

# Organizational Cost Flows



## LEARNING OBJECTIVES

*After completing this chapter, you should be able to answer the following questions:*

- 1 How are costs classified and why are such classifications useful?
- 2 How does the conversion process occur in manufacturing and service companies?
- 3 What assumptions do accountants make about cost behavior and why are these assumptions necessary?
- 4 How are the high-low method and least squares regression analysis (Appendix) used in analyzing mixed costs?
- 5 What product cost categories exist and what items compose those categories?
- 6 Why and how are overhead costs allocated to products and services?
- 7 What causes underapplied or overapplied overhead and how is it treated at the end of a period?
- 8 How is cost of goods manufactured calculated?

**W**isconsin Film & Bag (WF&B), headquartered in Shawano, Wisconsin, is a custom manufacturer of high-quality polyethylene bags and film for a variety of packaging applications such as food, electronics, and other manufactured products. WF&B serves a market niche that requires Manufactured to Order quality products. The company focuses on “time-sensitive,” low-volume orders including smaller, lighter gauge bags (bakery bags, parts bags, and specialized packaging bags) from which most large competitors shy away.

WF&B’s ability to produce a broad range of polyethylene products, low overhead, short lead times, production efficiencies, and “in-line” bag-making capabilities competitively position the company and enhance its potential to acquire new customers.

The company’s success in the last several years can be attributed to its service to customers—ranging from short lead times, quick responses to requests for quotations, flexible manufacturing and scheduling, immediate

problem solving by customer service representatives, to training of distributor sales representatives by WF&B employees.

Raw materials consist primarily of prime and offgrade low-density and linear low-density polyethylene resin pellets. Management splits purchases among suppliers to ensure competitive pricing and stable supply during times of shortage. Approximately 50 percent of WF&B’s annual requirements are purchased from a variety of vendors under long-term contract.

WF&B has two plants: one in Shawano, Wisconsin, and the other in Hartland, Wisconsin. The Shawano plant operates two 12-hour shifts, 363 days annually. Each production line is comprised of a machine operator and each shift includes a lead operator, an extruder technician and a quality control specialist. WF&B’s plant layout and parallel production lines allow it to achieve a high degree of workforce flexibility, thus avoiding unnecessary use of manpower and excess material handling.

SOURCE: Corporate Headquarters, Wisconsin Film & Bag, 3100 E. Richmond Street, Shawano, WI 54166.

Every product or service has costs for material, labor, and overhead associated with it. **Cost** reflects the monetary measure of resources given up to attain an objective such as acquiring a good or service. However, like many other words, the term *cost* must be defined more specifically before “the cost” can be determined. Thus, a preceding adjective is generally used to specify the type of cost being considered. Different definitions for the term *cost* are used in different situations for different purposes. For example, the value presented on the balance sheet for an asset is an **unexpired cost**, but the portion of an asset’s value consumed or sacrificed during a period is presented as an expense or **expired cost** on the income statement.

Before being able to effectively communicate information to others, accountants must clearly understand the differences among the various types of costs, their computations, and their usage. This chapter provides the terminology that is necessary to understand and articulate cost and management accounting information. The chapter also presents cost flows and accumulation in a production environment.

Costs are commonly defined based on the objective or information desired and in terms of their relationship to the following four items: (1) time of incidence (e.g., historical or budgeted), (2) reaction to changes in activity (e.g., variable, fixed, or mixed), (3) classification on the financial statements (e.g., unexpired or expired), and (4) impact on decision making (e.g., relevant or irrelevant). These categories are not mutually exclusive; a cost may be defined in one way at one time and in another way at a different time. The first three cost classifications are discussed in this chapter. Costs related to decision making are covered at various points throughout the text.

**cost**

**unexpired cost**  
**expired cost**

## COST CLASSIFICATIONS ON THE FINANCIAL STATEMENTS

1

How are costs classified and why are such classifications useful?

The balance sheet and income statement are two financial statements prepared by a company. The balance sheet is a statement of unexpired costs (assets) and equities (liabilities and owners' capital); the income statement is a statement of revenues and expired costs (expenses and losses). The concept of matching revenues and expenses on the income statement is central to financial accounting. The matching concept provides a basis for deciding when an unexpired cost becomes an expired cost and is moved from an asset category to an expense or loss category.

Expenses and losses differ in that expenses are intentionally incurred in the process of generating revenues, and losses are unintentionally incurred in the context of business operations. Cost of goods sold and expired selling and administrative costs are examples of expenses. Costs incurred for damage related to fires, for abnormal production waste, and for the sale of a machine at below book value are examples of losses.

**product cost**

Costs can also be classified as either product or period costs. **Product costs** are related to making or acquiring the products or providing the services that directly generate the revenues of an entity; **period costs** are related to other business functions such as selling and administration.

**period cost**

**inventoriable cost**

Product costs are also called **inventoriable costs** and include the cost of direct material, direct labor, and overhead. Any readily identifiable part of a product (such as the clay in a vase) is a **direct material**. Direct material includes raw materials, purchased components from contract manufacturers, and manufactured subassemblies. **Direct labor** refers to the time spent by individuals who work specifically on manufacturing a product or performing a service. At WF&B, the people handling the polyethylene material for storage bags are considered direct labor and their wages are direct labor costs. Any factory or production cost that is indirect to the product or service and, accordingly, does not include direct material and direct labor is **overhead**. This cost element includes factory supervisors' salaries, depreciation on the machines producing plastic food storage bags, and insurance on the production facilities. The sum of direct labor and overhead costs is referred to as **conversion cost**.

**direct material**

**direct labor**

**overhead**

**conversion cost**

Direct material, direct labor, and overhead are discussed in depth later in the chapter. Precise classification of some costs into one of these categories may be difficult and judgment may be required in the classification process.

Period costs are generally more closely associated with a particular time period rather than with making or acquiring a product or performing a service. Period costs that have future benefit are classified as assets, whereas those deemed to have no future benefit are expensed as incurred. Prepaid insurance on an administration building represents an unexpired period cost; when the premium period passes, the insurance becomes an expired period cost (insurance expense). Salaries paid to the sales force and depreciation on computers in the administrative area are also period costs.

**distribution cost**

Mention must be made of one specific type of period cost: distribution. A **distribution cost** is any cost incurred to warehouse, transport, or deliver a product or service. Although distribution costs are expensed as incurred, managers should remember that these costs relate directly to products and services and should not adopt an "out-of-sight, out-of-mind" attitude about these costs simply because they have been expensed for financial accounting purposes. Distribution costs must be planned for in relationship to product/service volume, and these costs must be controlled for profitability to result from sales. Thus, even though distribution costs are not technically considered part of product cost, they can have a major impact on managerial decision making.<sup>1</sup>

<sup>1</sup> The uniform capitalization rules (unicap rules) of the Tax Reform Act of 1986 caused many manufacturers, wholesalers, and retailers to expand the types and amounts of nonproduction-area costs that are treated as product costs for tax purposes. The unicap rules require that distribution costs for warehousing be considered part of product cost, but not distribution costs for marketing and customer delivery. The rationale for such treatment is that such warehousing costs are incidental to production or acquisition.

## THE CONVERSION PROCESS

In general, product costs are incurred in the production or conversion area and period costs are incurred in all nonproduction or nonconversion areas.<sup>2</sup> To some extent, all organizations convert (or change) inputs into outputs. Inputs typically consist of material, labor, and overhead. The output of a conversion process is usually either products or services. Exhibit 3–1 compares the conversion activities of different types of organizations. Note that many service companies engage in a high degree of conversion. Firms of professionals (such as accountants, architects, attorneys, engineers, and surveyors) convert labor and other resource inputs (material and overhead) into completed jobs (audit reports, building plans, contracts, blueprints, and property survey reports).

