is a key concept since such costs can end up on the balance sheet as assets if goods are only partially completed or are unsold at the end of a period. To illustrate this point, refer again to Exhibit 2–5. At the end of the period, the

materials, labor, and overhead costs that are associated with the units in the Work in Process and Finished Goods inventory accounts will appear on the balance sheet as part of the company's assets. As explained earlier, these costs will not become expenses until later when the goods are completed and sold.

Selling and administrative expenses are not involved in making a product. For this reason, they are not treated as product costs but rather as period costs that are expensed as they are incurred, as shown in Exhibit 2–5.

An Example of Cost Flows

To provide an example of cost flows in a manufacturing company, assume that a company's annual insurance cost is \$2,000. Three-fourths of this amount (\$1,500) applies to factory operations, and one-fourth (\$500) applies to selling and administrative activities. Therefore, \$1,500 of the \$2,000 insurance cost would be a product (inventoriable) cost and would be added to the cost of the goods produced during the year. This concept is illustrated in Exhibit 2–6, where \$1,500 of insurance cost is added into Work in Process. As shown in the exhibit, this portion of the year's insurance cost will not become an expense until the goods that are produced during the year are sold—which may not happen until the following year or even later. Until the goods are sold, the \$1,500 will remain as part of the asset, inventory (either as part of Work in Process or as part of Finished Goods), along with the other costs of producing the goods.

By contrast, the \$500 of insurance cost that applies to the company's selling and administrative activities will be expensed immediately.

Thus far, we have been mainly concerned with classifications of manufacturing costs for the purpose of determining inventory valuations on the balance sheet and cost of goods sold on the income statement of external financial reports. However, costs are used for many other purposes, and each purpose requires a different classification of costs. We

EXHIBIT 2–6

An Example of Cost Flows in a Manufacturing Company

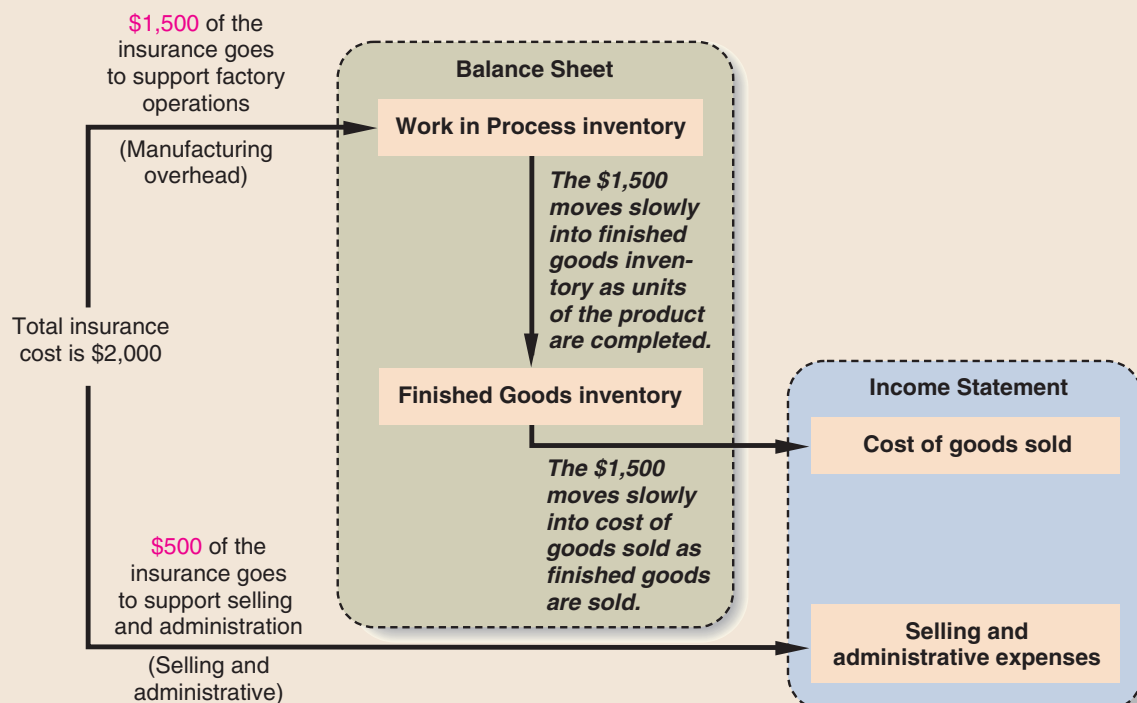


EXHIBIT 2–7

Summary of Cost Classifications

Purpose of Cost Classification	Cost Classifications
Preparing external financial statements	<ul style="list-style-type: none"> • Product costs (inventoriable) <ul style="list-style-type: none"> • Direct materials • Direct labor • Manufacturing overhead • Period costs (expensed) <ul style="list-style-type: none"> • Nonmanufacturing costs <ul style="list-style-type: none"> • Marketing or selling costs • Administrative costs
Predicting cost behavior in response to changes in activity	<ul style="list-style-type: none"> • Variable cost (proportional to activity) • Fixed cost (constant in total)
Assigning costs to cost objects such as departments or products	<ul style="list-style-type: none"> • Direct cost (can be easily traced) • Indirect cost (cannot be easily traced; must be allocated)
Making decisions	<ul style="list-style-type: none"> • Differential cost (differs between alternatives) • Sunk cost (past cost not affected by a decision) • Opportunity cost (forgone benefit)
Cost of quality (Appendix)	<ul style="list-style-type: none"> • Prevention costs • Appraisal costs • Internal failure costs • External failure costs

will consider several different purposes for cost classifications in the remaining sections of this chapter. These purposes and the corresponding cost classifications are summarized in Exhibit 2–7. To help keep the big picture in mind, we suggest that you refer back to this exhibit frequently as you progress through the rest of this chapter.

PRODUCT OR PERIOD EXPENSE—WHO CARES?

Whether a cost is considered a product or period cost can have an important impact on a company's financial statements. Consider the following excerpts from a conversation recorded on the Institute of Management Accountant's Ethics Hot-Line:

Caller: My problem basically is that my boss, the division general manager, wants me to put costs into inventory that I know should be expensed. . . .

Counselor: Have you expressed your doubts to your boss?

Caller: Yes, but he is basically a salesman and claims he knows nothing about GAAP. He just wants the "numbers" to back up the good news he keeps telling corporate [headquarters], which is what corporate demands. Also, he asks if I am ready to make the entries that I think are improper. It seems he wants to make it look like my idea all along. Our company had legal problems a few years ago with some government contracts, and it was the lower level people who were "hung out to dry" rather than the higher-ups who were really at fault.

Counselor: . . . What does he say when you tell him these matters need resolution?

Caller: He just says we need a meeting, but the meetings never solve anything. . . .

Counselor: Does your company have an ethics hot-line?

Caller: Yes, but my boss would view use of the hot-line as snitching or even whistle-blowing. . . .

Counselor: . . . If you might face reprisals for using the hot-line, perhaps you should evaluate whether or not you really want to work for a company whose ethical climate is one you are uncomfortable in.

Source: Curtis C. Verschoor, "Using a Hot-Line Isn't Whistle-Blowing," *Strategic Finance*, April 1999, pp. 27–28. Reprinted with permission from the IMA, Montvale, NJ, USA www.imanet.org.

IN BUSINESS



Cost Classifications for Predicting Cost Behavior

LEARNING OBJECTIVE 5

Understand the differences between variable costs and fixed costs.



Quite frequently, it is necessary to predict how a certain cost will behave in response to a change in activity. For example, a manager at **AT&T** may want to estimate the impact a 5% increase in long-distance calls would have on the company's total electric bill or on the total wages the company pays its long-distance operators. **Cost behavior** refers to how a cost will react to changes in the level of activity. As the activity level rises and falls, a particular cost may rise and fall as well—or it may remain constant. For planning purposes, a manager must be able to anticipate which of these will happen; and if a cost can be expected to change, the manager must be able to estimate how much it will change. To help make such distinctions, costs are often categorized as variable or fixed.

Variable Cost

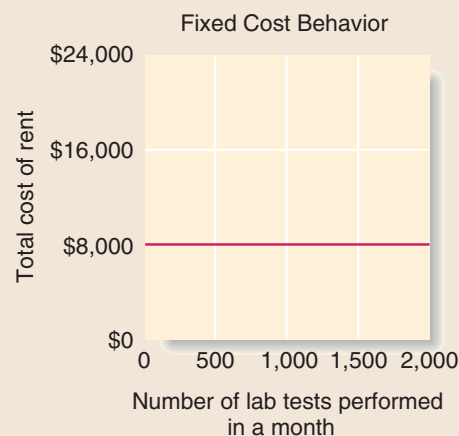
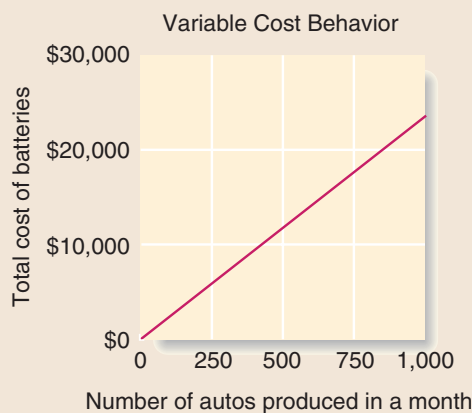
A **variable cost** is a cost that varies, in total, in direct proportion to changes in the level of activity. The activity can be expressed in many ways, such as units produced, units sold, miles driven, beds occupied, lines of print, hours worked, and so forth. A good example of a variable cost is direct materials. The cost of direct materials used during a period will vary, in total, in direct proportion to the number of units that are produced. To illustrate this idea, consider the Saturn Division of **GM**. Each auto requires one battery. As the output of autos increases and decreases, the number of batteries used will increase and decrease proportionately. If auto production goes up 10%, then the number of batteries used will also go up 10%. The concept of a variable cost is shown in graphic form in Exhibit 2–8.

It is important to note that when we speak of a cost as being variable, we mean the *total* cost rises and falls as the activity level rises and falls. This idea is presented below, assuming that a Saturn's battery costs \$24:

Number of Autos Produced	Cost per Battery	Total Variable Cost— Batteries
1	\$24	\$24
500	\$24	\$12,000
1,000	\$24	\$24,000

EXHIBIT 2–8

Variable and Fixed Cost Behavior



One interesting aspect of variable cost behavior is that a variable cost is constant if expressed on a *per unit* basis. Observe from the tabulation above that the per unit cost of batteries remains constant at \$24 even though the total cost of the batteries increases and decreases with activity.

There are many examples of costs that are variable with respect to the products and services provided by a company. In a manufacturing company, variable costs include items such as direct materials and some elements of manufacturing overhead such as lubricants, shipping costs, and sales commissions. For the present, we will also assume that direct labor is a variable cost, although as we shall see in Chapter 5, direct labor may act more like a fixed cost in many situations. In a merchandising company, variable costs include items such as cost of goods sold, commissions to salespersons, and billing costs. In a hospital, the variable costs of providing health care services to patients would include the costs of the supplies, drugs, meals, and perhaps nursing services.

When we say that a cost is variable, we ordinarily mean that it is variable with respect to the amount of goods or services the organization produces. However, costs can be variable with respect to other things. For example, the wages paid to employees at a **Blockbuster Video** outlet will depend on the number of hours the store is open and not strictly on the number of videos rented. In this case, we would say that wage costs are variable with respect to the hours of operation. Nevertheless, when we say that a cost is variable, we ordinarily mean it is variable with respect to the amount of goods and services produced. This could be how many Jeep Cherokees are produced, how many videos are rented, how many patients are treated, and so on.

Fixed Cost

A **fixed cost** is a cost that remains constant, in total, regardless of changes in the level of activity. Unlike variable costs, fixed costs are not affected by changes in activity. Consequently, as the activity level rises and falls, total fixed costs remain constant unless influenced by some outside force, such as a price change. Rent is a good example of a fixed cost. Suppose the **Mayo Clinic** rents a machine for \$8,000 per month that tests blood samples for the presence of leukemia cells. The \$8,000 monthly rental cost will be sustained regardless of the number of tests that may be performed during the month. The concept of a fixed cost is shown in graphic form in Exhibit 2–8.

Very few costs are completely fixed. Most will change if there is a large enough change in activity. For example, suppose that the capacity of the leukemia diagnostic machine at the Mayo Clinic is 2,000 tests per month. If the clinic wishes to perform more than 2,000 tests in a month, it would be necessary to rent an additional machine, which would cause a jump in the fixed costs. When we say a cost is fixed, we mean it is fixed within some *relevant range*. The **relevant range** is the range of activity within which the assumptions about variable and fixed costs are valid. For example, the assumption that the rent for diagnostic machines is \$8,000 per month is valid within the relevant range of 0 to 2,000 tests per month.

Fixed costs can create confusion if they are expressed on a per unit basis. This is because the average fixed cost per unit increases and decreases *inversely* with changes in activity. In the Mayo Clinic, for example, the average cost per test will fall as the number of tests performed increases. This is because the \$8,000 rental cost will be spread over more tests. Conversely, as the number of tests performed in the clinic declines, the average cost per test will rise as the \$8,000 rental cost is spread over fewer tests. This concept is illustrated in the table below:

Monthly Rental Cost	Number of Tests Performed	Average Cost per Test
\$8,000	10	\$800
8,000	500	\$16
8,000	2,000	\$4



EXHIBIT 2–9Summary of Variable and Fixed
Cost Behavior

Cost	Behavior of the Cost (within the relevant range)	
	In Total	Per Unit
Variable cost	Total variable cost increases and decreases in proportion to changes in the activity level.	Variable cost per unit remains constant.
Fixed cost	Total fixed cost is not affected by changes in the activity level within the relevant range.	Fixed cost per unit decreases as the activity level rises and increases as the activity level falls.

Note that if the Mayo Clinic performs only 10 tests each month, the rental cost of the equipment will average \$800 per test. But if 2,000 tests are performed each month, the average cost will drop to only \$4 per test. More will be said later about the problems created for both the accountant and the manager by this variation in unit costs.

Examples of fixed costs include straight-line depreciation, insurance, property taxes, rent, supervisory salaries, administrative salaries, and advertising.

A summary of both variable and fixed cost behavior is presented in Exhibit 2–9.

IN BUSINESS**THE COST OF A CALL**

On average, the variable cost of physically transporting a telephone call is about 7% of the price a customer pays for the call. It now costs more to bill for the call than to provide it. Then why aren't telephone companies fabulously profitable? In short, they have extremely high fixed costs for equipment, buildings, and personnel. The prices the telephone companies charge to consumers must cover these fixed costs as well as the relatively small variable costs of completing a particular call for a customer.

Source: Scott Woolley, "Meltdown," *Forbes*, July 3, 2000, pp. 70–71.

Cost Classifications for Assigning Costs to Cost Objects**LEARNING OBJECTIVE 6**

Understand the differences between direct and indirect costs.

Costs are assigned to cost objects for a variety of purposes including pricing, profitability studies, and control of spending. A **cost object** is anything for which cost data are desired—including products, product lines, customers, jobs, and organizational subunits. For purposes of assigning costs to cost objects, costs are classified as either *direct* or *indirect*.

Direct Cost

A **direct cost** is a cost that can be easily and conveniently traced to the particular cost object under consideration. The concept of direct cost extends beyond just direct materials and direct labor. For example, if **Reebok** is assigning costs to its various regional and national sales offices, then the salary of the sales manager in its Tokyo office would be a direct cost of that office.

Indirect Cost

An **indirect cost** is a cost that cannot be easily and conveniently traced to the particular cost object under consideration. For example, a **Campbell Soup** factory may produce dozens of varieties of canned soups. The factory manager's salary would be an indirect cost of a particular variety such as chicken noodle soup. The reason is that the factory manager's salary is not caused by any one variety of soup but rather is incurred as a

consequence of running the entire factory. *To be traced to a cost object such as a particular product, the cost must be caused by the cost object.* The factory manager's salary is called a *common cost* of producing the various products of the factory. A **common cost** is a cost that is incurred to support a number of costing objects but cannot be traced to them individually. A common cost is a type of indirect cost.

A particular cost may be direct or indirect, depending on the cost object. While the Campbell Soup factory manager's salary is an *indirect* cost of manufacturing chicken noodle soup, it is a *direct* cost of the manufacturing division. In the first case, the cost object is the chicken noodle soup product. In the second case, the cost object is the entire manufacturing division.

Cost Classifications for Decision Making

Costs are an important feature of many business decisions. In making decisions, it is essential to have a firm grasp of the concepts *differential cost*, *opportunity cost*, and *sunk cost*.

LEARNING OBJECTIVE 7

Define and give examples of cost classifications used in making decisions: differential costs, opportunity costs, and sunk costs.

Differential Cost and Revenue

Decisions involve choosing between alternatives. In business decisions, each alternative will have costs and benefits that must be compared to the costs and benefits of the other available alternatives. A difference in costs between any two alternatives is known as a **differential cost**. A difference in revenues between any two alternatives is known as **differential revenue**.

A differential cost is also known as an **incremental cost**, although technically an incremental cost should refer only to an increase in cost from one alternative to another; decreases in cost should be referred to as *decremental costs*. Differential cost is a broader term, encompassing both cost increases (incremental costs) and cost decreases (decremental costs) between alternatives.

The accountant's differential cost concept can be compared to the economist's marginal cost concept. In speaking of changes in cost and revenue, the economist employs the terms *marginal cost* and *marginal revenue*. The revenue that can be obtained from selling one more unit of product is called marginal revenue, and the cost involved in producing one more unit of product is called marginal cost. The economist's marginal concept is basically the same as the accountant's differential concept applied to a single unit of output.

Differential costs can be either fixed or variable. To illustrate, assume that Nature Way Cosmetics, Inc., is thinking about changing its marketing method from distribution through retailers to distribution by door-to-door direct sale. Present costs and revenues are compared to projected costs and revenues in the following table:

	Retailer Distribution (present)	Direct Sale Distribution (proposed)	Differential Costs and Revenues
Revenues (Variable)	\$700,000	\$800,000	\$100,000
Cost of goods sold (Variable)	350,000	400,000	50,000
Advertising (Fixed)	80,000	45,000	(35,000)
Commissions (Variable)	0	40,000	40,000
Warehouse depreciation (Fixed)	50,000	80,000	30,000
Other expenses (Fixed)	60,000	60,000	0
Total	540,000	625,000	85,000
Net operating income	<u>\$160,000</u>	<u>\$175,000</u>	<u>\$ 15,000</u>

According to the above analysis, the differential revenue is \$100,000 and the differential costs total \$85,000, leaving a positive differential net operating income of \$15,000 under the proposed marketing plan.

The decision of whether Nature Way Cosmetics should stay with the present retail distribution or switch to door-to-door direct selling could be made on the basis of the net operating incomes of the two alternatives. As we see in the above analysis, the net operating income under the present distribution method is \$160,000, whereas the net operating income under door-to-door direct selling is estimated to be \$175,000. Therefore, the door-to-door direct distribution method is preferred, since it would result in \$15,000 higher net operating income. Note that we would have arrived at exactly the same conclusion by simply focusing on the differential revenues, differential costs, and differential net operating income, which also show a \$15,000 advantage for the direct selling method.

In general, only the differences between alternatives are relevant in decisions. Those items that are the same under all alternatives and that are not affected by the decision can be ignored. For example, in the Nature Way Cosmetics example above, the “Other expenses” category, which is \$60,000 under both alternatives, can be ignored, since it has no effect on the decision. If it were removed from the calculations, the door-to-door direct selling method would still be preferred by \$15,000. This is an extremely important principle in management accounting that we will return to in later chapters.

IN BUSINESS

USING THOSE EMPTY SEATS

Cancer patients who seek specialized or experimental treatments must often travel far from home. Flying on a commercial airline can be an expensive and grueling experience for these patients. Priscilla Blum noted that many corporate jets fly with empty seats and she wondered why these seats couldn't be used for cancer patients. Taking the initiative, she founded **Corporate Angel Network** (www.corpangelnetwork.org), an organization that arranges free flights on some 1,500 jets from over 500 companies. There are no tax breaks for putting cancer patients in empty corporate jet seats, but filling an empty seat with a cancer patient doesn't involve any significant incremental cost. Since its founding, Corporate Angel Network has provided over 16,000 free flights.

Sources: Scott McCormack, “Waste Not, Want Not,” *Forbes*, July 26, 1999, p. 118. Roger McCaffrey, “A True Tale of Angels in the Sky,” *The Wall Street Journal*, February, 2002, p. A14. Helen Gibbs, Communication Director, Corporate Angel Network, private communication.

Opportunity Cost

Opportunity cost is the potential benefit that is given up when one alternative is selected over another. To illustrate this important concept, consider the following examples:

Example 1 Vicki has a part-time job that pays \$200 per week while attending college. She would like to spend a week at the beach during spring break, and her employer has agreed to give her the time off, but without pay. The \$200 in lost wages would be an opportunity cost of taking the week off to be at the beach.

Example 2 Suppose that **Neiman Marcus** is considering investing a large sum of money in land that may be a site for a future store. Rather than invest the funds in land, the company could invest the funds in high-grade securities. If the land is acquired, the opportunity cost will be the investment income that could have been realized if the securities had been purchased instead.



Example 3 Steve is employed with a company that pays him a salary of \$30,000 per year. He is thinking about leaving the company and returning to school. Since returning to school would require that he give up his \$30,000 salary, the forgone salary would be an opportunity cost of seeking further education.

Opportunity costs are not usually entered in the accounting records of an organization, but they are costs that must be explicitly considered in every decision a manager makes. Virtually every alternative has some opportunity cost attached to it. In example 3 above, for instance, if Steve decides to stay at his job, the higher income that could be realized in future years as a result of returning to school is an opportunity cost.

Sunk Cost

A **sunk cost** is a cost *that has already been incurred* and that cannot be changed by any decision made now or in the future. Since sunk costs cannot be changed by any decision, they are not differential costs. Therefore, sunk costs can and should be ignored when making a decision.

To illustrate a sunk cost, assume that a company paid \$50,000 several years ago for a special-purpose machine. The machine was used to make a product that is now obsolete and is no longer being sold. Even though in hindsight the purchase of the machine may have been unwise, the \$50,000 cost has already been incurred and cannot be undone. And it would be folly to continue making the obsolete product in a misguided attempt to “re-cover” the original cost of the machine. In short, the \$50,000 originally paid for the machine is a sunk cost that should be ignored in decisions.

THE SUNK COST TRAP

Hal Arkes, a psychologist at Ohio University, asked 61 college students to assume they had mistakenly purchased tickets for both a \$50 and a \$100 ski trip for the same weekend. They could go on only one of the ski trips and would have to throw away the unused ticket. He further asked them to assume that they would actually have more fun on the \$50 trip. Most of the students reported that they would go on the less enjoyable \$100 trip. The larger cost mattered more to the students than having more fun. However, the sunk costs of the tickets should have been totally irrelevant in this decision. No matter which trip was selected, the actual total cost was \$150—the cost of both tickets. And since this cost does not differ between the alternatives, it should be ignored. Like these students, most people have a great deal of difficulty ignoring sunk costs when making decisions.

Source: John Gourville and Dilip Soman, “Pricing and the Psychology of Consumption,” *Harvard Business Review*, September 2002, pp. 92–93.

IN BUSINESS

Summary

In this chapter, we have looked at some of the ways in which managers classify costs. How the costs will be used—for preparing external reports, predicting cost behavior, assigning costs to cost objects, or decision making—will dictate how the costs are classified.

For purposes of valuing inventories and determining expenses for the balance sheet and income statement, costs are classified as either product costs or period costs. Product costs are assigned to inventories and are considered assets until the products are sold. At the point of sale, product costs become cost of goods sold on the income statement. In contrast, following the usual accrual practices, period costs are taken directly to the income statement as expenses in the period in which they are incurred.

In a merchandising company, product cost is whatever the company paid for its merchandise. For external financial reports in a manufacturing company, product costs consist of all manufacturing costs. In both kinds of companies, selling and administrative costs are considered to be period costs and are expensed as incurred.

For purposes of predicting cost behavior—how costs will react to changes in activity—managers commonly classify costs into two categories—variable and fixed. Variable costs, in total, are strictly proportional to activity. The variable cost per unit is constant. Fixed costs, in total,

remain at the same level for changes in activity that occur within the relevant range. The average fixed cost per unit decreases as the number of units increases.

For purposes of assigning costs to cost objects such as products or departments, costs are classified as direct or indirect. Direct costs can be conveniently traced to cost objects. Indirect costs cannot be conveniently traced to cost objects.

For purposes of making decisions, the concepts of differential cost and revenue, opportunity cost, and sunk cost are of vital importance. Differential costs and revenues are the costs and revenues that differ between alternatives. Opportunity cost is the benefit that is forgone when one alternative is selected over another. Sunk cost is a cost that occurred in the past and cannot be altered. Differential costs and opportunity costs should be carefully considered in decisions. Sunk costs are always irrelevant in decisions and should be ignored.

These various cost classifications are *different* ways of looking at costs. A particular cost, such as the cost of cheese in a taco served at **Taco Bell**, could be a manufacturing cost, a product cost, a variable cost, a direct cost, and a differential cost—all at the same time. Taco Bell can be considered to be a manufacturer of fast food. The cost of the cheese in a taco would be considered a manufacturing cost and, as such, it would be a product cost as well. In addition, the cost of cheese would be considered variable with respect to the number of tacos served and would be a direct cost of serving tacos. Finally, the cost of the cheese in a taco would be considered a differential cost of making and serving the taco.

Review Problem 1: Cost Terms

Many new cost terms have been introduced in this chapter. It will take you some time to learn what each term means and how to properly classify costs in an organization. Consider the following example: Porter Company manufactures furniture, including tables. Selected costs are given below:

1. The tables are made of wood that costs \$100 per table.
2. The tables are made by workers, at a wage cost of \$40 per table.
3. Workers making the tables are supervised by a factory supervisor who is paid \$38,000 per year.
4. Electrical costs are \$2 per machine-hour. Four machine-hours are required to produce a table.
5. The depreciation on the machines used to make the tables totals \$10,000 per year. The machines have no resale value and do not wear out through use.
6. The salary of the president of Porter Company is \$100,000 per year.
7. Porter Company spends \$250,000 per year to advertise its products.
8. Salespersons are paid a commission of \$30 for each table sold.
9. Instead of producing the tables, Porter Company could rent its factory space for \$50,000 per year.

Required:

Classify these costs according to the various cost terms used in the chapter. *Carefully study the classification of each cost.* If you don't understand why a particular cost is classified the way it is, reread the section of the chapter discussing the particular cost term. The terms *variable cost* and *fixed cost* refer to how costs behave with respect to the number of tables produced in a year.

Solution to Review Problem 1

	Variable Cost	Fixed Cost	Period (selling and administrative) Cost	Product Cost			Sunk Cost	Opportunity Cost
				Direct Materials	Direct Labor	Manufacturing Overhead		
1. Wood used in a table (\$100 per table)	X			X				
2. Labor cost to assemble a table (\$40 per table)	X				X			
3. Salary of the factory supervisor (\$38,000 per year)		X						

	Variable Cost	Fixed Cost	Period (selling and administrative) Cost	Product Cost			Sunk Cost	Opportunity Cost
				Direct Materials	Direct Labor	Manufacturing Overhead		
4. Cost of electricity to produce tables (\$2 per machine-hour)	X					X		
5. Depreciation of machines used to produce tables (\$10,000 per year)		X				X	X*	
6. Salary of the company president (\$100,000 per year)		X	X					
7. Advertising expense (\$250,000 per year)		X	X					
8. Commissions paid to salespersons (\$30 per table sold)	X		X					
9. Rental income forgone on factory space								X†

*This is a sunk cost, since the outlay for the equipment was made in a previous period.

†This is an opportunity cost, since it represents the potential benefit that is lost or sacrificed as a result of using the factory space to produce tables. Opportunity cost is a special category of cost that is not ordinarily recorded in an organization's accounting books. To avoid possible confusion with other costs, we will not attempt to classify this cost in any other way except as an opportunity cost.