Firms that engage in only low or moderate degrees of conversion can conveniently expense insignificant costs of labor and overhead related to conversion. The savings in clerical cost from expensing outweigh the value of any slightly improved information that might result from assigning such costs to products or services. For example, when employees open shipping containers, hang clothing on racks, and tag merchandise with sales tickets, a labor cost for conversion is incurred. Retail clothing stores, however, do not try to attach the stockpeople's wages to inventory; such labor costs are treated as period costs and are expensed when they are incurred.

In contrast, in high-conversion firms, the informational benefits gained from accumulating the material, labor, and overhead costs of the output produced significantly exceed the clerical accumulation costs. For instance, to immediately expense labor costs incurred for workers constructing a building would be inappropriate; these costs are treated as product costs and inventoried as part of the cost of the construction job until the building is completed.

For convenience, a **manufacturer** is defined as any company engaged in a high degree of conversion of raw material input into other tangible output. Manufacturers typically use people and machines to convert raw material to output that has substance and can, if desired, be physically inspected. A **service company** refers to a firm engaged in a high or moderate degree of conversion using a significant amount of labor. A service company's output may be tangible (an architectural drawing) or intangible (insurance protection) and normally cannot be inspected prior to use. Service firms may be profit-making businesses or not-for-profit organizations.

2

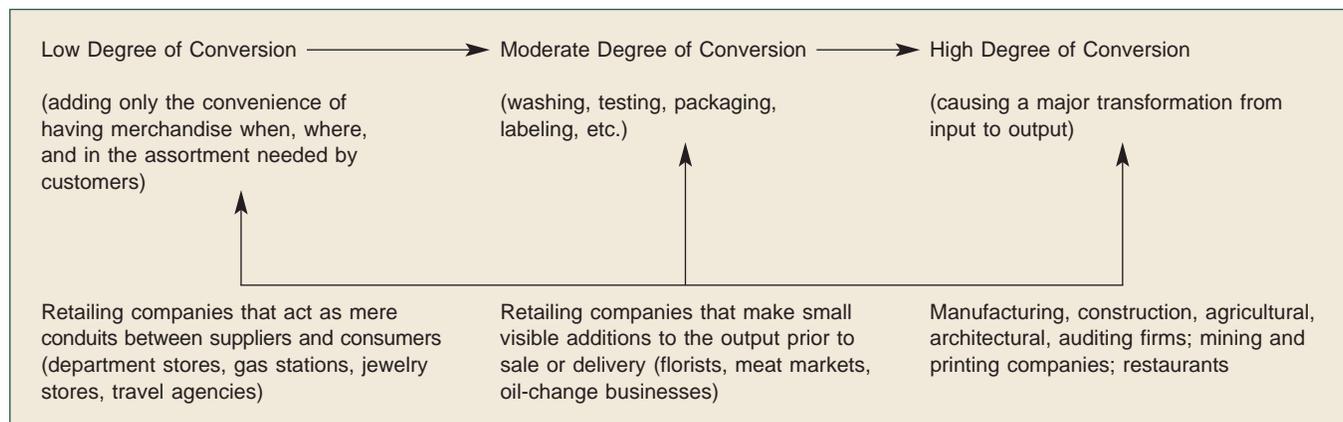
How does the conversion process occur in manufacturing and service companies?

**manufacturer**

**service company**

### EXHIBIT 3-1

*Degrees of Conversion in Firms*



<sup>2</sup> It is less common, but possible, for a cost incurred outside the production area to be in direct support of production and, therefore, considered a product cost. An example of this situation is the salary of a product cost analyst who is based at corporate headquarters; this cost is part of overhead.

Firms engaging in only low or moderate degrees of conversion ordinarily have only one inventory account (Merchandise Inventory). In contrast, manufacturers normally use three inventory accounts: (1) Raw Material Inventory, (2) Work in Process Inventory (for partially converted goods), and (3) Finished Goods Inventory. Service firms will have an inventory account for the supplies used in the conversion process and may have a Work in Process Inventory account, but these firms do not normally have a Finished Goods Inventory account because services typically cannot be warehoused. If collection is yet to be made for a completed service engagement, the service firm has a receivable from its client instead of Finished Goods Inventory.

### **Retailers versus Manufacturers/Service Companies**

Retail companies purchase goods in finished or almost finished condition; thus those goods typically need little, if any, conversion before being sold to customers. Costs associated with such inventory are usually easy to determine, as are the valuations for financial statement presentation.

In comparison, manufacturers and service companies engage in activities that involve the physical transformation of inputs into, respectively, finished products and services. The materials or supplies and conversion costs of manufacturers and service companies must be assigned to output to determine cost of inventory produced and cost of goods sold or services rendered. Cost accounting provides the structure and process for assigning material and conversion costs to products and services.

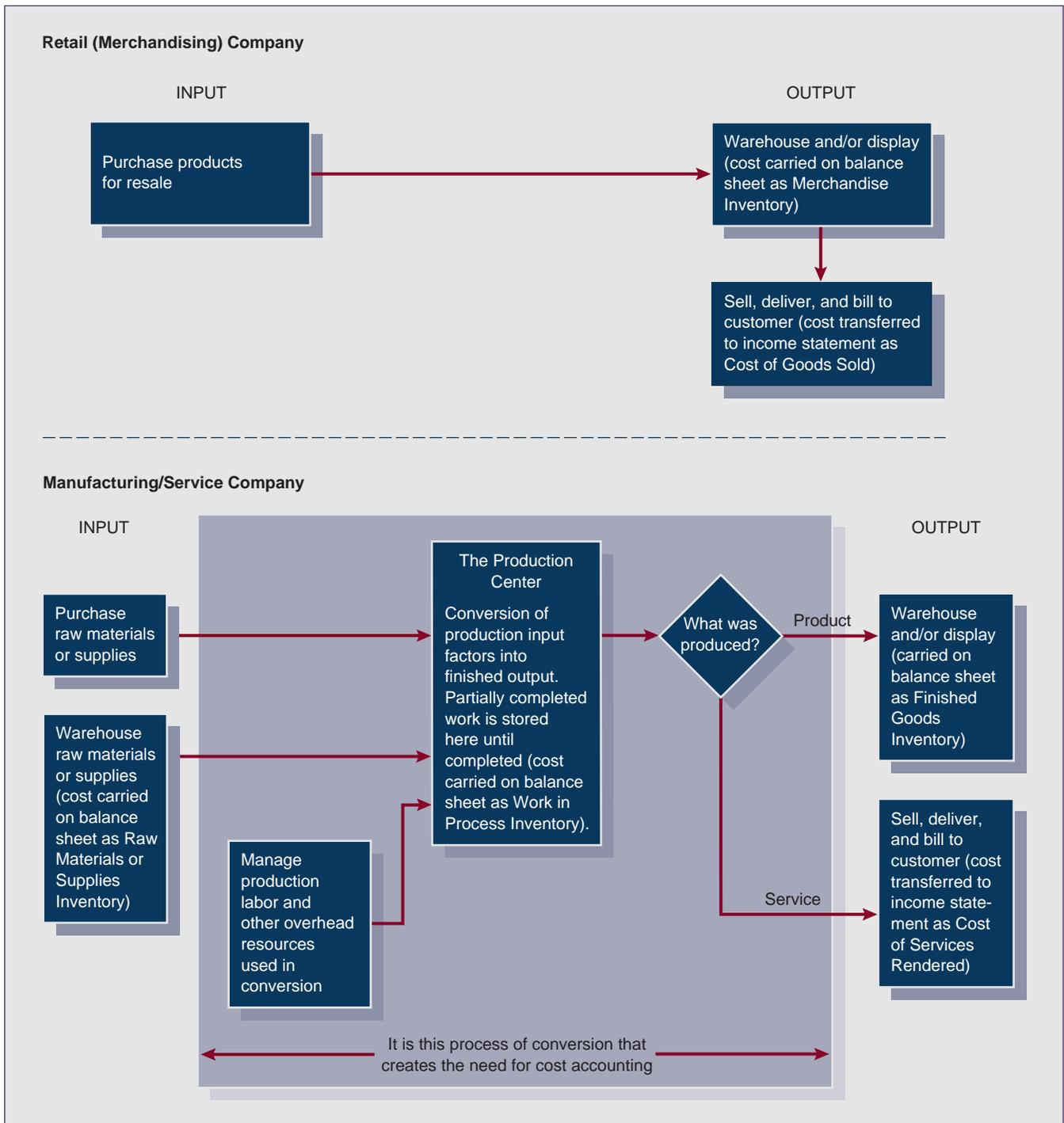
Exhibit 3–2 compares the input–output relationships of a retail company with those of a manufacturing/service company. This exhibit illustrates that the primary difference between retail companies and manufacturing/service companies is the absence or presence of the area labeled “the production center.” This center involves the conversion of raw material to final products. Input factors flow into the production center and are transformed and stored there until the goods or services are completed. If the output is a product, it can be warehoused and/or displayed until it is sold. Service outputs are directly provided to the client commissioning the work.