Review Problem 2: Schedule of Cost of Goods Manufactured and Income Statement

The following information has been taken from the accounting records of Klear-Seal Company for last year:

Selling expenses	\$140,000
Raw materials inventory, January 1	\$90,000
Raw materials inventory, December 31	\$60,000
Utilities, factory	\$36,000
Direct labor cost	\$150,000
Depreciation, factory	\$162,000
Purchases of raw materials	\$750,000
Sales	\$2,500,000
Insurance, factory	\$40,000
Supplies, factory	\$15,000
Administrative expenses	\$270,000
Indirect labor	\$300,000
Maintenance, factory	\$87,000
Work in process inventory, January 1	\$180,000
Work in process inventory, December 31	\$100,000
Finished goods inventory, January 1	\$260,000
Finished goods inventory, December 31	\$210,000

Management wants these data organized in a better format so that financial statements can be prepared for the year.

Required:

1. Prepare a schedule of cost of goods manufactured as in Exhibit 2–4.
2. Compute the cost of goods sold.
3. Using data as needed from (1) and (2) above, prepare an income statement.

Solution to Review Problem 2

1.

KLEAR-SEAL COMPANY			
Schedule of Cost of Goods Manufactured			
For the Year Ended December 31			
Direct materials:			
Raw materials inventory, January 1	\$ 90,000		
Add: Purchases of raw materials	750,000		
Raw materials available for use	840,000		
Deduct: Raw materials inventory, December 31	60,000		
Raw materials used in production		\$ 780,000	
Direct labor		150,000	
Manufacturing overhead:			
Utilities, factory	36,000		
Depreciation, factory	162,000		
Insurance, factory	40,000		
Supplies, factory	15,000		
Indirect labor	300,000		
Maintenance, factory	87,000		
Total manufacturing overhead costs		640,000	
Total manufacturing costs		1,570,000	
Add: Work in process inventory, January 1		180,000	
		1,750,000	
Deduct: Work in process inventory, December 31		100,000	
Cost of goods manufactured		<u>\$1,650,000</u>	

2. The cost of goods sold would be computed as follows:

Finished goods inventory, January 1	\$ 260,000
Add: Cost of goods manufactured	1,650,000
Goods available for sale	1,910,000
Deduct: Finished goods inventory, December 31	210,000
Cost of goods sold	<u>\$1,700,000</u>

3.

KLEAR-SEAL COMPANY			
Income Statement			
For the Year Ended December 31			
Sales		\$2,500,000	
Less cost of goods sold (above)		1,700,000	
Gross margin		800,000	
Less selling and administrative expenses:			
Selling expenses	\$140,000		
Administrative expenses	270,000		
Total selling and administrative expenses		410,000	
Net operating income		<u>\$ 390,000</u>	

Glossary

- Administrative costs** All executive, organizational, and clerical costs associated with the general management of an organization rather than with manufacturing, marketing, or selling. (p. 38)
- Common costs** A common cost is incurred to support a number of cost objects but cannot be traced to them individually. For example, the wage cost of the pilot of a 747 airliner is a common cost of all of the passengers on the aircraft. Without the pilot, there would be no flight and no passengers. But no part of the pilot's wage is caused by any one passenger taking the flight. (p. 51)
- Conversion cost** Direct labor cost plus manufacturing overhead cost. (p. 37)
- Cost behavior** The way in which a cost reacts to changes in the level of activity. (p. 48)
- Cost object** Anything for which cost data are desired. Examples of possible cost objects are products, product lines, customers, jobs, and organizational subunits such as departments or divisions of a company. (p. 50)
- Cost of goods manufactured** The manufacturing costs associated with the goods that were finished during the period. (p. 43)
- Differential cost** A difference in cost between two alternatives. Also see *Incremental cost*. (p. 51)
- Differential revenue** The difference in revenue between two alternatives. (p. 51)
- Direct cost** A cost that can be easily and conveniently traced to a specified cost object. (p. 50)
- Direct labor** Factory labor costs that can be easily traced to individual units of product. Also called *touch labor*. (p. 37)
- Direct materials** Materials that become an integral part of a finished product and whose costs can be conveniently traced to it. (p. 37)
- Finished goods** Units of product that have been completed but not yet sold to customers. (p. 41)
- Fixed cost** A cost that remains constant, in total, regardless of changes in the level of activity within the relevant range. If a fixed cost is expressed on a per unit basis, it varies inversely with the level of activity. (p. 49)
- Incremental cost** An increase in cost between two alternatives. Also see *Differential cost*. (p. 51)
- Indirect cost** A cost that cannot be easily and conveniently traced to a specified cost object. (p. 50)
- Indirect labor** The labor costs of janitors, supervisors, materials handlers, and other factory workers that cannot be conveniently traced directly to particular products. (p. 37)
- Indirect materials** Small items of material such as glue and nails. These items may become an integral part of a finished product, but their costs cannot be easily or conveniently traced to it. (p. 37)
- Inventoriable costs** Synonym for *product costs*. (p. 39)
- Manufacturing overhead** All costs associated with manufacturing except direct materials and direct labor. (p. 37)
- Marketing or selling costs** All costs necessary to secure customer orders and get the finished product or service into the hands of the customer. (p. 38)
- Opportunity cost** The potential benefit that is given up when one alternative is selected over another. (p. 52)
- Period costs** Costs that are taken directly to the income statement as expenses in the period in which they are incurred or accrued. (p. 39)
- Prime cost** Direct materials cost plus direct labor cost. (p. 38)
- Product costs** All costs that are involved in the purchase or manufacture of goods. In the case of manufactured goods, these costs consist of direct materials, direct labor, and manufacturing overhead. Also see *Inventoriable costs*. (p. 38)
- Raw materials** Any materials that go into the final product. (p. 36)
- Relevant range** The range of activity within which assumptions about variable and fixed cost behavior are valid. (p. 49)
- Schedule of cost of goods manufactured** A schedule showing the direct materials, direct labor, and manufacturing overhead costs incurred for a period and that are assigned to Work in Process and completed goods. (p. 43)
- Sunk cost** Any cost that has already been incurred and that cannot be changed by any decision made now or in the future. (p. 53)
- Variable cost** A cost that varies, in total, in direct proportion to changes in the level of activity. A variable cost is constant per unit. (p. 48)

Appendix 2A: Further Classification of Labor Costs

LEARNING OBJECTIVE 8

Properly account for labor costs associated with idle time, overtime, and fringe benefits.

Idle time, overtime, and fringe benefits associated with direct labor workers pose particular problems in accounting for labor costs. Are these costs a part of the costs of direct labor or are they something else?

Idle Time

Machine breakdowns, materials shortages, power failures, and the like result in idle time. The labor costs incurred during idle time may be treated as a manufacturing overhead cost rather than as a direct labor cost. This approach spreads such costs over all the production of a period rather than just the jobs that happen to be in process when breakdowns or other disruptions occur.

To give an example of how the cost of idle time may be handled, assume that a press operator earns \$12 per hour. If the press operator is paid for a normal 40-hour workweek but is idle for 3 hours during a given week due to breakdowns, labor cost would be allocated as follows:

Direct labor (\$12 per hour \times 37 hours)	\$444
Manufacturing overhead (idle time: \$12 per hour \times 3 hours)	36
Total cost for the week	<u>\$480</u>

Overtime Premium

The overtime premium paid to *all* factory workers (direct labor as well as indirect labor) is usually considered to be part of manufacturing overhead and is not assigned to any particular order. At first glance this may seem strange, since overtime is always spent working on some particular order. Why not charge that order for the overtime cost? The reason is that it would be considered unfair and arbitrary to charge an overtime premium against a particular order simply because the order *happened* to fall on the tail end of the daily production schedule.

To illustrate, assume that two batches of goods, order A and order B, each take three hours to complete. The production run on order A is scheduled early in the day, but the production run on order B isn't scheduled until late in the afternoon. By the time the run on order B is completed, two hours of overtime have been logged. The necessity to work overtime was a result of the fact that total production exceeded the regular time available. Order B was no more responsible for the overtime than was order A. Therefore, managers feel that all production should share in the premium charge that resulted. This is considered a more equitable way of handling overtime premium in that it doesn't penalize one run simply because it happens to occur late in the day.

Let us again assume that a press operator in a plant earns \$12 per hour. She is paid time and a half for overtime (time in excess of 40 hours a week). During a given week, she works 45 hours and has no idle time. Her labor cost for the week would be allocated as follows:

Direct labor (\$12 per hour \times 45 hours)	\$540
Manufacturing overhead (overtime premium: \$6 per hour \times 5 hours)	30
Total cost for the week	<u>\$570</u>

Observe from this computation that only the overtime premium of \$6 per hour is charged to the overhead account—not the entire \$18 earned for each hour of overtime work (\$12 regular rate \times 1.5 = \$18).

Labor Fringe Benefits

Labor fringe benefits are made up of employment-related costs paid by the employer and include the costs of insurance programs, retirement plans, various supplemental unemployment benefits, and hospitalization plans. The employer also pays the employer's share of Social Security, Medicare, workers' compensation, federal employment tax, and state unemployment insurance. These costs often add up to as much as 30% to 40% of base pay.

Many companies treat all such costs as indirect labor by adding them to manufacturing overhead. Other companies treat the portion of fringe benefits that relates to direct labor as additional direct labor cost. This approach is conceptually superior, since the fringe benefits provided to direct labor workers clearly represent an added cost of their services.

Appendix 2B: Cost of Quality

A company may have a product with a high-quality design that uses high-quality components, but if the product is poorly assembled or has other defects, the company will have high warranty repair costs and dissatisfied customers. People who are dissatisfied with a product are unlikely to buy the product again. They are also likely to tell others about their bad experiences. One study found that “[c]ustomers who have bad experiences tell approximately 11 people about it.”¹ This is the worst possible sort of advertising. To prevent such problems, companies have been expending a great deal of effort to reduce defects. The objective is to have high *quality of conformance*.

Quality of Conformance

A product that meets or exceeds its design specifications and is free of defects that mar its appearance or degrade its performance is said to have high **quality of conformance**. Note that if an economy car is free of defects, it can have a quality of conformance that is just as high as a defect-free luxury car. The purchasers of economy cars cannot expect their cars to be as opulently equipped as luxury cars, but they can and do expect them to be free of defects.

Preventing, detecting, and dealing with defects causes costs that are called *quality costs* or the *cost of quality*. The use of the term *quality cost* is confusing to some people. It does not refer to costs such as using a higher-grade leather to make a wallet or using 14K gold instead of gold-plating in jewelry. Instead, the term **quality cost** refers to all of the costs that are incurred to prevent defects or that result from defects in products.

LEARNING OBJECTIVE 9

Identify the four types of quality costs and explain how they interact.

THE QUALITY BLACK BELT

General Electric (GE) has adopted the “Black Belt” quality control program developed by Motorola, Inc. Individuals selected to be Black Belts undergo intensive training for four months in statistical process control and other quality-control techniques. GE's CEO has made it clear to young managers that “they haven't much future at GE unless they are selected to be Black Belts. [With this program,] your customers are happy with you, you are not firefighting, you are not running in a reactive mode.” GE hopes to save \$7 to \$10 billion over ten years as a result of its Black Belt program.

Source: William M. Carley, “Charging Ahead: To Keep GE's Profits Rising, Welch Pushes Quality-Control Plan,” *The Wall Street Journal*, January 13, 1997, pp. A1 and A6.

IN BUSINESS

¹ Christopher W. L. Hart, James L. Heskett, and W. Earl Sasser, Jr., “The Profitable Art of Service Recovery,” *Harvard Business Review*, July–August 1990, p. 153.

EXHIBIT 2B–1
Typical Quality Costs

Prevention Costs	Internal Failure Costs
Systems development	Net cost of scrap
Quality engineering	Net cost of spoilage
Quality training	Rework labor and overhead
Quality circles	Reinspection of reworked products
Statistical process control activities	Retesting of reworked products
Supervision of prevention activities	Downtime caused by quality problems
Quality data gathering, analysis, and reporting	Disposal of defective products
Quality improvement projects	Analysis of the cause of defects in production
Technical support provided to suppliers	Re-entering data because of keying errors
Audits of the effectiveness of the quality system	Debugging software errors
Appraisal Costs	External Failure Costs
Test and inspection of incoming materials	Cost of field servicing and handling complaints
Test and inspection of in-process goods	Warranty repairs and replacements
Final product testing and inspection	Repairs and replacements beyond the warranty period
Supplies used in testing and inspection	Product recalls
Supervision of testing and inspection activities	Liability arising from defective products
Depreciation of test equipment	Returns and allowances arising from quality problems
Maintenance of test equipment	Lost sales arising from a reputation for poor quality
Plant utilities in the inspection area	
Field testing and appraisal at customer site	

Quality costs can be broken down into four broad groups. Two of these groups—known as *prevention costs* and *appraisal costs*—are incurred in an effort to keep defective products from falling into the hands of customers. The other two groups of costs—known as *internal failure costs* and *external failure costs*—are incurred because defects are produced despite efforts to prevent them. Examples of specific costs involved in each of these four groups are given in Exhibit 2B–1.

Several things should be noted about the quality costs shown in the exhibit. First, quality costs don't relate to just manufacturing; rather, they relate to all the activities in a company from initial research and development (R&D) through customer service. Second, the number of costs associated with quality is very large; total quality cost can be quite high unless management gives this area special attention. Finally, the costs in the four groupings are quite different. We will now look at each of these groupings more closely.

Prevention Costs

Generally, the most effective way to manage quality costs is to avoid having defects in the first place. It is much less costly to prevent a problem from ever happening than it is to find and correct the problem after it has occurred. **Prevention costs** support activities whose purpose is to reduce the number of defects. Companies employ many techniques to prevent defects including statistical process control, quality engineering, training, and a variety of tools from Total Quality Management.

Note from Exhibit 2B–1 that prevention costs include activities relating to quality circles and statistical process control. **Quality circles** consist of small groups of employees that meet on a regular basis to discuss ways to improve quality. Both management and workers are included in these circles. Quality circles are widely used and can be found in manufacturing companies, utilities, health care organizations, banks, and many other organizations.

Statistical process control is a technique that is used to detect whether a process is in or out of control. An out-of-control process results in defective units and may be caused by a miscalibrated machine or some other factor. In statistical process control, workers use charts to monitor the quality of units that pass through their workstations. With these charts, workers can quickly spot processes that are out of control and that are creating defects. Problems can be immediately corrected and further defects prevented rather than waiting for an inspector to catch the defects later.

Note also from the list of prevention costs in Exhibit 2B–1 that some companies provide technical support to their suppliers as a way of preventing defects. Particularly in just-in-time (JIT) systems, such support to suppliers is vital. In a JIT system, parts are delivered from suppliers just in time and in just the correct quantity to fill customer orders. There are no stockpiles of parts. If a defective part is received from a supplier, the part cannot be used and the order for the ultimate customer cannot be filled on time. Hence, every part received from a supplier must be free of defects. Consequently, companies that use JIT often require that their suppliers use sophisticated quality control programs such as statistical process control and that their suppliers certify that they will deliver parts and materials that are free of defects.

SIMPLE SOLUTIONS

Very simple and inexpensive procedures can be used to prevent defects. **Yamada Electric** had a persistent problem assembling a simple push-button switch. The switch has two buttons, an on button and an off button, with a small spring under each button. Assembly is very simple. A worker inserts the small springs in the device and then installs the buttons. However, the worker sometimes forgets to put in one of the springs. When the customer discovers such a defective switch in a shipment from Yamada, an inspector has to be sent to the customer's plant to check every switch in the shipment. After each such incident, workers are urged to be more careful, and for a while quality improves. But eventually, someone forgets to put in a spring, and Yamada gets into trouble with the customer again. This chronic problem was very embarrassing to Yamada.

Shigeo Shingo, an expert on quality control, suggested a very simple solution. A small dish was placed next to the assembly station. At the beginning of each operation, two of the small springs are taken out of a parts box containing hundreds of springs and placed in the dish. The worker then assembles the switch. If a spring remains on the dish after assembling the switch, the worker immediately realizes a spring has been left out, and the switch is reassembled. This simple change in procedures completely eliminated the problem.

Source: Shigeo Shingo and Dr. Alan Robinson, editor-in-chief, *Modern Approaches to Manufacturing Improvement: The Shingo System*, (Cambridge, MA: Productivity Press), pp. 214–216.

IN BUSINESS

Appraisal Costs

Any defective parts and products should be caught as early as possible in the production process. **Appraisal costs**, which are sometimes called *inspection costs*, are incurred to identify defective products *before* the products are shipped to customers. Unfortunately, performing appraisal activities doesn't keep defects from happening again, and most managers now realize that maintaining an army of inspectors is a costly (and ineffective) approach to quality control.

Professor John K. Shank of Dartmouth College has aptly stated, "The old-style approach was to say, 'We've got great quality. We have 40 quality control inspectors in the factory.' Then somebody realized that if you need 40 inspectors, it must be a lousy factory. So now the trick is to run a factory without any quality control inspectors; each employee is his or her own quality control person."²

² Robert W. Casey, "The Changing World of the CEO," *PPM World* 24, no. 2, p. 31.

Employees are increasingly being asked to be responsible for their own quality control. This approach, along with designing products to be easy to manufacture properly, allows quality to be built into products rather than relying on inspection to get the defects out.

Internal Failure Costs

Failure costs are incurred when a product fails to conform to its design specifications. Failure costs can be either internal or external. **Internal failure costs** result from identifying defects before they are shipped to customers. These costs include scrap, rejected products, reworking of defective units, and downtime caused by quality problems. In some companies, as little as 10% of the company's products make it through the production process without rework of some kind. Of course, the more effective a company's appraisal activities, the greater the chance of catching defects internally and the greater the level of internal failure costs. This is the price that is paid to avoid incurring external failure costs, which can be devastating.

External Failure Costs

External failure costs result when a defective product is delivered to a customer. As shown in Exhibit 2B–1, external failure costs include warranty repairs and replacements, product recalls, liability arising from legal action against a company, and lost sales arising from a reputation for poor quality. Such costs can decimate profits.

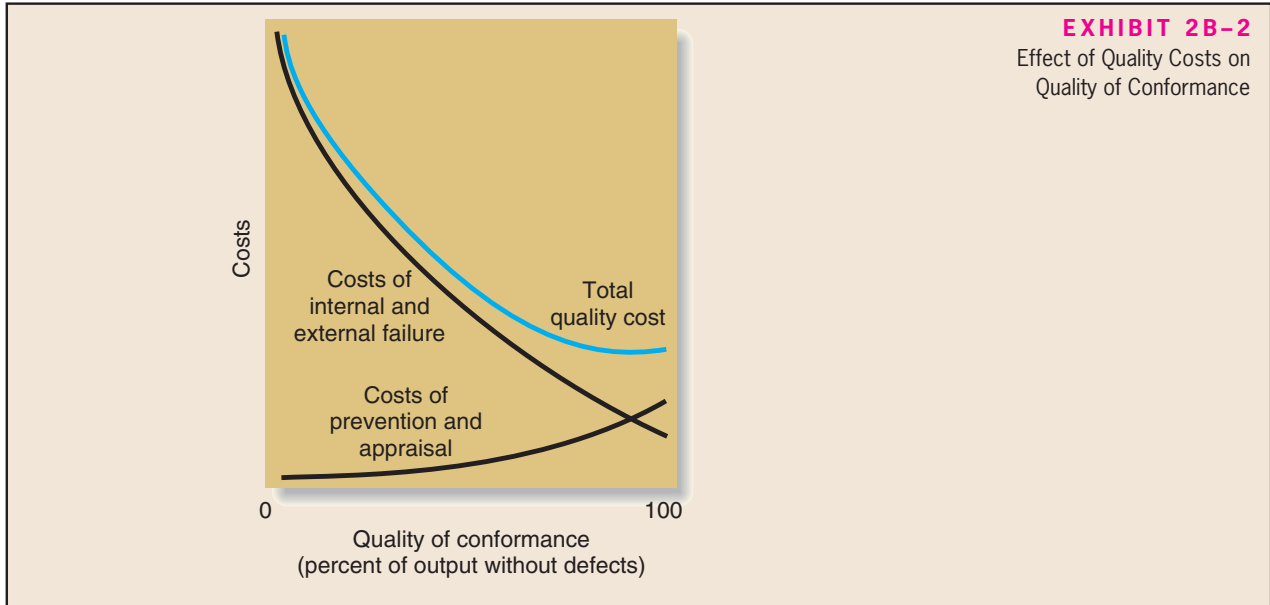
In the past, some managers have taken the attitude, “Let’s go ahead and ship everything to customers, and we’ll take care of any problems under the warranty.” This attitude generally results in high external failure costs, customer ill will, and declining market share and profits.

Distribution of Quality Costs

A company's total quality cost is likely to be very high unless management gives this area special attention. Quality costs for U.S. companies range between 10% and 20% of total sales, whereas experts say that these costs should be more in the 2% to 4% range. How does a company reduce its total quality cost? The answer lies in how the quality costs are distributed. Refer to the graph in Exhibit 2B–2, which shows total quality costs as a function of the quality of conformance.

The graph shows that when the quality of conformance is low, total quality cost is high and that most of this cost consists of costs of internal and external failure. A low quality of conformance means that a high percentage of units are defective and hence the company must incur high failure costs. However, as a company spends more and more on prevention and appraisal, the percentage of defective units drops (the percentage of defect-free units increases). This results in lower internal and external failure costs. Ordinarily, total quality cost drops rapidly as the quality of conformance increases. Thus, a company can reduce its total quality cost by focusing its efforts on prevention and appraisal. The cost savings from reduced defects usually swamp the costs of the additional prevention and appraisal efforts.

The graph in Exhibit 2B–2 has been drawn so that the total quality cost is minimized when the quality of conformance is less than 100%. However, some experts contend that the total quality cost is not minimized until the quality of conformance is 100% and there are no defects. Indeed, many companies have found that the total quality costs seem to keep dropping even when the quality of conformance approaches 100% and defect rates get as low as 1 in a million units. Others argue that total quality cost eventually increases as the quality of conformance increases. However, in most companies this does not seem to happen until the quality of conformance is very close to 100% and defect rates are very close to zero.



As a company's quality program becomes more refined and as its failure costs begin to fall, prevention activities usually become more effective than appraisal activities. Appraisal can only find defects, whereas prevention can eliminate them. The best way to prevent defects from happening is to design processes that reduce the likelihood of defects and to continually monitor processes using statistical process control methods.

Quality Cost Reports

As an initial step in quality improvement programs, companies often construct a *quality cost report* that provides an estimate of the financial consequences of the company's current level of defects. A **quality cost report** details the prevention costs, appraisal costs, and costs of internal and external failures that arise from the company's current quality control efforts. Managers are often shocked by the magnitude of these costs. A typical quality cost report is shown in Exhibit 2B-3 (page 64).

Several things should be noted from the data in the exhibit. First, Ventura Company's quality costs are poorly distributed in both years, with most of the costs being traceable to either internal failure or external failure. The external failure costs are particularly high in Year 1 in comparison to other costs.

Second, note that the company increased its spending on prevention and appraisal activities in Year 2. As a result, internal failure costs went up in that year (from \$2 million in Year 1 to \$3 million in Year 2), but external failure costs dropped sharply (from \$5.15 million in Year 1 to only \$2 million in Year 2). Because of the increase in appraisal activity in Year 2, more defects were caught inside the company before they were shipped to customers. This resulted in more cost for scrap, rework, and so forth, but saved huge amounts in warranty repairs, warranty replacements, and other external failure costs.

Third, note that as a result of greater emphasis on prevention and appraisal, *total* quality cost decreased in Year 2. As continued emphasis is placed on prevention and appraisal in future years, total quality cost should continue to decrease. That is, future

LEARNING OBJECTIVE 10

Prepare and interpret a quality cost report.

EXHIBIT 2B-3

Quality Cost Report

VENTURA COMPANY Quality Cost Report For Years 1 and 2				
	Year 2		Year 1	
	Amount	Percent*	Amount	Percent*
Prevention costs:				
Systems development	\$ 400,000	0.80%	\$ 270,000	0.54%
Quality training	210,000	0.42%	130,000	0.26%
Supervision of prevention activities	70,000	0.14%	40,000	0.08%
Quality improvement projects	320,000	0.64%	210,000	0.42%
Total prevention cost	<u>1,000,000</u>	<u>2.00%</u>	<u>650,000</u>	<u>1.30%</u>
Appraisal costs:				
Inspection	600,000	1.20%	560,000	1.12%
Reliability testing	580,000	1.16%	420,000	0.84%
Supervision of testing and inspection	120,000	0.24%	80,000	0.16%
Depreciation of test equipment	200,000	0.40%	140,000	0.28%
Total appraisal cost	<u>1,500,000</u>	<u>3.00%</u>	<u>1,200,000</u>	<u>2.40%</u>
Internal failure costs:				
Net cost of scrap	900,000	1.80%	750,000	1.50%
Rework labor and overhead	1,430,000	2.86%	810,000	1.62%
Downtime due to defects in quality	170,000	0.34%	100,000	0.20%
Disposal of defective products	500,000	1.00%	340,000	0.68%
Total internal failure cost	<u>3,000,000</u>	<u>6.00%</u>	<u>2,000,000</u>	<u>4.00%</u>
External failure costs:				
Warranty repairs	400,000	0.80%	900,000	1.80%
Warranty replacements	870,000	1.74%	2,300,000	4.60%
Allowances	130,000	0.26%	630,000	1.26%
Cost of field servicing	600,000	1.20%	1,320,000	2.64%
Total external failure cost	<u>2,000,000</u>	<u>4.00%</u>	<u>5,150,000</u>	<u>10.30%</u>
Total quality cost	<u>\$7,500,000</u>	<u>15.00%</u>	<u>\$9,000,000</u>	<u>18.00%</u>

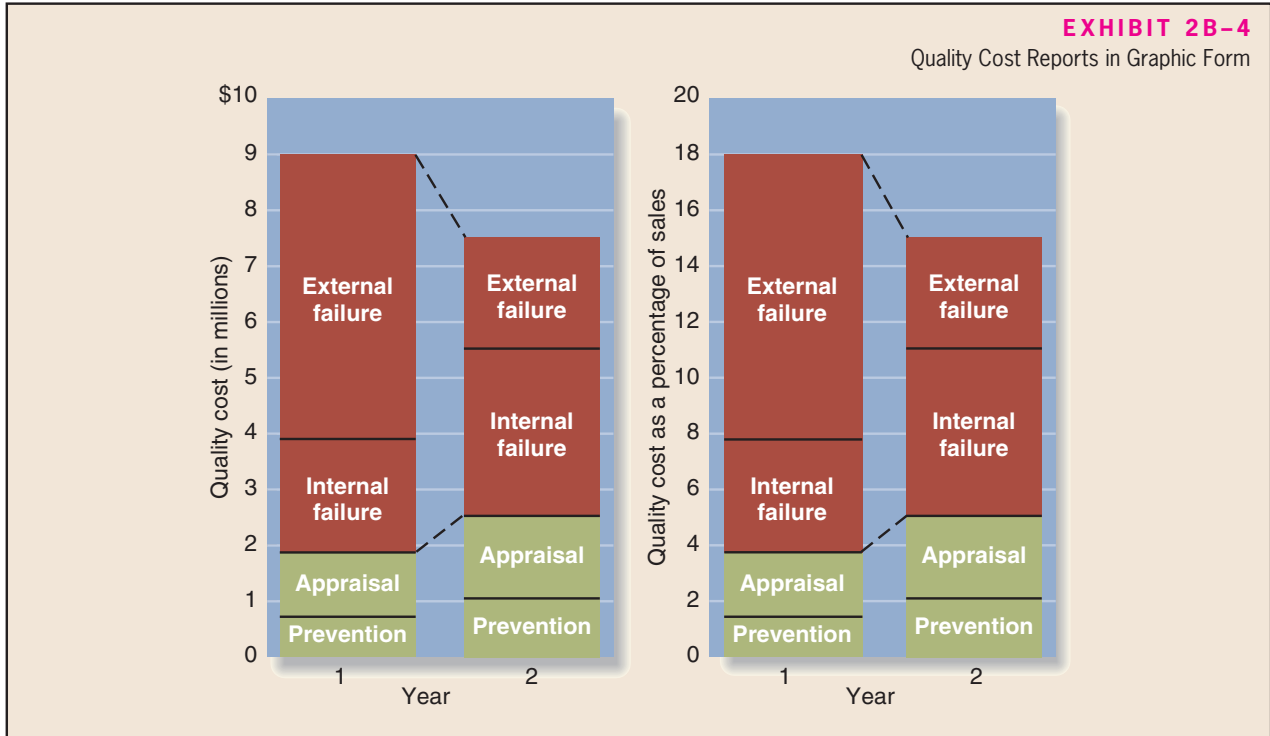
*As a percentage of total sales. In each year sales totaled \$50,000,000.

increases in prevention and appraisal costs should be more than offset by decreases in failure costs. Moreover, appraisal costs should also decrease as more effort is placed in prevention.