As mentioned previously, the time, effort, and cost of conversion in a retail business are not as significant as they are in a manufacturing or service company. Thus, although a retailer could have a department (such as one that adds store name labels to goods) that might be viewed as a “mini” production center, most often, retailers have no designated “production center.”

Exhibit 3–2 reflects an accrual-based accounting system in which costs flow from the various inventory accounts on the balance sheet through (if necessary) the production center. The cost accumulation process begins when raw materials or supplies are placed into production. As work progresses on a product or service, costs are accumulated in the firm’s accounting records. Accumulating costs in appropriate inventory accounts allows businesses to match the costs of buying or manufacturing a product or providing a service with the revenues generated when the goods or services are sold. At the point of sale, these product/service costs will flow from an inventory account to cost of goods sold or cost of services rendered on the income statement.

### **Manufacturers versus Service Companies**

Several differences in accounting for production activities exist between a manufacturer and a service company. A manufacturer must account for raw materials, work in process, and finished goods to maintain control over the production process. An accrual accounting system is essential for such organizations so that the total production costs can be accumulated as the goods flow through the manufacturing



**EXHIBIT 3-2**

*Business Input/Output Relationships*

process. On the other hand, most service firms need only to keep track of their work in process (incomplete jobs). Such accounting is acceptable because service firms normally have few, if any, materials costs other than supplies for work not started. As mentioned earlier, because services generally cannot be warehoused, costs of finished jobs are usually transferred immediately to the income statement to be matched against job revenues, rather than being carried on the balance sheet in a finished goods account.

Despite the accounting differences among retailers, manufacturers, and service firms, each type of organization can use cost and management accounting concepts and techniques, although in different degrees. Managers in all firms engage in planning, controlling, evaluating performance, and making decisions. Thus, management accounting is appropriate for all firms. Cost accounting techniques are essential to all firms engaged in significant conversion activities. In most companies, managers are constantly looking for ways to reduce costs; cost accounting and management accounting are used extensively in this pursuit.

Regardless of how costs are classified, managers are continuously looking for new and better ways to reduce costs without sacrificing quality or productivity. Consider some of DaimlerChrysler's management plans to save \$3 billion annually in various activities:

<http://www.daimlerchrysler.com>

- *Advanced technologies:* Eliminate overlapping research into fuel cells, electric cars, and advanced diesel engines.
- *Finance:* Reduce back-office costs and coordinate tax planning and other activities.
- *Purchasing:* Consolidate parts and equipment buying. DaimlerChrysler is expected to follow Chrysler's system of working with suppliers.
- *Joint production:* Build Daimler sport-utility vehicles at a plant in Austria where Chrysler makes Jeeps and minivans.
- *New products:* Possibly cooperate on future products, such as minivans.
- *New markets:* Cooperate in emerging markets such as Latin America and Asia, perhaps with joint ventures.<sup>3</sup>

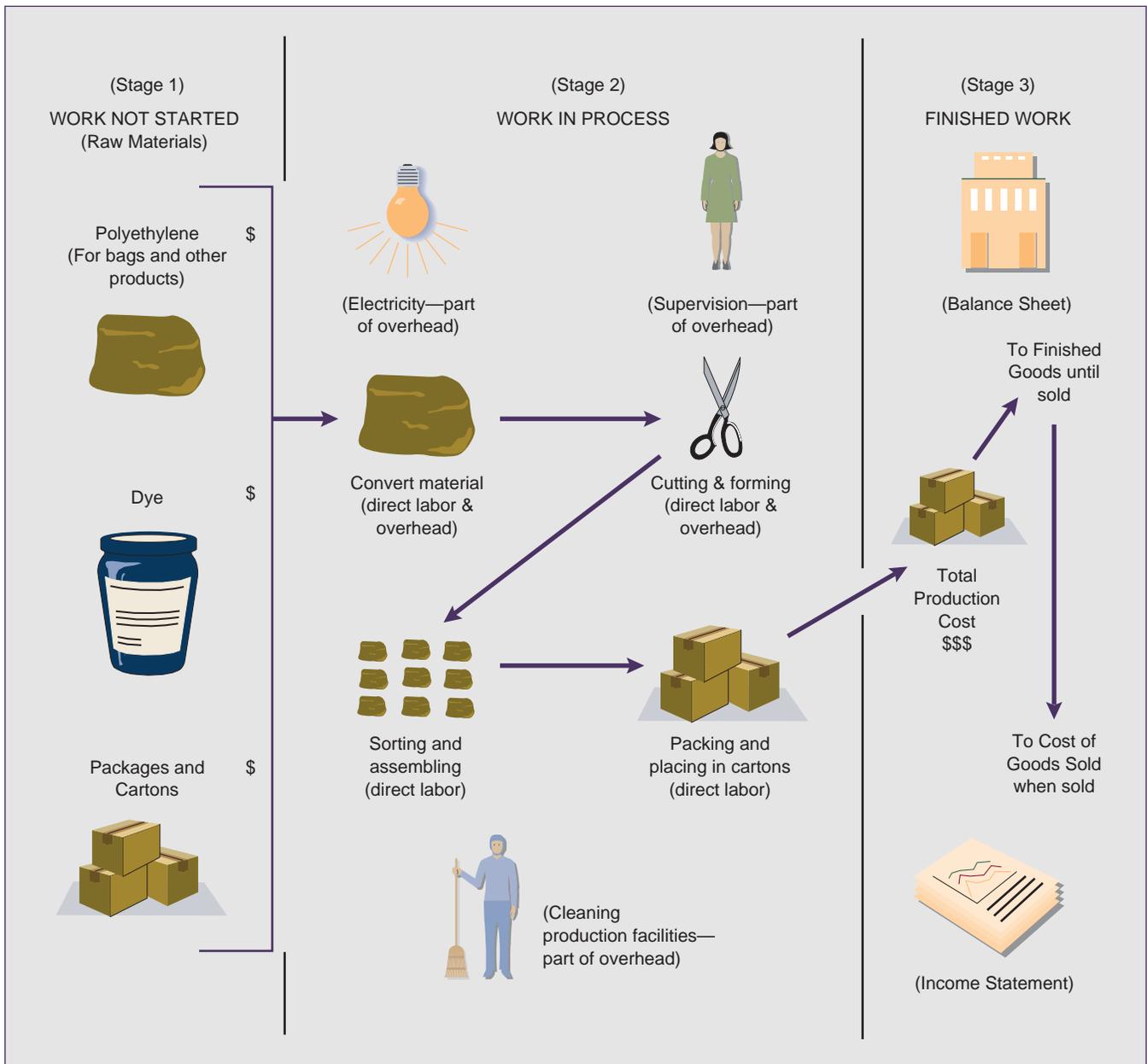
## STAGES OF PRODUCTION

The production or conversion process can be viewed in three stages: (1) work not started (raw materials), (2) work in process, and (3) finished work. Costs are associated with each processing stage. The stages of production in a manufacturing firm and some costs associated with each stage are illustrated in Exhibit 3-3. In the first stage of processing, the cost incurred reflects the prices paid for raw materials and/or supplies. As work progresses through the second stage, accrual-based accounting requires that labor and overhead costs related to the conversion of raw materials or supplies be accumulated and attached to the goods. The total costs incurred in stages 1 and 2 equal the total production cost of finished goods in stage 3.