IN BUSINESS**FIGHTING BUGS**

Software bugs can have catastrophic consequences. Companies that sell products that rely on software know this, and fighting these particular defects can consume enormous resources. For example, it was once estimated that the cost of quality (i.e., the costs of preventing, detecting, and fixing bugs) at **Raytheon Electronics Systems** was almost 60% of the total cost of producing software for its products. That percentage has fallen to 15% due to new software management tools designed to prevent bugs from being written into the computer code in the first place.

Source: Otis Port, "Will Bugs Eat Up the U.S. Lead in Software?" *Business Week*, December 6, 1999, p. 118.



EXTERNAL FAILURE; IT'S WORSE THAN YOU THINK

Venky Nagar and Madhav Rajan investigated quality costs at 11 manufacturing plants of a large U.S. company. They found that total quality costs were about 7% of sales. Moreover, they found that external failure costs as usually measured grossly understate the true impact of external failures on the company's profits. In addition to the obvious costs of repairing defective products that are under warranty, defective products sold to customers negatively impact the company's reputation and hence future sales. Statistical analysis of the data from the manufacturing plants indicated that a \$1 increase in external failure costs such as warranty repairs was associated with a \$26 decrease in cumulative future sales and a \$10.40 cumulative decrease in future profits.

Source: Venky Nagar and Madhav V. Rajan, "The Revenue Implications of Financial and Operational Measures of Product Quality," *The Accounting Review* 76, no. 4, October 2001, pp. 495–513.

IN BUSINESS

Quality Cost Reports in Graphic Form

As a supplement to the quality cost report shown in Exhibit 2B–3, companies frequently prepare quality cost information in graphic form. Graphic presentations include pie charts, bar graphs, trend lines, and so forth. The data for Ventura Company from Exhibit 2B–3 are presented in bar graph form in Exhibit 2B–4.

The first bar graph in Exhibit 2B–4 is scaled in terms of dollars of quality cost, and the second is scaled in terms of quality cost as a percentage of sales. In both graphs, the data are "stacked" upward. That is, appraisal costs are stacked on top of prevention costs, internal failure costs are stacked on top of the sum of prevention costs plus appraisal costs, and so forth. The percentage figures in the second graph show that total quality cost equals 18% of sales in Year 1 and 15% of sales in Year 2, the same as reported earlier in Exhibit 2B–3.

Data in graphic form help managers to see trends more clearly and to see the magnitude of the various costs in relation to each other. Such graphs are easily prepared using computer graphics and spreadsheet applications.

Uses of Quality Cost Information

A quality cost report has several uses. First, quality cost information helps managers see the financial significance of defects. Managers usually are not aware of the magnitude of their quality costs because these costs cut across departmental lines and are not normally tracked and accumulated by the cost system. Thus, when first presented with a quality cost report, managers often are surprised by the amount of cost attributable to poor quality.

Second, quality cost information helps managers identify the relative importance of the quality problems faced by their companies. For example, the quality cost report may show that scrap is a major quality problem or that the company is incurring huge warranty costs. With this information, managers have a better idea of where to focus their efforts.

Third, quality cost information helps managers see whether their quality costs are poorly distributed. In general, quality costs should be distributed more toward prevention and appraisal activities and less toward failures.

Counterbalancing these uses, three limitations of quality cost information should be recognized. First, simply measuring and reporting quality costs does not solve quality problems. Problems can be solved only by taking action. Second, results usually lag behind quality improvement programs. Initially, total quality cost may even increase as quality control systems are designed and installed. Decreases in quality costs may not begin to occur until the quality program has been in effect for a year or more. And third, the most important quality cost, lost sales arising from customer ill will, is usually omitted from the quality cost report because it is difficult to estimate.

Typically, during the initial years of a quality improvement program, the benefits of compiling a quality cost report outweigh the costs and limitations of the reports. As managers gain experience in balancing prevention and appraisal activities, the need for quality cost reports often diminishes.

IN BUSINESS

TRADING OFF QUALITY COSTS IN INDIA

The quality costs at tanneries operated by two leather companies in India are quite different. Company X spends about 5% of its quality costs on prevention, whereas Company Y spends over 14% of its quality costs on prevention. Consequently, the total quality cost at Company X is about 10% higher than at Company Y. By spending more on prevention, Company X should be able to lower its total quality cost.

Source: P. K. Bandyopadhyay and K. K. Ghosh, "An Indepth Analysis in Quality Costing—A Case," *The Management Accountant (India)*, March 1999, pp. 167–171.

International Aspects of Quality

Many of the tools used in quality management today were developed in Japan after World War II. In statistical process control, Japanese companies borrowed heavily from the work of W. Edwards Deming. However, Japanese companies are largely responsible for quality circles, JIT, the idea that quality is everyone's responsibility, and the emphasis on prevention rather than on inspection.

In the 1980s, quality reemerged as a pivotal factor in the market. Many companies now find that it is impossible to effectively compete without a very strong quality program in place. This is particularly true of companies that wish to compete in the European market.

The ISO 9000 Standards

The International Organization for Standardization (ISO), based in Geneva, Switzerland, has established quality control guidelines known as the **ISO 9000 standards**. Many companies and organizations in Europe will buy only from ISO 9000-certified suppliers. This means that the suppliers must demonstrate to a certifying agency that:

1. A quality control system is in use, and the system clearly defines an expected level of quality.
2. The system is fully operational and is backed up with detailed documentation of quality control procedures.
3. The intended level of quality is being achieved on a sustained, consistent basis.

The key to receiving certification under the ISO 9000 standards is documentation. It's one thing for a company to say that it has a quality control system in operation, but it's quite a different thing to be able to document the steps in that system. Under ISO 9000, this documentation must be so detailed and precise that if all the employees in a company were suddenly replaced, the new employees could use the documentation to make the product exactly as it was made by the old employees. Even companies with good quality control systems find that it takes up to two years of painstaking work to develop this detailed documentation. But companies often find that compiling this documentation results in improvements in their quality systems.

The ISO 9000 standards have become an international measure of quality. Although the standards were developed to control the quality of goods sold in European countries, they have become widely accepted elsewhere as well. Companies in the United States that export to Europe often expect their own suppliers to comply with the ISO 9000 standards, since these exporters must document the quality of the materials going into their products as part of their own ISO 9000 certification.

The ISO program for certification of quality management programs is not limited to manufacturing companies. The American Institute of Certified Public Accountants was the first professional membership organization in the United States to win recognition under an ISO certification program.³

Summary

Defects cause costs, which can be classified into prevention costs, appraisal costs, internal failure costs, and external failure costs. Prevention costs are incurred to keep defects from happening. Appraisal costs are incurred to ensure that defective products, once made, are not shipped to customers. Internal failure costs are incurred as a consequence of detecting defective products before they are shipped to customers. External failure costs are the consequences (in terms of repairs, servicing, and lost future business) of delivering defective products to customers. Most experts agree that management effort should be focused on preventing defects. Small investments in prevention can lead to dramatic reductions in appraisal costs and costs of internal and external failure.

Quality costs are summarized on a quality cost report. This report shows the type of quality costs being incurred and their significance and trends. The report helps managers understand the importance of quality costs, spot problem areas, and assess the way in which the quality costs are distributed.

³ The CPA Letter, May 1998, p. 1.

Glossary

- Appraisal costs** Costs that are incurred to identify defective products before the products are shipped to customers. (p. 61)
- External failure costs** Costs that are incurred when a product or service that is defective is delivered to a customer. (p. 62)
- Internal failure costs** Costs that are incurred as a result of identifying defective products before they are shipped to customers. (p. 62)
- ISO 9000 standards** Quality control requirements issued by the International Organization for Standardization that relate to products sold in European countries. (p. 67)
- Prevention costs** Costs that are incurred to keep defects from occurring. (p. 60)
- Quality circles** Small groups of employees that meet on a regular basis to discuss ways of improving quality. (p. 60)
- Quality cost** Costs that are incurred to prevent defective products from falling into the hands of customers or that are incurred as a result of defective units. (p. 59)
- Quality cost report** A report that details prevention costs, appraisal costs, and the costs of internal and external failures. (p. 63)
- Quality of conformance** The degree to which a product or service meets or exceeds its design specifications and is free of defects or other problems that mar its appearance or degrade its performance. (p. 59)
- Statistical process control** A charting technique used to monitor the quality of work being done in a workstation for the purpose of immediately correcting any problems. (p. 61)

Questions

- 2–1 What are the three major elements of product costs in a manufacturing company?
- 2–2 Distinguish between the following: (a) direct materials, (b) indirect materials, (c) direct labor, (d) indirect labor, and (e) manufacturing overhead.
- 2–3 Explain the difference between a product cost and a period cost.
- 2–4 Describe how the income statement of a manufacturing company differs from the income statement of a merchandising company.
- 2–5 Of what value is the schedule of cost of goods manufactured? How does it tie into the income statement?
- 2–6 Describe how the inventory accounts of a manufacturing company differ from the inventory account of a merchandising company.
- 2–7 Why are product costs sometimes called inventoriable costs? Describe the flow of such costs in a manufacturing company from the point of incurrence until they finally become expenses on the income statement.
- 2–8 Is it possible for costs such as salaries or depreciation to end up as assets on the balance sheet? Explain.
- 2–9 What is meant by the term *cost behavior*?
- 2–10 “A variable cost is a cost that varies per unit of product, whereas a fixed cost is constant per unit of product.” Do you agree? Explain.
- 2–11 How do fixed costs create difficulties in costing units of product?
- 2–12 Why is manufacturing overhead considered an indirect cost of a unit of product?
- 2–13 Define the following terms: differential cost, opportunity cost, and sunk cost.
- 2–14 Only variable costs can be differential costs. Do you agree? Explain.
- 2–15 (Appendix 2A) Mary Adams is employed by Acme Company. Last week she worked 34 hours assembling one of the company’s products and was idle 6 hours due to material shortages. Acme’s employees are engaged at their workstations for a normal 40-hour week. Ms. Adams is paid \$15 per hour. Allocate her earnings between direct labor cost and manufacturing overhead cost.
- 2–16 (Appendix 2A) John Olsen operates a stamping machine on the assembly line of Drake Manufacturing Company. Last week Mr. Olsen worked 45 hours. His basic wage rate is \$14 per hour, with time and a half for overtime (time worked in excess of 40 hours per week). Allocate Mr. Olsen’s wages for the week between direct labor cost and manufacturing overhead cost.

- 2–17 (Appendix 2B) Costs associated with the quality of conformance can be broken down into four broad groups. What are these four groups and how do they differ?
- 2–18 (Appendix 2B) In their efforts to reduce the total cost of quality, should companies generally focus on decreasing prevention costs and appraisal costs?
- 2–19 (Appendix 2B) What is probably the most effective way to reduce a company's total quality costs?
- 2–20 (Appendix 2B) What are the main uses of quality cost reports?
- 2–21 (Appendix 2B) Why are managers often unaware of the magnitude of quality costs?



Exercises

EXERCISE 2–1 Classifying Manufacturing Costs [LO1]

The PC Works assembles custom computers from components supplied by various manufacturers. The company is very small and its assembly shop and retail sales store are housed in a single facility in a Redmond, Washington, industrial park. Listed below are some of the costs that are incurred at the company.

Required:

For each cost, indicate whether it would most likely be classified as direct labor, direct materials, manufacturing overhead, marketing and selling, or an administrative cost.

1. The cost of a hard drive installed in a computer.
2. The cost of advertising in the *Puget Sound Computer User* newspaper.
3. The wages of employees who assemble computers from components.
4. Sales commissions paid to the company's salespeople.
5. The wages of the assembly shop's supervisor.
6. The wages of the company's accountant.
7. Depreciation on equipment used to test assembled computers before release to customers.
8. Rent on the facility in the industrial park.

EXERCISE 2–2 Classification of Costs as Period or Product Cost [LO2]

A product cost is also known as an inventoriable cost. Classify the following costs as either product (inventoriable) costs or period (noninventoriable) costs in a manufacturing company:

1. Depreciation on salespersons' cars.
2. Rent on equipment used in the factory.
3. Lubricants used for maintenance of machines.
4. Salaries of finished goods warehouse personnel.
5. Soap and paper towels used by factory workers at the end of a shift.
6. Factory supervisors' salaries.
7. Heat, water, and power consumed in the factory.
8. Materials used for boxing products for shipment overseas. (Units are not normally boxed.)
9. Advertising costs.
10. Workers' compensation insurance on factory employees.
11. Depreciation on chairs and tables in the factory lunchroom.
12. The wages of the receptionist in the administrative offices.
13. Lease cost of the corporate jet used by the company's executives.
14. Rent on rooms at a Florida resort for holding of the annual sales conference.
15. Attractively designed box for packaging the company's product—breakfast cereal.

EXERCISE 2–3 Constructing an Income Statement [LO3]

Last month CyberGames, a computer game retailer, had total sales of \$1,450,000, selling expenses of \$210,000, and administrative expenses of \$180,000. The company had beginning merchandise inventory of \$240,000, purchased additional merchandise inventory for \$950,000, and had ending merchandise inventory of \$170,000.

Required:

Prepare an income statement for the company for the month.



EXERCISE 2–4 Prepare a Schedule of Cost of Goods Manufactured [LO4]

Lompac Products manufactures a variety of products in its factory. Data for the most recent month's operations appear below:

Beginning raw materials inventory	\$ 60,000
Purchases of raw materials	\$690,000
Ending raw materials inventory	\$ 45,000
Direct labor	\$135,000
Manufacturing overhead	\$370,000
Beginning work in process inventory	\$120,000
Ending work in process inventory	\$130,000

Required:

Prepare a schedule of cost of goods manufactured for the company for the month.

**EXERCISE 2-5 Classification of Costs as Fixed or Variable [LO5]**

Below are a number of costs that are incurred in a variety of organizations.

Required:

Classify each cost as being variable or fixed with respect to the number of units of product or services sold by the organization by placing an X in the appropriate column.

Cost Item	Cost Behavior	
	Variable	Fixed
1. X-ray film used in the radiology lab at Virginia Mason Hospital in Seattle.		
2. The costs of advertising a Madonna rock concert in New York City.		
3. Rental cost of a McDonald's restaurant building in Hong Kong.		
4. The electrical costs of running a roller coaster at Magic Mountain.		
5. Property taxes on your local cinema.		
6. Commissions paid to salespersons at Nordstrom.		
7. Property insurance on a Coca-Cola bottling plant.		
8. The costs of synthetic materials used to make Nike running shoes.		
9. The costs of shipping Panasonic televisions to retail stores.		
10. The cost of leasing an ultra-scan diagnostic machine at the American Hospital in Paris.		

**EXERCISE 2-6 Identifying Direct and Indirect Costs [LO6]**

Northwest Hospital is a full-service hospital that provides everything from major surgery and emergency room care to outpatient clinics.

Required:

For each cost incurred at Northwest Hospital, indicate whether it would most likely be a direct cost or an indirect cost of the specified cost object by placing an X in the appropriate column.

Cost	Cost object	Direct Cost	Indirect Cost
Ex. Catered food served to patients	A particular patient	X	
1. The wages of pediatric nurses	The pediatric department		
2. Prescription drugs	A particular patient		
3. Heating the hospital	The pediatric department		
4. The salary of the head of pediatrics	The pediatric department		
5. The salary of the head of pediatrics	A particular pediatric patient		
6. Hospital chaplain's salary	A particular patient		
7. Lab tests by outside contractor	A particular patient		
8. Lab tests by outside contractor	A particular department		

**EXERCISE 2-7 Differential, Opportunity, and Sunk Costs [LO7]**

Northwest Hospital is a full-service hospital that provides everything from major surgery and emergency room care to outpatient clinics. The hospital's Radiology Department is considering replacing an old inefficient X-ray machine with a state-of-the-art digital X-ray machine. The new machine would provide higher quality X-rays in less time and at a lower cost per X-ray. It would

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also require less power and would use a color laser printer to produce easily readable X-ray images. Instead of investing the funds in the new X-ray machine, the Laboratory Department is lobbying the hospital's management to buy a new DNA analyzer.

Required:

For each of the items below, indicate by placing an *X* in the appropriate column whether it should be considered a differential cost, an opportunity cost, or a sunk cost in the decision to replace the old X-ray machine with a new machine. If none of the categories apply for a particular item, leave all columns blank.

Item	Differential Cost	Opportunity Cost	Sunk Cost
Ex. Cost of X-ray film used in the old machine	X		
1. Cost of the old X-ray machine			
2. The salary of the head of the Radiology Department . . .			
3. The salary of the head of the Pediatrics Department . . .			
4. Cost of the new color laser printer			
5. Rent on the space occupied by Radiology			
6. The cost of maintaining the old machine			
7. Benefits from a new DNA analyzer			
8. Cost of electricity to run the X-ray machines			

EXERCISE 2–8 (Appendix 2A) Classification of Overtime Cost [LO8]

Several days ago you took your TV set into a shop to have some repair work done. When you later picked up the set, the bill showed a \$75 charge for labor. This charge represented two hours of service time—\$30 for the first hour and \$45 for the second.

When questioned about the difference in hourly rates, the shop manager explained that work on your set was started at 4 o'clock in the afternoon. By the time work was completed two hours later at 6 o'clock, an hour of overtime had been put in by the repair technician. The second hour therefore contained a charge for an "overtime premium," since the company had to pay the repair technician time and a half for any work in excess of eight hours per day. The shop manager further explained that the shop was working overtime to "catch up a little" on its backlog of repairs, but it still needed to maintain a "decent" profit margin on the technicians' time.

Required:

- Do you agree with the shop's computation of the service charge on your job?
- Assume that the shop pays its technicians \$14 per hour for the first eight hours worked in a day and \$21 per hour for any additional time worked in a day. Prepare computations to show how the cost of the repair technician's time for the day (nine hours) should be allocated between direct labor cost and general overhead cost on the shop's books.
- Under what circumstances might the shop be justified in charging an overtime premium for repair work on your set?

EXERCISE 2–9 (Appendix 2B) Classification of Quality Costs [LO9]

Listed below are a number of costs that are incurred in connection with a company's quality control system.

- | | |
|---------------------------------|--|
| a. Product testing. | k. Net cost of scrap. |
| b. Product recalls. | l. Depreciation of test equipment. |
| c. Rework labor and overhead. | m. Returns and allowances arising from poor quality. |
| d. Quality circles. | n. Disposal of defective products. |
| e. Downtime caused by defects. | o. Technical support to suppliers. |
| f. Cost of field servicing. | p. Systems development. |
| g. Inspection of goods. | q. Warranty replacements. |
| h. Quality engineering. | r. Field testing at customer site. |
| i. Warranty repairs. | s. Product design. |
| j. Statistical process control. | |

Required:

- Classify each of the costs above into one of the following categories: prevention cost, appraisal cost, internal failure cost, or external failure cost.
- Which of the costs in (1) above are incurred in an effort to keep poor quality of conformance from occurring? Which of the costs in (1) above are incurred because poor quality of conformance has occurred?



EXERCISE 2–10 Preparation of Schedule of Costs of Goods Manufactured and Cost of Goods Sold
[LO1, LO3, LO4]

The following cost and inventory data are taken from the accounting records of Mason Company for the year just completed:

Costs incurred:	
Direct labor cost	\$70,000
Purchases of raw materials	\$118,000
Indirect labor	\$30,000
Maintenance, factory equipment	\$6,000
Advertising expense	\$90,000
Insurance, factory equipment	\$800
Sales salaries	\$50,000
Rent, factory facilities	\$20,000
Supplies	\$4,200
Depreciation, office equipment	\$3,000
Depreciation, factory equipment	\$19,000

	Beginning of the Year	End of the Year
Inventories:		
Raw materials	\$7,000	\$15,000
Work in process	\$10,000	\$5,000
Finished goods	\$20,000	\$35,000

Required:

1. Prepare a schedule of cost of goods manufactured in good form.
2. Prepare the cost of goods sold section of Mason Company's income statement for the year.

EXERCISE 2–11 Classification of Costs as Variable or Fixed and as Selling and Administrative or Product
[LO2, LO5]

Below are listed various costs that are found in organizations.

1. Hamburger buns in a Wendy's outlet.
2. Advertising by a dental office.
3. Apples processed and canned by Del Monte.
4. Shipping canned apples from a Del Monte plant to customers.
5. Insurance on a Bausch & Lomb factory producing contact lenses.
6. Insurance on IBM's corporate headquarters.
7. Salary of a supervisor overseeing production of printers at Hewlett-Packard.
8. Commissions paid to Encyclopedia Britannica salespersons.
9. Depreciation of factory lunchroom facilities at a General Electric plant.
10. Steering wheels installed in BMWs.

Required:

Classify each cost as being either variable or fixed with respect to the number of units produced and sold. Also classify each cost as either a selling and administrative cost or a product cost. Prepare your answer sheet as shown below. Place an X in the appropriate columns to show the proper classification of each cost.

Cost Item	Cost Behavior		Selling and Administrative Cost	Product Cost
	Variable	Fixed		

EXERCISE 2–12 Product Cost Flows; Product versus Period Costs
[LO2, LO3]

The Devon Motor Company produces motorcycles. During April, the company purchased 8,000 batteries at a cost of \$10 per battery. Devon withdrew 7,600 batteries from the storeroom during the month. Of these, 100 were used to replace batteries in motorcycles used by the company's traveling sales staff. The remaining 7,500 batteries withdrawn from the storeroom were placed in motorcycles being produced by the company. Of the motorcycles in production during April, 90% were completed and transferred from work in process to finished goods. Of the motorcycles completed during the month, 30% were unsold at April 30.

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There were no inventories of any type on April 1.

Required:

- Determine the cost of batteries that would appear in each of the following accounts at April 30:
 - Raw Materials.
 - Work in Process.
 - Finished Goods.
 - Cost of Goods Sold.
 - Selling Expense.
- Specify whether each of the above accounts would appear on the balance sheet or on the income statement at April 30.

EXERCISE 2-13 (Appendix 2A) Classification of Labor Costs [LO8]

Paul Clark is employed by Aerotech Products and assembles a component part for one of the company's product lines. He is paid \$14 per hour for regular time and time and a half (i.e., \$21 per hour) for all work in excess of 40 hours per week.



Required:

- Assume that during a given week Paul is idle for five hours due to machine breakdowns and that he is idle for four more hours due to material shortages. No overtime is recorded for the week. Allocate Paul's wages for the week between direct labor cost and manufacturing overhead cost.
- Assume that during the following week Paul works a total of 48 hours. He has no idle time for the week. Allocate Paul's wages for the week between direct labor cost and manufacturing overhead cost.
- Paul's company provides an attractive package of fringe benefits for its employees. This package includes a retirement program and a health insurance program. Explain two ways that the company could handle the costs of its direct laborers' fringe benefits in its cost records.

Problems**PROBLEM 2-14 Classification of Costs [LO1, LO2, LO5, LO7]**

Wollogong Group Ltd. of New South Wales, Australia, acquired its factory building about 10 years ago. For several years the company has rented out a small annex attached to the rear of the building. The company has received a rental income of \$30,000 per year on this space. The renter's lease will expire soon, and rather than renewing the lease, the company has decided to use the space itself to manufacture a new product.

Direct materials cost for the new product will total \$80 per unit. To have a place to store finished units of product, the company will rent a small warehouse nearby. The rental cost will be \$500 per month. In addition, the company must rent equipment for use in producing the new product; the rental cost will be \$4,000 per month. Workers will be hired to manufacture the new product, with direct labor cost amounting to \$60 per unit. The space in the annex will continue to be depreciated on a straight-line basis, as in prior years. This depreciation is \$8,000 per year.

Advertising costs for the new product will total \$50,000 per year. A supervisor will be hired to oversee production; her salary will be \$1,500 per month. Electricity for operating machines will be \$1.20 per unit. Costs of shipping the new product to customers will be \$9 per unit.

To provide funds to purchase materials, meet payrolls, and so forth, the company will have to liquidate some temporary investments. These investments are presently yielding a return of about \$3,000 per year.

Required:

Prepare an answer sheet with the following column headings:

Name of the Cost	Product Cost					Period (selling and administrative) Cost	Opportunity Cost	Sunk Cost
	Variable Cost	Fixed Cost	Direct Materials	Direct Labor	Manufacturing Overhead			

List the different costs associated with the new product decision down the extreme left column (under Name of the Cost). Then place an X under each heading that helps to describe the type of

cost involved. There may be X's under several column headings for a single cost. (For example, a cost may be a fixed cost, a period cost, and a sunk cost; you would place an X under each of these column headings opposite the cost.)

PROBLEM 2–15 Cost Classification [L02, L05, L06]

Listed below are a number of costs typically found in organizations.

1. Property taxes, factory.
2. Boxes used for packaging detergent produced by the company.
3. Salespersons' commissions.
4. Supervisor's salary, factory.
5. Depreciation, executive autos.
6. Wages of workers assembling computers.
7. Insurance, finished goods warehouses.
8. Lubricants for machines.
9. Advertising costs.
10. Microchips used in producing calculators.
11. Shipping costs on merchandise sold.
12. Magazine subscriptions, factory lunchroom.
13. Thread in a garment factory.
14. Billing costs.
15. Executive life insurance.
16. Ink used in textbook production.
17. Fringe benefits, assembly-line workers.
18. Yarn used in sweater production.
19. Wages of receptionist, executive offices.

Required:

Prepare an answer sheet with column headings as shown below. For each cost item, indicate whether it would be variable or fixed with respect to the number of units produced and sold; and then whether it would be a selling cost, an administrative cost, or a manufacturing cost. If it is a manufacturing cost, indicate whether it would typically be treated as a direct cost or an indirect cost with respect to units of product. Three sample answers are provided for illustration.

Cost Item	Variable or Fixed	Selling Cost	Administrative Cost	Manufacturing (Product) Cost	
				Direct	Indirect
Direct labor	V			X	
Executive salaries	F		X		
Factory rent	F				X

PROBLEM 2–16 Cost Classification [L05, L06]

Various costs associated with the operation of factories are given below:

1. Electricity used in operating machines.
2. Rent on a factory building.
3. Cloth used in drapery production.
4. Production superintendent's salary.
5. Wages of laborers assembling a product.
6. Depreciation of air purification equipment used in furniture production.
7. Janitorial salaries.
8. Peaches used in canning fruit.
9. Lubricants needed for machines.
10. Sugar used in soft-drink production.
11. Property taxes on the factory.
12. Wages of workers painting a product.
13. Depreciation on cafeteria equipment.
14. Insurance on a building used in producing helicopters.
15. Cost of rotor blades used in producing helicopters.

Required:

Classify each cost as either variable or fixed with respect to the number of units produced and sold. Also indicate whether each cost would typically be treated as a direct cost or an indirect cost with respect to units of product. Prepare your answer sheet as shown below:

Cost Item	Cost Behavior		To Units of Product	
	Variable	Fixed	Direct	Indirect
Example: Factory insurance		X		X

PROBLEM 2–17 (Appendix 2A) Allocating Labor Costs [LO8]

Mark Hansen is employed by Eastern Products, Inc., and works on the company's assembly line. Mark's basic wage rate is \$20 per hour. The company's union contract states that employees are to be paid time and a half (i.e., \$30 per hour) for any work in excess of 40 hours per week.

Required:

- Suppose that in a given week Mark works 46 hours. Compute Mark's total wages for the week. How much of this amount would be allocated to direct labor cost? To manufacturing overhead cost?
- Suppose in another week that Mark works 48 hours but is idle for 3 hours during the week due to machine breakdowns. Compute Mark's total wages for the week. How much of this amount would be allocated to direct labor cost? To manufacturing overhead cost?
- Eastern Products, Inc., has an attractive package of fringe benefits that costs the company \$6 for each hour of employee time (either regular time or overtime). During a particular week, Mark works 50 hours but is idle for 2 hours due to material shortages. Compute Mark's total wages and fringe benefits for the week. If the company treats all fringe benefits as part of manufacturing overhead cost, how much of Mark's wages and fringe benefits for the week would be allocated to direct labor cost? To manufacturing overhead cost?
- Refer to the data in (3) above. If the company treats that part of fringe benefits relating to direct labor as added direct labor cost, how much of Mark's wages and fringe benefits for the week will be allocated to direct labor cost? To manufacturing overhead cost?