Cost accounting uses the Raw Material, Work in Process, and Finished Goods Inventory accounts to accumulate the processing costs and assign them to the goods produced. The three inventory accounts relate to the three stages of production shown in Exhibit 3-3 and form a common database for cost, management, and financial accounting information.

In a service firm, the work-not-started stage of processing normally consists of the cost of supplies needed to perform the services (Supplies Inventory). When supplies are placed into work in process, labor and overhead are added to achieve finished results. Determining the cost of services provided is extremely important in both profit-oriented service businesses and not-for-profit entities. For instance, architectural firms need to accumulate the costs incurred for designs and models of each project, and hospitals need to accumulate the costs incurred by each patient during his or her hospital stay.

<sup>3</sup> Gregory White and Brian Coleman, "Chrysler, Daimler Focus on Value of Stock," *The Wall Street Journal* (September 21, 1998), p. A3.



**EXHIBIT 3-3**

*Stages and Costs of Production*

### COST REACTIONS TO CHANGES IN ACTIVITY

Accountants describe a given cost's behavior pattern according to the way its *total* cost (rather than its unit cost) reacts to changes in a related activity measure. Every cost in an organization will change if activity levels are shifted to extremes or if the time span is long enough. However, a total cost may be observed to behave within a period in relation to limited changes in an associated activity measure. Activity measures include production, service and sales volumes, hours of machine time used, pounds of material moved, and number of purchase orders sent. To

3

What assumptions do accountants make about cost behavior and why are these assumptions necessary?

**relevant range****variable cost**

properly identify, analyze, and use cost behavior information, a time frame must be specified to indicate how far into the future a cost should be examined, and a particular range of activity must be assumed. For example, the standard-sized container of polyethylene material for WF&B to make a production run might increase by \$1 next year but by \$5 by the year 2010. If WF&B's management is planning for next year, the \$1 increase is relevant but the \$5 increase is not. The assumed range of activity that reflects the company's normal operating range is referred to as the **relevant range**. Within the relevant range, the two most common cost behaviors are variable and fixed.

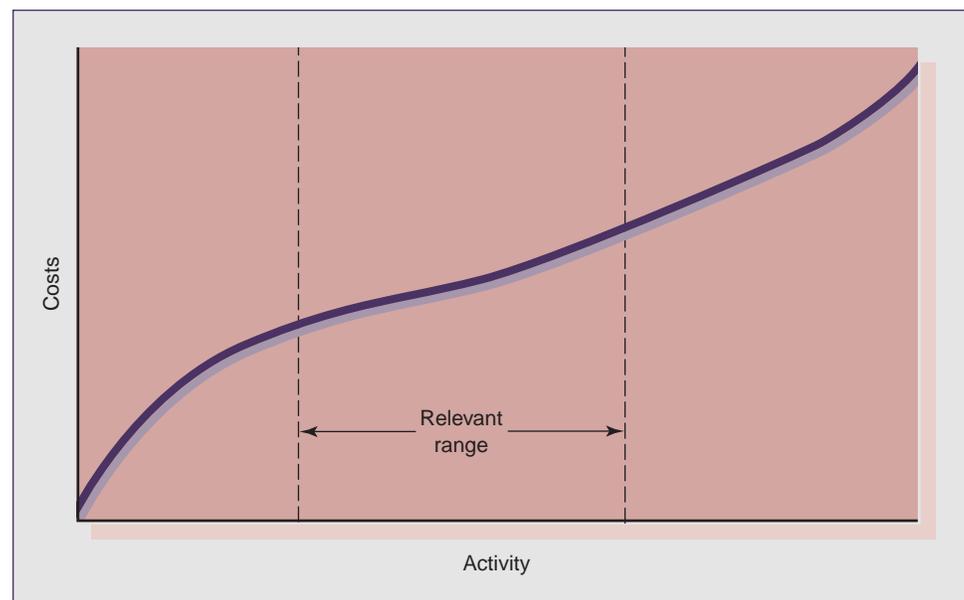
A cost that varies in total in direct proportion to changes in activity is a **variable cost**. Examples include the costs of materials, wages, and sales commissions. Variable costs can be extremely important in the total profit picture of a company, because every time a product is produced and/or sold or a service is rendered and/or sold, a corresponding amount of that variable cost is incurred. Because the total cost varies in direct proportion to changes in activity, a variable cost is a constant amount per unit.

Although accountants view variable costs as linear, economists view these costs as curvilinear as shown in Exhibit 3-4. The cost line slopes upward at a given rate until a range of activity is reached in which the average variable cost rate becomes fairly constant. Within this range, the firm experiences benefits such as discounts on material prices, improved worker skill and productivity, and other operating efficiencies. Beyond this range, the slope becomes quite steep as the entity enters a range of activity in which certain operating factors cause the average variable cost to increase. In this range, the firm finds that costs rise rapidly due to worker crowding, equipment shortages, and other operating inefficiencies. Although the curvilinear graph is more correct, it is not as easy to use in planning or controlling costs.

To illustrate how to determine a variable cost, assume that Smith Company makes lawnmowers with batteries attached to start them electrically. Each battery costs a constant \$8 as long as the company produces within the relevant range of 0 to 3,000 mowers annually. Within this range, total battery cost can be calculated as \$8 multiplied by the number of mowers produced. For instance, if 2,500 mowers were produced, total variable cost of batteries is \$20,000 ( $\$8 \times 2,500$  mowers).

**EXHIBIT 3-4**

*Economic Representation of a Variable Cost*



If the firm advances to a new relevant range and makes between 3,001 units and 7,000 mowers annually, the new unit cost would drop to \$6. Total battery cost for making, for example, 5,800 mowers annually would be \$34,800 ( $\$6 \times 5,800$  mowers).

In contrast, a cost that remains constant in total within the relevant range of activity is considered a **fixed cost**. Many fixed costs are incurred to provide a firm with production capacity. Fixed costs include salaries (as opposed to wages), depreciation (other than that computed under the units-of-production method), and insurance. On a per-unit basis, a fixed cost varies inversely with changes in the level of activity: the per-unit fixed cost decreases with increases in the activity level, and increases with decreases in the activity level. If a greater proportion of capacity is used, then fixed costs per unit are lower.

To illustrate how to determine the total and unit amounts of a fixed cost, suppose that Smith Company rents for \$12,000 annually manufacturing facilities in which its operating relevant range is 0 to 8,000 mowers annually. However, if Smith Company wants to produce between 8,001 and 12,000 mowers, it can rent an adjacent building for an additional \$4,000, thus making the annual total fixed rent \$16,000 in that higher capacity range.

If the firm produces fewer than 8,001 mowers, its total fixed annual facility rental cost is \$12,000. Unit fixed cost can be found by dividing \$12,000 by the number of units produced. For instance, if 6,000 units were made, the fixed facility rental cost per mower would be \$2 ( $\$12,000 \div 6,000$  mowers).

If Smith Company rents the second facility, then total fixed rent would be \$16,000 for this new relevant range of 8,001 to 12,000 mowers annually. Suppose that Smith made 10,000 mowers in a given year. The unit fixed cost for facilities rental can be calculated as \$1.60 ( $\$16,000 \div 10,000$  mowers). The respective total cost and unit cost definitions for variable and fixed cost behaviors are presented in Exhibit 3–5.