PROBLEM 2–18 (Appendix 2B) Quality Cost Report [LO9, LO10]

In response to intensive foreign competition, the management of Florex Company has attempted over the past year to improve the quality of its products. A statistical process control system has been installed and other steps have been taken to decrease the amount of warranty and other field costs, which have been trending upward over the past several years. Costs relating to quality and quality control over the last two years are given below:



	Costs (in thousands)	
	This Year	Last Year
Inspection	\$900	\$750
Quality engineering	\$570	\$420
Depreciation of test equipment	\$240	\$210
Rework labor	\$1,500	\$1,050
Statistical process control	\$180	\$0
Cost of field servicing	\$900	\$1,200
Supplies used in testing	\$60	\$30
Systems development	\$750	\$480
Warranty repairs	\$1,050	\$3,600
Net cost of scrap	\$1,125	\$630
Product testing	\$1,200	\$810
Product recalls	\$750	\$2,100
Disposal of defective products	\$975	\$720

Sales have been flat over the past few years, at \$75,000,000 per year. A great deal of money has been spent in the effort to upgrade quality, and management is anxious to see whether or not the effort has been effective.

Required:

- Prepare a quality cost report that contains data for both this year and last year. Carry percentage computations to two decimal places.
- Prepare a bar graph showing the distribution of the various quality costs by category.
- Prepare a written evaluation to accompany the reports you have prepared in (1) and (2) above. This evaluation should discuss the distribution of quality costs in the company, changes in this distribution that you see taking place, the reasons for changes in costs in the various categories, and any other information that would be of value to management.

**PROBLEM 2-19 Classification of Various Costs [LO1, LO2, LO5, LO7]**

Staci Valek began dabbling in pottery several years ago as a hobby. Her work is quite creative, and it has been so popular with friends and others that she has decided to quit her job with an aerospace firm and manufacture pottery full time. The salary from Staci's aerospace job is \$3,800 per month.

Staci will rent a small building near her home to use as a place for manufacturing the pottery. The rent will be \$500 per month. She estimates that the cost of clay and glaze will be \$2 for each finished piece of pottery. She will hire workers to produce the pottery at a labor rate of \$8 per pot. To sell her pots, Staci feels that she must advertise heavily in the local area. An advertising agency states that it will handle all advertising for a fee of \$600 per month. Staci's brother will sell the pots; he will be paid a commission of \$4 for each pot sold. Equipment needed to manufacture the pots will be rented at a cost of \$300 per month.

Staci has already paid the legal and filing fees associated with incorporating her business in the state. These fees amounted to \$500. A small room has been located in a tourist area that Staci will use as a sales office. The rent will be \$250 per month. A phone installed in the room for taking orders will cost \$40 per month. In addition, a recording device will be attached to the phone for taking after-hours messages.

Staci has some money in savings that is earning interest of \$1,200 per year. These savings will be withdrawn and used to get the business going. For the time being, Staci does not intend to draw any salary from the new company.

Required:

1. Prepare an answer sheet with the following column headings:

Name of the Cost	Product Cost					Period (selling and administrative) Cost	Opportunity Cost	Sunk Cost
	Variable Cost	Fixed Cost	Direct Materials	Direct Labor	Manufacturing Overhead			

List the different costs associated with the new company down the extreme left column (under Name of Cost). Then place an X under each heading that helps to describe the type of cost involved. There may be X's under several column headings for a single cost. (That is, a cost may be a fixed cost, a period cost, and a sunk cost; you would place an X under each of these column headings opposite the cost.)

Under the Variable Cost column, list only those costs that would be variable with respect to the number of units of pottery that are produced and sold.

2. All of the costs you have listed above, except one, would be differential costs between the alternatives of Staci producing pottery or staying with the aerospace firm. Which cost is *not* differential? Explain.

**PROBLEM 2-20 Classification of Salary Cost as a Period or Product Cost [LO2]**

You have just been hired by Ogden Company to fill a new position that was created in response to rapid growth in sales. It is your responsibility to coordinate shipments of finished goods from the factory to distribution warehouses located in various parts of the United States so that goods will be available as orders are received from customers.

The company is unsure how to classify your annual salary in its cost records. The company's cost analyst says that your salary should be classified as a manufacturing (product) cost; the controller says that it should be classified as a selling expense; and the president says that it doesn't matter which way your salary cost is classified.

Required:

1. Which viewpoint is correct? Why?
2. From the point of view of the reported net operating income for the year, is the president correct in his statement that it doesn't matter which way your salary cost is classified? Explain.

**PROBLEM 2-21 Variable and Fixed Costs; Subtleties of Direct and Indirect Costs [LO5, LO6]**

Madison Seniors Care Center is a nonprofit organization that provides a variety of health services to the elderly. The center is organized into a number of departments, one of which is the meals-on-wheels program that delivers hot meals to seniors in their homes on a daily basis. Below are listed a number of costs of the center and the meals-on-wheels program.

example The cost of groceries used in meal preparation.

- a. The cost of leasing the meals-on-wheels van.
- b. The cost of incidental supplies such as salt, pepper, napkins, and so on.
- c. The cost of gasoline consumed by the meals-on-wheels van.

- d. The rent on the facility that houses Madison Seniors Care Center, including the meals-on-wheels program.
- e. The salary of the part-time manager of the meals-on-wheels program.
- f. Depreciation on the kitchen equipment used in the meals-on-wheels program.
- g. The hourly wages of the caregiver who drives the van and delivers the meals.
- h. The costs of complying with health safety regulations in the kitchen.
- i. The costs of mailing letters soliciting donations to the meals-on-wheels program.

Required:

For each cost listed above, indicate whether it is a direct or indirect cost of the meals-on-wheels program, whether it is a direct or indirect cost of particular seniors served by the program, and whether it is variable or fixed with respect to the number of seniors served. Use the below form for your answer.

Item	Description	Direct or Indirect Cost of the Meals- on-Wheels Program		Direct or Indirect Cost of Particular Seniors Served by the Meals-on- Wheels Program		Variable or Fixed with Respect to the Number of Seniors Served by the Meals-on- Wheels Program	
		Direct	Indirect	Direct	Indirect	Variable	Fixed
example	The cost of groceries used in meal preparation	X		X		X	

PROBLEM 2–22 (Appendix 2B) Analyzing a Quality Cost Report [LO10]

Mercury, Inc., produces pagers at its plant in Texas. In recent years, the company's market share has been eroded by stiff competition from overseas. Price and product quality are the two key areas in which companies compete in this market.

A year ago, the company's pagers had been ranked low in product quality in a consumer survey. Shocked by this result, Jorge Gomez, Mercury's president, initiated a crash effort to improve product quality. Gomez set up a task force to implement a formal quality improvement program. Included on this task force were representatives from the Engineering, Marketing, Customer Service, Production, and Accounting departments. The broad representation was needed because Gomez believed that this was a companywide program and that all employees should share the responsibility for its success.

After the first meeting of the task force, Holly Elsoe, manager of the Marketing Department, asked John Tran, production manager, what he thought of the proposed program. Tran replied, "I have reservations. Quality is too abstract to be attaching costs to it and then to be holding you and me responsible for cost improvements. I like to work with goals that I can see and count! I'm nervous about having my annual bonus based on a decrease in quality costs; there are too many variables that we have no control over."

Mercury's quality improvement program has now been in operation for one year. The company's most recent quality cost report is shown below.

MERCURY, INC. Quality Cost Report (in thousands)		
	This Year	Last Year
Prevention costs:		
Machine maintenance	\$ 120	\$ 70
Training suppliers	10	0
Quality circles	20	0
Total prevention costs	150	70
Appraisal costs:		
Incoming inspection	40	20
Final testing	90	80
Total appraisal costs	130	100

continued



Internal failure costs:		
Rework	130	50
Scrap	70	40
Total internal failure costs	200	90
External failure costs:		
Warranty repairs	30	90
Customer returns	80	320
Total external failure costs	110	410
Total quality cost	\$ 590	\$ 670
Total production cost	\$4,800	\$4,200

As they were reviewing the report, Elsoe asked Tran what he now thought of the quality improvement program. Tran replied, “I’m relieved that the new quality improvement program hasn’t hurt our bonuses, but the program has increased the workload in the Production Department. It is true that customer returns are way down, but the pagers that were returned by customers to retail outlets were rarely sent back to us for rework.”

Required:

1. Expand the company’s quality cost report by showing the costs in both years as percentages of both total production cost and total quality cost. Carry all computations to one decimal place. By analyzing the report, determine if Mercury, Inc.’s quality improvement program has been successful. *List specific evidence to support your answer.*
2. Do you expect the improvement program as it progresses to continue to increase the workload in the Production Department?
3. Jorge Gomez believed that the quality improvement program was essential and that Mercury, Inc., could no longer afford to ignore the importance of product quality. Discuss how Mercury, Inc., could measure the cost of *not* implementing the quality improvement program.

(CMA, adapted)



PROBLEM 2–23 Ethics and the Manager [LO2]

M. K. Gallant is president of Kranbrack Corporation, a company whose stock is traded on a national exchange. In a meeting with investment analysts at the beginning of the year, Gallant had predicted that the company’s earnings would grow by 20% this year. Unfortunately, sales have been less than expected for the year, and Gallant concluded within two weeks of the end of the fiscal year that it would be impossible to ultimately report an increase in earnings as large as predicted unless some drastic action was taken. Accordingly, Gallant has ordered that wherever possible, expenditures should be postponed to the new year—including canceling or postponing orders with suppliers, delaying planned maintenance and training, and cutting back on end-of-year advertising and travel. Additionally, Gallant ordered the company’s controller to carefully scrutinize all costs that are currently classified as period costs and reclassify as many as possible as product costs. The company is expected to have substantial inventories of work in process and finished goods at the end of the year.

Required:

1. Why would reclassifying period costs as product costs increase this period’s reported earnings?
2. Do you believe Gallant’s actions are ethical? Why or why not?

Excel



PROBLEM 2–24 Schedule of Cost of Goods Manufactured; Income Statement; Cost Behavior [LO1, LO2, LO3, LO4, LO5]

Various cost and sales data for Meriwell Company for the just completed year appear in the worksheet below:

Required:

1. Prepare a schedule of cost of goods manufactured.
2. Prepare an income statement.
3. Assume that the company produced the equivalent of 10,000 units of product during the year just completed. What was the average cost per unit for direct materials? What was the average cost per unit for factory depreciation?
4. Assume that the company expects to produce 15,000 units of product during the coming year. What average cost per unit and what total cost would you expect the company to incur for

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	A	B	C	D
1	Finished goods inventory, beginning	\$20,000		
2	Finished goods inventory, ending	\$40,000		
3	Depreciation, factory	\$27,000		
4	Administrative expenses	\$110,000		
5	Utilities, factory	\$8,000		
6	Maintenance, factory	\$40,000		
7	Supplies, factory	\$11,000		
8	Insurance, factory	\$4,000		
9	Purchases of raw materials	\$125,000		
10	Raw materials inventory, beginning	\$9,000		
11	Raw materials inventory, ending	\$6,000		
12	Direct labor	\$70,000		
13	Indirect labor	\$15,000		
14	Work in process inventory, beginning	\$17,000		
15	Work in process inventory, ending	\$30,000		
16	Sales	\$500,000		
17	Selling expenses	\$80,000		

direct materials at this level of activity? For factory depreciation? (In preparing your answer, assume that direct materials is a variable cost and that depreciation is a fixed cost; also assume that depreciation is computed on a straight-line basis.)

5. As the manager responsible for production costs, explain to the president any difference in the average costs per unit between (3) and (4) above.

PROBLEM 2–25 Cost Classification and Cost Behavior [LO2, LO5, LO6]

The Dorilane Company specializes in producing a set of wood patio furniture consisting of a table and four chairs. The set enjoys great popularity, and the company has ample orders to keep production going at its full capacity of 2,000 sets per year. Annual cost data at full capacity follow:



Factory labor, direct	\$118,000
Advertising	\$50,000
Factory supervision	\$40,000
Property taxes, factory building	\$3,500
Sales commissions	\$80,000
Insurance, factory	\$2,500
Depreciation, office equipment	\$4,000
Lease cost, factory equipment	\$12,000
Indirect materials, factory	\$6,000
Depreciation, factory building	\$10,000
General office supplies (billing)	\$3,000
General office salaries	\$60,000
Direct materials used (wood, bolts, etc.)	\$94,000
Utilities, factory	\$20,000

Required:

1. Prepare an answer sheet with the column headings shown below. Enter each cost item on your answer sheet, placing the dollar amount under the appropriate headings. As examples, this has been done already for the first two items in the list above. Note that each cost item is classified in two ways: first, as variable or fixed with respect to the number of units produced and sold; and second, as a selling and administrative cost or a product cost. (If the item is a product cost, it should also be classified as either direct or indirect as shown.)

Cost Item	Cost Behavior		Selling or Administrative Cost	Product Cost	
	Variable	Fixed		Direct	Indirect*
Factory labor, direct	\$118,000			\$118,000	
Advertising		\$50,000	\$50,000		

*To units of product.

2. Total the dollar amounts in each of the columns in (1) above. Compute the average product cost of one patio set.
3. Assume that production drops to only 1,000 sets annually. Would you expect the average product cost of one set to increase, decrease, or remain unchanged? Explain. No computations are necessary.
4. Refer to the original data. The president's brother-in-law has considered making himself a patio set and has priced the necessary materials at a building supply store. The brother-in-law has asked the president if he could purchase a patio set from the Dorilane Company "at cost," and the president agreed to let him do so.
 - a. Would you expect any disagreement between the two men over the price the brother-in-law should pay? Explain. What price does the president probably have in mind? The brother-in-law?
 - b. Since the company is operating at full capacity, what cost term used in the chapter might be justification for the president to charge the full, regular price to the brother-in-law and still be selling "at cost"?