Consider the following excerpt regarding automobile manufacturing costs and prices:

*The ultimate culprit [of widely fluctuating costs and, therefore, prices of cars], explains [Bill] Pochiluk [a partner at PriceWaterhouse Coopers LLP], is the auto industry's excess capacity. When the manufacturers can't sell as many vehicles as they can build, the fixed costs of the assembly plants drive up the cost of each vehicle. Thus, the automakers use incentives so they can sell more cars, and thus keep production up and unit costs down.<sup>4</sup>*

### fixed cost

	Total Cost	Unit Cost
Variable Cost	Varies in direct proportion to changes in activity	Is constant throughout the relevant range
Fixed Cost	Remains constant throughout the relevant range	Varies inversely with changes in activity throughout the relevant range

### EXHIBIT 3-5

Comparative Total and Unit Cost Behavior Definitions

<sup>4</sup> Al Haas, "Falling Prices Make It a Vintage Year for Used-Car Buying," *The (New Orleans) Times-Picayune* (July 3, 1998), p. F1.

In the long run, however, even fixed costs will not remain constant. Business will increase or decrease sufficiently that production capacity may be added or sold. Alternatively, management may decide to “trade” fixed and variable costs for one another. For example, if WF&B installed new more highly computerized equipment, that decision would generate an additional fixed cost for depreciation and eliminate the variable cost of some hourly production workers.

If WF&B decided to outsource its data processing support function, the company might be able to trade its fixed costs of depreciation of data processing equipment and personnel salaries for a variable cost based on transaction volume. Whether variable costs are traded for fixed or vice versa, a shift in costs from one type of cost behavior to another changes the basic cost structure of a company and can have a significant impact on profits.

### mixed cost

Other costs exist that are not strictly variable or fixed. For example, a **mixed cost** has both a variable and a fixed component. On a per-unit basis, a mixed cost does not fluctuate in direct proportion to changes in activity nor does it remain constant with changes in activity. An electric bill that is computed as a flat charge for basic service (the fixed component) plus a stated rate for each kilowatt-hour of usage (the variable component) is an example of a mixed cost. Exhibit 3–6 shows a graph for Grand Polymers’ electricity charge from its power company, which consists of \$500 per month plus \$0.018 per kilowatt-hour (kwh) used. In a month when Grand Polymers uses 80,000 kwhs of electricity, its total electricity bill is \$1,940 [ $\$500 + (\$0.018 \times 80,000)$ ]. If 90,000 kwhs are used, the electricity bill is \$2,120.

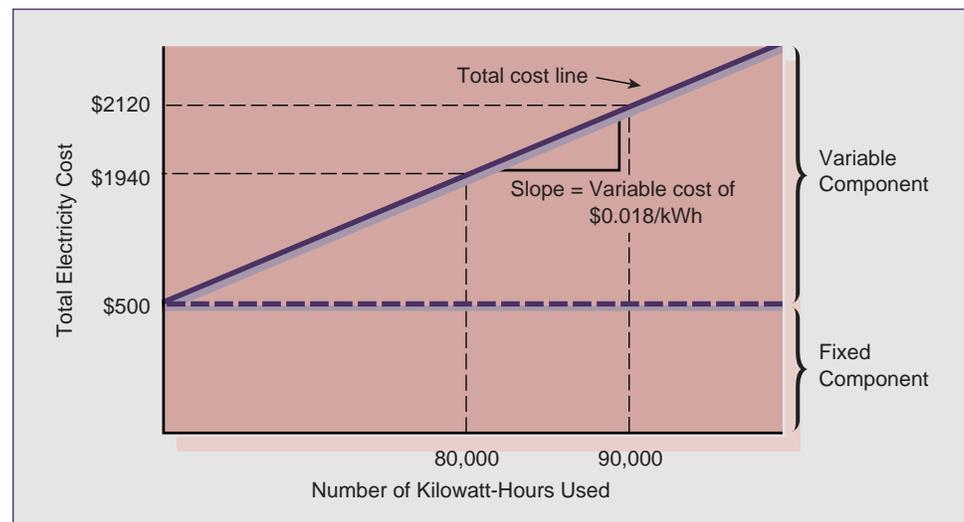
### step cost

Another type of cost shifts upward or downward when activity changes by a certain interval or “step.” A **step cost** can be variable or fixed. Step variable costs have small steps and step fixed costs have large steps. For example, a water bill computed as \$0.002 per gallon for up to 1,000 gallons, \$0.003 per gallon for 1,001 to 2,000 gallons, \$0.005 per gallon for 2,001 to 3,000 gallons, is an example of a step variable cost. In contrast, the salary cost for an airline ticket agent who can serve 3,500 customers per month is \$3,200 per month. If airline volume increases from 10,000 customers to 12,800 customers, the airline will need four ticket agents rather than three. Each additional 3,500 passengers will result in an additional step fixed cost of \$3,200.

Understanding the types of behavior exhibited by costs is necessary to make valid estimates of total costs at various activity levels. Although all costs do not

### EXHIBIT 3-6

Graph of a Mixed Cost



conform strictly to the aforementioned behavioral categories, the categories represent the types of cost behavior typically encountered in business. Cost accountants generally separate mixed costs into their variable and fixed components so that the behavior of these costs is more readily apparent. When step variable or step fixed costs exist, accountants must choose a specific relevant range of activity that will allow step variable costs to be treated as variable and step fixed costs to be treated as fixed.

By separating mixed costs into their variable and fixed components and by specifying a relevant range for step costs, accountants force all costs into either variable or fixed categories as an approximation of true cost behavior. Assuming a variable cost to be constant per unit and a fixed cost to be constant in total within the relevant range can be justified for two reasons. First, the assumed conditions approximate reality and, if the company operates only within the relevant range of activity, the cost behaviors selected are appropriate. Second, selection of a constant per-unit variable cost and a constant total fixed cost provides a convenient, stable measurement for use in planning, controlling, and decision making.

To make these generalizations about variable and fixed costs, accountants can use predictors for cost changes. A **predictor** is an activity measure that, when changed, is accompanied by consistent, observable changes in a cost item. However, simply because the two items change together does not prove that the predictor causes the change in the other item. For instance, assume that every time the mosquito control truck sprays in a particular neighborhood, the local high school principal wears a black dress. If this is consistent, observable behavior, you can use the mosquito truck spraying incident to predict that the principal will wear her black dress—but the spraying does not cause the principal to wear that black dress!

**predictor**

In contrast, a predictor that has a direct cause and effect relation to a cost is called a **cost driver**. For example, production volume has a direct effect on the total cost of raw material used and can be said to “drive” that cost. Thus, production volume can be used as a valid predictor of that cost. In most situations, the cause–effect relationship is less clear because costs are commonly caused by multiple factors. For example, factors including production volume, material quality, worker skill levels, and level of automation affect quality control costs. Although determining which factor actually caused a specific change in a quality control cost may be difficult, any of these factors could be chosen to predict that cost if confidence exists about the factor’s relationship with cost changes. To be used as a predictor, the factor and the cost need only change together in a foreseeable manner.

**cost driver**

Traditionally, a single predictor has been used to predict all types of costs. Accountants and managers, however, are realizing that single predictors do not necessarily provide the most reasonable forecasts. This realization has caused a movement toward activity-based costing (Chapter 4), which uses different cost drivers to predict different costs. Production volume, for instance, would be a valid cost driver for the cost of standard-sized containers of polyethylene material, but the number of vendors used might be a more realistic driver for WF&B’s purchasing department costs.<sup>5</sup>

## Separating Mixed Costs

As discussed earlier in this chapter, accountants assume that costs are linear rather than curvilinear. Because of this assumption, the general formula for a straight line

<sup>5</sup> Using multiple cost drivers for illustrative purposes in the text would be unwieldy. Therefore, except when topics such as activity-based costing are being discussed, examples will typically make use of a single cost driver.

can be used to describe any type of cost within a relevant range of activity. The straight-line formula is

$$y = a + bX$$

where  $y$  = total cost (dependent variable)

$a$  = fixed portion of total cost

$b$  = unit change of variable cost relative to unit changes in activity

$X$  = activity base to which  $y$  is being related (the predictor, cost driver, or independent variable)

If a cost is entirely variable, the  $a$  value in the formula will be zero. If the cost is entirely fixed, the  $b$  value in the formula will be zero. If a cost is mixed, it is necessary to determine formula values for both  $a$  and  $b$ .

4

How are the high-low method and least squares regression analysis (Appendix) used in analyzing mixed costs?

### high-low method

### outlier

### HIGH-LOW METHOD

The **high-low method** analyzes a mixed cost by first selecting two observation points in a data set: the highest and lowest levels of activity, if these points are within the relevant range. Activity levels are used because activities cause costs to change and not the reverse. Occasionally, operations may occur at a level outside the relevant range (a rush special order may be taken that requires excess labor or machine time) or distortions might occur in a normal cost within the relevant range (a leak in a water pipe goes unnoticed for a period of time). Such nonrepresentative or abnormal observations are called **outliers** and should be disregarded when analyzing a mixed cost.

Next changes in activity and cost are determined by subtracting low values from high values. These changes are used to calculate the  $b$  (variable unit cost) value in the  $y = a + bX$  formula as follows:

$$b = \frac{\text{Cost at High Activity Level} - \text{Cost at Low Activity Level}}{\text{High Activity Level} - \text{Low Activity Level}}$$

$$= \frac{\text{Change in the Total Cost}}{\text{Change in Activity Level}}$$

The  $b$  value is the unit variable cost per measure of activity. This value is multiplied by the activity level to determine the amount of total variable cost contained in total cost at either (high or low) level of activity. The fixed portion of a mixed cost is then found by subtracting total variable cost from total cost.

Total mixed cost changes with changes in activity. The change in the total mixed cost is equal to the change in activity times the unit variable cost; the fixed cost element does not fluctuate with changes in activity.

Exhibit 3–7 illustrates the high-low method using machine hours and utility cost information for the Cutting and Mounting Department of the Indianapolis Division of Alexander Polymers International. Information was gathered for the eight months prior to setting the predetermined overhead rate for 2001. During 2000, the department's normal operating range of activity was between 4,500 and 9,000 machine hours per month. For the Cutting and Mounting Department, the March observation is an outlier (substantially in excess of normal activity levels) and should not be used in the analysis of utility cost.

One potential weakness of the high-low method is that outliers may be inadvertently used in the calculation. Estimates of future costs calculated from a line drawn using such points will not be indicative of actual costs and probably are not good predictions. A second weakness is that this method considers only two data

**EXHIBIT 3-7***Analysis of Mixed Cost*

The following machine hours and utility cost information is available:

Month	Machine Hours	Utility Cost
January	4,800	\$192
February	9,000	350
March	11,000	390 <i>Outlier</i>
April	4,900	186
May	4,600	218
June	8,900	347
July	5,900	248
August	5,500	231

STEP 1: Select the highest and lowest levels of activity within the relevant range and obtain the costs associated with those levels. These levels and costs are 9,000 and 4,600 hours, and \$350 and \$218, respectively.

STEP 2: Calculate the change in cost compared to the change in activity.

	Machine Hours	Associated Total Cost
High activity	9,000	\$350
Low activity	4,600	218
Changes	<u>4,400</u>	<u>\$132</u>

STEP 3: Determine the relationship of cost change to activity change to find the variable cost element.

$$b = \$132 \div 4,400 \text{ MH} = \$0.03 \text{ per machine hour}$$

STEP 4: Compute total variable cost (TVC) at either level of activity.

$$\begin{aligned} \text{High level of activity: TVC} &= \$0.03(9,000) = \$270 \\ \text{Low level of activity: TVC} &= \$0.03(4,600) = \$138 \end{aligned}$$

STEP 5: Subtract total variable cost from total cost at the associated level of activity to determine fixed cost.

$$\begin{aligned} \text{High level of activity: } a &= \$350 - \$270 = \$80 \\ \text{Low level of activity: } a &= \$218 - \$138 = \$80 \end{aligned}$$

STEP 6: Substitute the fixed and variable cost values in the straight-line formula to get an equation that can be used to estimate total cost at any level of activity within the relevant range.

$$y = \$80 + \$0.03X$$

where  $X$  = machine hours

points. A more precise method of analyzing mixed costs is least squares regression analysis, which is presented in the Appendix at the end of this chapter.

**COMPONENTS OF PRODUCT COST**

Product costs are related to the products or services that generate an entity's revenues. These costs can be separated into three components: direct material, direct labor, and production overhead.<sup>6</sup> A **direct cost** is one that is distinctly traceable

5

What product cost categories exist and what items compose these categories?

**direct cost**

<sup>6</sup> This definition of product cost is the traditional one and is referred to as *absorption cost*. Another product costing method, called variable costing, excludes the fixed overhead component. Absorption and variable costing are compared in Chapter 11.

**cost object****indirect cost**

to a specified cost object. A **cost object** is anything of interest or useful informational value, such as a product, service, department, division, or territory. Costs that must be allocated or assigned to a cost object using one or more predictors or cost drivers are called **indirect** (or common) **costs**. Different cost objects may be designated for different decisions. As the cost object changes, the costs that are direct and indirect to it may also change. For instance, if a production division is specified as the cost object, the production division manager's salary is direct. If, instead, the cost object is a sales territory and the production division operates in more than one territory, the production division manager's salary is indirect.

## Direct Material

Any readily identifiable part of a product is called a direct material. Direct material costs theoretically should include the cost of all materials used in the manufacture of a product or performance of a service. However, some material costs are not conveniently or practically traceable from an accounting standpoint. Such costs are treated and classified as indirect costs. For example, in producing gallon-sized kitchen storage bags (see Exhibit 3-3), the polyethylene raw material, dye to highlight the bag zippers, and packaging for the bags are all costs for the materials needed in production. Because the dye cost is not easily traceable or monetarily significant to WF&B's production cost, this cost may be classified and accounted for as an indirect material and included as part of overhead.

In a service business, direct materials are often insignificant or may not be easily traced to a designated cost object. For instance, in a telephone company, the department responsible for new customer hook-ups could be designated as a cost object. Although the cost of preprinted application forms might be significant enough to trace directly to this department, the cost of other departmental supplies (such as pens, paper, and paperclips) might be relatively inconvenient to trace and thus would be treated as overhead.

Managers usually try to keep the cost of raw materials at the lowest price possible within the context of satisfactory quality. However, as indicated in the following News Note on page 91, enlightened businesspeople are now more often taking a longer run view that considers the economic health of their raw material suppliers.

## Direct Labor

Direct labor refers to the individuals who work specifically on manufacturing a product or performing a service. Another perspective of direct labor is that it directly adds value to the final product or service. The chef preparing the meals at the local restaurant and the dental hygienist at the dental clinic represent direct labor workers.

Direct labor cost consists of wages or salaries paid to direct labor employees. Such wages and salaries must also be conveniently traceable to the product or service. Direct labor cost should include basic compensation, production efficiency bonuses, and the employer's share of Social Security and Medicare taxes. In addition, if a company's operations are relatively stable, direct labor cost should include all employer-paid insurance costs, holiday and vacation pay, and pension and other retirement benefits.<sup>7</sup>

As with materials, some labor costs that theoretically should be considered direct are treated as indirect. The first reason for this treatment is that specifically tracing the particular labor costs to production may be inefficient. For instance,

<sup>7</sup> Institute of Management Accountants (formerly National Association of Accountants), *Statements on Management Accounting Number 4C: Definition and Measurement of Direct Labor Cost* (Montvale, N.J.: NAA, June 13, 1985), p. 4.