PROBLEM 2–26 Schedule of Cost of Goods Manufactured; Income Statement [LO1, LO2, LO3, LO4]

Swift Company was organized on March 1 of the current year. After five months of start-up losses, management had expected to earn a profit during August. Management was disappointed, however, when the income statement for August also showed a loss. August's income statement follows:



SWIFT COMPANY Income Statement For the Month Ended August 31		
Sales		\$450,000
Less operating expenses:		
Indirect labor cost	\$ 12,000	
Utilities	15,000	
Direct labor cost	70,000	
Depreciation, factory equipment	21,000	
Raw materials purchased	165,000	
Depreciation, sales equipment	18,000	
Insurance	4,000	
Rent on facilities	50,000	
Selling and administrative salaries	32,000	
Advertising	75,000	462,000
Net operating loss		<u>\$ (12,000)</u>

After seeing the \$12,000 loss for August, Swift's president stated, "I was sure we'd be profitable within six months, but our six months are up and this loss for August is even worse than July's. I think it's time to start looking for someone to buy out the company's assets—if we don't, within a few months there won't be any assets to sell. By the way, I don't see any reason to look for a new controller. We'll just limp along with Sam for the time being."

The company's controller resigned a month ago. Sam, a new assistant in the controller's office, prepared the income statement above. Sam has had little experience in manufacturing operations. Additional information about the company follows:

- a. Some 60% of the utilities cost and 75% of the insurance apply to factory operations. The remaining amounts apply to selling and administrative activities.
- b. Inventory balances at the beginning and end of August were:

	August 1	August 31
Raw materials	\$8,000	\$13,000
Work in process	\$16,000	\$21,000
Finished goods	\$40,000	\$60,000

- c. Only 80% of the rent on facilities applies to factory operations; the remainder applies to selling and administrative activities.

The president has asked you to check over the income statement and make a recommendation as to whether the company should look for a buyer for its assets.

Required:

1. As one step in gathering data for a recommendation to the president, prepare a schedule of cost of goods manufactured for August.
2. As a second step, prepare a new income statement for August.
3. Based on your statements prepared in (1) and (2) above, would you recommend that the company look for a buyer?

PROBLEM 2–27 Schedule of Cost of Goods Manufactured; Income Statement; Cost Behavior [L01, L02, L03, L04, L05]

Selected account balances for the year ended December 31 are provided below for Superior Company:

Selling and administrative salaries	\$110,000
Insurance, factory	\$8,000
Utilities, factory	\$45,000
Purchases of raw materials	\$290,000
Indirect labor	\$60,000
Direct labor	?
Advertising expense	\$80,000
Cleaning supplies, factory	\$7,000
Sales commissions	\$50,000
Rent, factory building	\$120,000
Maintenance, factory	\$30,000

Inventory balances at the beginning and end of the year were as follows:

	Beginning of the Year	End of the Year
Raw materials	\$40,000	\$10,000
Work in process	?	\$35,000
Finished goods	\$50,000	?

The total manufacturing costs for the year were \$683,000; the goods available for sale totaled \$740,000; and the cost of goods sold totaled \$660,000.

Required:

1. Prepare a schedule of cost of goods manufactured and the cost of goods sold section of the company's income statement for the year.
2. Assume that the dollar amounts given above are for the equivalent of 40,000 units produced during the year. Compute the average cost per unit for direct materials used and the average cost per unit for rent on the factory building.
3. Assume that in the following year the company expects to produce 50,000 units. What average cost per unit and total cost would you expect to be incurred for direct materials? For rent on the factory building? (Assume that direct materials is a variable cost and that rent is a fixed cost.)
4. As the manager in charge of production costs, explain to the president the reason for any difference in average cost per unit between (2) and (3) above.

PROBLEM 2–28 Income Statement; Schedule of Cost of Goods Manufactured [L01, L02, L03, L04]

Visic Corporation, a manufacturing company, produces a single product. The following information has been taken from the company's production, sales, and cost records for the just completed year.

Production in units	29,000
Sales in units	?
Ending finished goods inventory in units	?
Sales in dollars	\$1,300,000
Costs:	
Advertising	\$105,000
Entertainment and travel	\$40,000
Direct labor	\$90,000
Indirect labor	\$85,000
Raw materials purchased	\$480,000
	<i>continued</i>



Building rent (production uses 80% of the space; administrative and sales offices use the rest)	\$40,000
Utilities, factory	\$108,000
Royalty paid for use of production patent, \$1.50 per unit produced	?
Maintenance, factory	\$9,000
Rent for special production equipment, \$7,000 per year plus \$0.30 per unit produced	?
Selling and administrative salaries	\$210,000
Other factory overhead costs	\$6,800
Other selling and administrative expenses	\$17,000

	Beginning of the Year	End of the Year
Inventories:		
Raw materials	\$20,000	\$30,000
Work in process	\$50,000	\$40,000
Finished goods	\$0	?

The finished goods inventory is being carried at the average unit production cost for the year. The selling price of the product is \$50 per unit.

Required:

1. Prepare a schedule of cost of goods manufactured for the year.
2. Compute the following:
 - a. The number of units in the finished goods inventory at the end of the year.
 - b. The cost of the units in the finished goods inventory at the end of the year.
3. Prepare an income statement for the year.

PROBLEM 2–29 Working with Incomplete Data from the Income Statement and Schedule of Cost of Goods Manufactured [LO3, LO4]

Supply the missing data in the following cases. Each case is independent of the others.

	Case			
	1	2	3	4
Direct materials	\$4,500	\$6,000	\$5,000	\$3,000
Direct labor	?	\$3,000	\$7,000	\$4,000
Manufacturing overhead	\$5,000	\$4,000	?	\$9,000
Total manufacturing costs	\$18,500	?	\$20,000	?
Beginning work in process inventory	\$2,500	?	\$3,000	?
Ending work in process inventory	?	\$1,000	\$4,000	\$3,000
Sales	\$30,000	\$21,000	\$36,000	\$40,000
Beginning finished goods inventory	\$1,000	\$2,500	?	\$2,000
Cost of goods manufactured	\$18,000	\$14,000	?	\$17,500
Goods available for sale	?	?	?	?
Ending finished goods inventory	?	\$1,500	\$4,000	\$3,500
Cost of goods sold	\$17,000	?	\$18,500	?
Gross margin	\$13,000	?	\$17,500	?
Operating expenses	?	\$3,500	?	?
Net operating income	\$4,000	?	\$5,000	\$9,000

Cases

CASE 2–30 Inventory Computations from Incomplete Data [LO3, LO4]

Hector P. Wastrel, a careless employee, left some combustible materials near an open flame in Salter Company's plant. The resulting explosion and fire destroyed the entire plant and administrative

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offices. Justin Quick, the company's controller, and Constance Trueheart, the operations manager, were able to save only a few bits of information as they escaped from the roaring blaze.

"What a disaster," cried Justin. "And the worst part is that we have no records to use in filing an insurance claim."

"I know," replied Constance. "I was in the plant when the explosion occurred, and I managed to grab only this brief summary sheet that contains information on one or two of our costs. It says that our direct labor cost this year has totaled \$180,000 and that we have purchased \$290,000 in raw materials. But I'm afraid that doesn't help much; the rest of our records are just ashes."

"Well, not completely," said Justin. "I was working on the year-to-date income statement when the explosion knocked me out of my chair. I instinctively held onto the page I was working on, and from what I can make out, our sales to date this year have totaled \$1,200,000 and our gross margin rate has been 40% of sales. Also, I can see that our goods available for sale to customers has totaled \$810,000 at cost."

"Maybe we're not so bad off after all," exclaimed Constance. "My sheet says that prime cost has totaled \$410,000 so far this year and that manufacturing overhead is 70% of conversion cost. Now if we just had some information on our beginning inventories."

"Hey, look at this," cried Justin. "It's a copy of last year's annual report, and it shows what our inventories were when this year started. Let's see, raw materials was \$18,000, work in process was \$65,000, and finished goods was \$45,000."

"Super," yelled Constance. "Let's go to work."

To file an insurance claim, the company must determine the amount of cost in its inventories as of the date of the fire. You may assume that all materials used in production during the year were direct materials.

Required:

Determine the amount of cost in the Raw Materials, Work in Process, and Finished Goods inventory accounts as of the date of the fire. (Hint: One way to proceed would be to reconstruct the various schedules and statements that would have been affected by the company's inventory accounts during the period.)

CASE 2–31 Missing Data; Income Statement; Schedule of Cost of Goods Manufactured [L01, L02, L03, L04]

"I was sure that when our battery hit the market it would be an instant success," said Roger Strong, founder and president of Solar Technology, Inc. "But just look at the gusher of red ink for the first quarter. It's obvious that we're better scientists than we are businesspeople." The data to which Roger was referring follow:



SOLAR TECHNOLOGY, INC.		
Income Statement		
For the Quarter Ended March 31		
Sales (32,000 batteries)		\$ 960,000
Less operating expenses:		
Selling and administrative salaries	\$110,000	
Advertising	90,000	
Maintenance, factory	43,000	
Indirect labor cost	120,000	
Cleaning supplies, factory	7,000	
Purchases of raw materials	360,000	
Rental cost, facilities	75,000	
Insurance, factory	8,000	
Depreciation, office equipment	27,000	
Utilities	80,000	
Depreciation, factory equipment	100,000	
Direct labor cost	70,000	
Travel, salespersons	40,000	
		<u>1,130,000</u>
Net operating loss		<u>\$ (170,000)</u>

"At this rate we'll be out of business within a year," said Cindy Zhang, the company's accountant. "But I've double-checked these figures, so I know they're right."

Solar Technology was organized at the beginning of the current year to produce and market a revolutionary new solar battery. The company's accounting system was set up by Margie Wallace,

an experienced accountant who recently left the company to do independent consulting work. The statement above was prepared by Zhang, her assistant.

“We may not last a year if the insurance company doesn’t pay the \$226,000 it owes us for the 8,000 batteries lost in the warehouse fire last week,” said Roger. “The insurance adjuster says our claim is inflated, but he’s just trying to pressure us into a lower figure. We have the data to back up our claim, and it will stand up in any court.”

On April 3, just after the end of the first quarter, the company’s finished goods storage area was swept by fire and all 8,000 unsold batteries were destroyed. (These batteries were part of the 40,000 units completed during the first quarter.) The company’s insurance policy states that the company will be reimbursed for the “cost” of any finished batteries destroyed or stolen. Zhang has determined this cost as follows:

$$\frac{\text{Total costs for the quarter}}{\text{Batteries produced during the quarter}} = \frac{\$1,130,000}{40,000 \text{ units}} \\ = \$28.25 \text{ per unit}$$

$$8,000 \text{ batteries} \times \$28.25 \text{ per unit} = \$226,000$$

The following additional information is available on the company’s activities during the quarter ended March 31:

- a. Inventories at the beginning and end of the quarter were as follows:

	Beginning of the Quarter	End of the Quarter
Raw materials	\$0	\$10,000
Work in process	\$0	\$50,000
Finished goods	\$0	?

- b. Eighty percent of the rental cost for facilities and 90% of the utilities cost relate to manufacturing operations. The remaining amounts relate to selling and administrative activities.

Required:

- What conceptual errors, if any, were made in preparing the income statement above?
- Prepare a schedule of cost of goods manufactured for the first quarter.
- Prepare a corrected income statement for the first quarter. Your statement should show in detail how the cost of goods sold is computed.
- Do you agree that the insurance company owes Solar Technology, Inc., \$226,000? Explain your answer.

Group and Internet Exercises



GROUP EXERCISE 2–32 Implications of Mass Production

Management accounting systems tend to parallel the manufacturing systems they support and control. Traditional manufacturing systems emphasized productivity (average output per hour or per employee) and cost. This was the result of a competitive philosophy that was based on mass producing a few standard products and “meeting or beating competitors on price.” If a company is going to compete on price, it had better be a low-cost producer.

Companies achieved low unit cost for a fixed set of resources by maximizing the utilization of those resources. That is, traditional production strategies were based on the economies of mass production and maximizing output for a given productive capacity. The United States has experienced over 100 years of unprecedented economic prosperity in large part because innovators like Henry Ford applied these economic principles with a vengeance.

Competitors, never being completely satisfied with their present condition, were always looking for ways to lower the cost of a product or service even further to gain some temporary cost advantage. Additional productivity gains were achieved by standardizing work procedures, specializing work, and using machines to enhance the productivity of individual workers.

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Required:

1. Henry Ford made a now-famous statement that the Model T “could be had in any color as long as it was black.” Explain what he meant by this statement.
2. How would Henry Ford or any other manufacturer with a narrow product line gain even further efficiencies based on the traditional production model described above?
3. Are there any limits to lowering the cost of black Model Ts, black Bic pens, or any high-volume, commodity product? Explain.
4. Once understood, the economies of mass production were applied to most sectors of the American economy. Universities, hospitals, and airlines are prime examples. Describe how the concepts of mass production, standardization, and specialization have been applied to lower the costs of a university education. Of a stay in the hospital.

GROUP EXERCISE 2–33 If Big Is Good, Bigger Must Be Better

Steel production involves a large amount of fixed costs. Since competition is defined primarily in terms of price, American steel manufacturers (and many of their manufacturing and service industry counterparts) try to gain a competitive advantage by using economies of scale and investment in technology to increase productivity and drive unit costs lower. Their substantial fixed costs are the result of their size.



Required:

1. How are fixed costs and variable costs normally defined?
2. Give examples of fixed costs and variable costs for a steel company. What is the relevant measure of production activity?
3. Give examples of fixed and variable costs for a hospital, university, and auto manufacturer. What is the relevant measure of production or service activity for each of these organizations?
4. Using the examples of fixed and variable costs for steel companies from (2) above, explain the relationship between production output at a steel company and each of the following: total fixed costs, fixed cost per unit, total variable costs, variable cost per unit, total costs, and average unit cost.
5. With an *X* axis (horizontal axis) of tons produced and a *Y* axis (vertical axis) of total costs, graph total fixed costs, total variable costs, and total costs against tons produced.
6. With an *X* axis of tons produced and a *Y* axis of unit costs, graph fixed cost per unit, variable cost per unit, and total (or average) cost per unit against tons produced.
7. Explain how costs (total and per unit) behave with changes in demand once capacity has been set.

INTERNET EXERCISE 2–34

As you know, the World Wide Web is constantly evolving. Sites come and go, and change without notice. To enable periodic updating of site addresses, this problem has been posted to the textbook website (www.mhhe.com/garrison11e). After accessing the site, enter the Student Center and select this chapter. Select and complete the Internet Exercise.