## GENERAL BUSINESS

## NEWS NOTE

**Showing Concern for Suppliers**

As farmers saw hog prices plunge to Depression-era lows this winter, they felt as if salt were being rubbed into their wounds. For even as they were losing heavily, somebody down the line—big meat packers or supermarket chains—seemed to be getting rich on pigs. The price of pork at the supermarket was staying about as high as ever.

“These big companies are essentially saying, ‘Your goods are worth \$20—we’ll pay you \$4,’” says Tom Dewig, a local businessman. “That’s what our farmers are going through.”

At his meat shop, Mr. Dewig rushed to a monitor each morning to check the price of hogs, unable to believe his eyes. “We’d sit there and look at the thing and say, ‘It can’t go any lower.’ But it did,” he says, shaking his head. “The next day, we’d say, ‘It can’t go any lower.’ But, it did again.”

Mr. Dewig had always said that no hog should sell for less than 30 cents a pound. So when the market price dipped into the mid-20s in September and October, he continued paying farmers 30, knowing that even at that price, he could profit handily. By Halloween, though, the price farmers could get elsewhere was down almost to

20 cents. Mr. Dewig finally broke his rule and started paying less than 30 cents. “I lowered my standards,” he says.

When the market fell to the teens, Mr. Dewig set himself a new floor: 20 cents a pound. But then, in mid-December, prices briefly dipped below 10 cents a pound—about a 60-year low—and Mr. Dewig lowered his standards again. Still, on a day when [another] plant was offering farmers 11.5 cents a pound, Mr. Dewig offered a nickel more.

For his hog-farmer neighbors, the above-market prices Dewig paid helped ease both losses and resentment. “He’s fair,” says Ray Rexing, who has sold hogs to Mr. Dewig since 1970.

Mr. [Joe] Knapp is of two minds. Mr. Dewig “understands we’re losing our a—and he’s making money faster than he can rake it in,” the farmer says. But the next moment, he recalls the losses Mr. Dewig himself took two or three years ago when hog farmers were doing well, and calls him a “dang good guy.”

SOURCE: Carl Quintanilla, “Hog Raiser’s Pain Puts an Old-Style Butcher on the Knife-Edge,” *The Wall Street Journal* (March 24, 1999), pp. A1, A8.

fringe benefit costs should be treated as direct labor cost, but many companies do not have stable workforces that would allow a reasonable estimate of fringe benefit costs. Alternatively, the time, effort, and cost of such tracing might not be worth the additional accuracy it would provide. Thus, the treatment of employee fringe benefits as indirect costs is often based on clerical cost efficiencies.

Second, treating certain labor costs as direct may result in erroneous information about product or service costs. Assume that WF&B employs 20 workers in its cutting room, and that these workers are paid \$8 per hour and time and a half (\$12) for overtime. One week, the employees worked a total of 1,000 hours (or 200 hours of overtime) to complete all production orders. Of the total employee labor payroll of \$8,800, only \$8,000 (1,000 hours × \$8 per hour) would be classified as direct labor cost. The remaining \$800 (200 hours × \$4 per hour) would be considered overhead. If the overtime cost were assigned to products made during the overtime hours, these products would appear to have a labor cost 50 percent greater than items made during regular working hours. Because scheduling of particular production runs is random, the items completed during overtime hours should not be forced to bear overtime charges. Therefore, costs for overtime or shift premiums are usually considered overhead rather than direct labor cost and are allocated among all units.

There are, however, some occasions when costs such as overtime should not be considered overhead. If a customer requests a job to be scheduled during overtime hours or is in a rush and requests overtime to be worked, overtime or shift premiums should be considered direct labor and be attached to the job that created the costs. Assume that, in July, the purchasing agent for People’s Seafood Stores ordered a large shipment of gallon-sized freezer bags to be delivered in

Workers who specifically work on a product should be classified as direct labor and their wages can be assigned, without any allocation method, to production.



three days for a local seafood festival. To produce this order, WF&B workers had to work overtime. People's Seafood Stores' bill for the shipment should reflect the overtime charges.

Because people historically performed the majority of production activity, direct labor once represented a primary production cost. Now, in highly automated work environments, direct labor often comprises less than 10 to 15 percent of total manufacturing cost. Soon, managers may find that almost all direct labor cost is replaced with a new production cost—the cost of robots and other fully automated machinery. Consider the accompanying News Note regarding the diminished cost and size of direct labor in the era of high technology.

6

Why and how are overhead costs allocated to products and services?

## Overhead

Overhead is any factory or production cost that is indirect to manufacturing a product or providing a service and, accordingly, does not include direct material and direct labor. Overhead does include indirect material and indirect labor as well as any and all other costs incurred in the production area.<sup>8</sup> As direct labor has become a progressively smaller proportion of product cost in recent years, overhead has become progressively larger and merits much greater attention than in the past. The following comments reflect these fundamental changes in the way manufacturing is conducted:

*Automation, technology and computerization have shifted costs, making the typical manufacturing process less labor intensive and more capital intensive. This shift has changed the cost profile of many industries. No longer do direct materials and labor costs make up the major portion of total product cost. Instead, overhead, which is shared by many products and services, is the dominant cost.<sup>9</sup>*

<sup>8</sup> Another term used for overhead is *burden*. Although this is the term under which the definition appears in SMA No. 2, *Management Accounting Terminology*, the authors believe that this term is unacceptable because it connotes costs that are extra, unnecessary, or oppressive. Overhead costs are essential to the conversion process, but simply cannot be traced directly to output.

<sup>9</sup> Sidney J. Baxendale and Michael J. Spurlock, "Does Activity-Based Cost Management Have Any Relevance for Electricity?" *Public Utilities Fortnightly* (July 15, 1997), p. 32.

## INTERNATIONAL



## NEWS NOTE

### **Firms See High-Wage Germany in A New Light**

They're still talking about it. The roof-raising ceremony for Motorola's new \$110-million cellular-telephone factory in Germany [in 1998] was one of a kind.

But how typical is Motorola with its big investment in Germany? Isn't this the land of the fading economic miracle? The place where consumer demand is flat on its back, and where no one can agree on how to bring down unemployment hovering near the double digits? Is Motorola crazy to bet on Germany? German manufacturing labor costs may be the highest in the world—more than \$31 an hour, or nearly twice the U.S. figure—and people here may regularly disappear for the world's longest vacations and sick leaves. You can't lay off thousands here in one fell swoop.

Consider Varta, a big German maker of batteries. Until last year, it was making small, rechargeable "button-cell" batteries at a big plant in Singapore, a city-state known for its disciplined work force and other competitive strengths. That plant had seven production lines and employed about 500 people.

But in 1995—way too early to be influenced by the current Asian financial upheavals—Varta decided to move its button-cell operation back home to Germany. Here, according to board member Wout van der Kooij, Varta has been able to set up far more modern machin-

ery and, beginning this year, is able to produce 50% more batteries than in Singapore in a tenth the space. Only 70 Germans will be needed to run the plant.

"If you need to pay only 70 people, then the high wage cost of Germany is not relevant anymore," Van der Kooij said. "What is relevant," he said, "is Germany's technological infrastructure: the host of skilled electrochemical engineers and related technicians available on the job market. Electrochemists are virtually nonexistent in Southeast Asia," Van der Kooij said. But with their abundance here in Germany, Varta could install its state-of-the-art equipment, confident of maintaining it, repairing it and buying needed supplies without ever leaving the company's own backyard.

Because the German working class tends to be so well-educated, [Norbert] Quinkert [Motorola Country Manager] said, "Motorola's existing cell-phone factory here has higher productivity than the company's other such plants in China, Scotland, and Illinois. The only bad mark Motorola's German plant gets," he said, "is for its high direct labor costs—but labor accounts for only 2% of the total cost of manufacturing a cellular phone."

SOURCE: Mary Williams Walsh, "Firms See High-Wage Germany in a New Light," *Los Angeles Times—Sunday Home Edition* (April 12, 1998), p. D1.

Overhead costs are either variable or fixed based on their behavior in response to changes in production volume or some other activity measure. Variable overhead includes the costs of indirect material, indirect labor paid on an hourly basis (such as wages for forklift operators, material handlers, and others who support the production, assembly, and/or service process), lubricants used for machine maintenance, and the variable portion of factory electricity charges. Depreciation calculated using either the units-of-production or service life method is also a variable overhead cost; this depreciation method reflects a decline in machine utility based on usage rather than time passage and is appropriate in an automated plant.

Fixed overhead comprises costs such as straight-line depreciation on factory plant assets, factory license fees, and factory insurance and property taxes. Fixed indirect labor costs include salaries for production supervisors, shift superintendents, and plant managers. The fixed portion of factory mixed costs (such as maintenance and utilities) is also part of fixed overhead. An example of fixed overhead for a professional sports team is depreciation of arena seating. The accompanying News Note on page 94 discusses a trend in cost management that does not sit too well with some sports fans.

One important overhead cost is the amount spent on quality. Quality is a managerial concern on two general levels. First, product or service quality from the consumer perspective is an important consideration because consumers want the best quality they can find for the money. Second, managers are concerned about production process quality because higher process quality leads to greater

<http://www.nba.com>  
<http://www.nba.com/magic>  
<http://www.nfl.com/redskins>

## NEWS NOTE



## QUALITY

**Stadium Squeeze Play**

At a time when most indoor arenas are spending millions of dollars on a slew of upgrades, from cigar bars to gourmet chow, one aspect of the fan experience is quietly shrinking: seat size. Indeed, many sports patrons are being stuffed into chairs that are about as wide as a computer keyboard, or the average coach-class airplane seat.

And it's only getting worse. A new basketball and hockey arena that's being built in Atlanta will be state-of-the-art in all respects except one: seats that could be as narrow as 18 inches in some places. Another, Denver's Pepsi Center, plans to jam in up to 30% more seats per row.

For their part, National Basketball Association teams and stadium officials say they're simply trying to keep pace with the soaring player salaries and construction costs. At today's ticket prices, one general-admission seat can generate \$1 million in revenue over a facility's lifetime, experts say. "If the Orlando Magic hadn't renovated its arena to fit an additional 2,000 seats four years ago," says team executive Pat Williams, "the Magic would have had to hike ticket prices to an untenable level."

"I know some longtime fans will never get over it," Mr. Williams says, "But without the extra seats we would have been priced out of business."

"It's like a sardine can," says a longtime Washington Redskins fan who has season tickets at the team's new Jack Kent Cooke Stadium in suburban Maryland. "It's good to have someone you love sitting next to you."

Back in Portland, Jerry Nothman, a former season ticket holder, didn't like his new basketball arena seat. Arena officials say it's possible some fans might have wound up in narrower chairs when the team moved there in 1995. But they insist that the average seat size is still pretty much the same.

But Mr. Nothman isn't buying it. And he's not buying season tickets anymore, either. Last year, he declined to renew them for the first time in 22 years. "It was insulting," he says. "I don't mind sitting on a wooden bench for \$7, but if someone is going to charge me \$60, I expect a certain comfort level."

SOURCE: Sam Walker, "Stadium Squeeze Play," *The Wall Street Journal* (March 26, 1999), pp. W1, W4. Permission conveyed through the Copyright Clearance Center.

customer satisfaction through minimizing production cycle time, cost, and defects. Both levels of quality generate costs that often total 20 to 25 percent of sales.<sup>10</sup> The two categories of quality costs are the cost of control and the cost of failure to control.

The cost of control includes prevention and appraisal costs. Prevention costs are incurred to improve quality by precluding product defects and dysfunctional processing from occurring. Amounts spent on implementing training programs, researching customer needs, and acquiring improved production equipment are prevention costs. Amounts incurred for monitoring or inspection are called appraisal costs; these costs compensate for mistakes not eliminated through prevention.

The second category of quality costs is failure costs, which may be internal (such as scrap and rework) or external (such as product returns caused by quality problems, warranty costs, and complaint department costs). Expenditures made for prevention will minimize the costs that will be incurred for appraisal and failure. Quality costs are discussed in greater depth in Chapter 8.

In manufacturing, quality costs may be variable in relation to the quantity of defective output, step fixed with increases at specific levels of defective output, or fixed. Rework cost approaches zero if the quantity of defective output is also nearly zero. However, these costs would be extremely high if the number of defective parts produced were high. In contrast, training expenditures are set by management and might not vary regardless of the quantity of defective output produced in a given period.

<sup>10</sup> "Measuring the Cost of Quality Takes Creativity" (*Grant Thornton*) *Manufacturing Issues* (Spring 1991), p. 1.

## ACCUMULATION AND ALLOCATION OF OVERHEAD

Direct material and direct labor are easily traced to a product or service. Overhead, on the other hand, must be accumulated over a period and allocated to the products manufactured or services rendered during that time. **Cost allocation** refers to the assignment of an indirect cost to one or more cost objects using some reasonable basis. This section of the chapter discusses underlying reasons for cost allocation, use of predetermined overhead rates, separation of mixed costs into variable and fixed elements, and capacity measures that can be used to compute predetermined overhead rates.

### cost allocation

### Why Overhead Costs Are Allocated

Many accounting procedures are based on allocations. Cost allocations can be made over several time periods or within a single time period. For example, in financial accounting, a building's cost is allocated through depreciation charges over its useful or service life. This process is necessary to fulfill the matching principle. In cost accounting, production overhead costs are allocated within a period through the use of predictors or cost drivers to products or services. This process reflects application of the cost principle, which requires that all production or acquisition costs attach to the units produced, services rendered, or units purchased.

Overhead costs are allocated to cost objects for three reasons: (1) to determine a full cost of the cost object, (2) to motivate the manager in charge of the cost object to manage it efficiently, and (3) to compare alternative courses of action for management planning, controlling, and decision making.<sup>11</sup> The first reason relates to financial statement valuations. Under generally accepted accounting principles (GAAP), "full cost" must include allocated production overhead. In contrast, the assignment of nonfactory overhead costs to products is not normally allowed under GAAP.<sup>12</sup> The other two reasons for overhead allocations are related to internal purposes and, thus, no hard-and-fast rules apply to the overhead allocation process.

Regardless of why overhead costs are allocated, the method and basis of the allocation process should be rational and systematic so that the resulting information is useful for product costing and managerial purposes. Traditionally, the information generated for satisfying the "full cost" objective was also used for the second and third objectives. However, because the first purpose is externally focused and the others are internally focused, different methods can be used to provide different costs for different needs.

### Predetermined Overhead Rates

In an **actual cost system**, actual direct material and direct labor costs are accumulated in Work in Process Inventory as the costs are incurred. Actual production overhead costs are accumulated separately in an Overhead Control account and are assigned to Work in Process Inventory at the end of a period or at completion of production.

### actual cost system

The use of an actual cost system is generally considered to be less than desirable because all production overhead information must be available before any cost allocation can be made to products or services. For example, the cost of products and services produced in May could not be calculated until the May electricity bill is received in June.

<sup>11</sup> Institute of Management Accountants, *Statements on Management Accounting Number 4B: Allocation of Service and Administrative Costs* (Montvale, N.J.: NAA, June 13, 1985), pp. 9–10.

<sup>12</sup> Although potentially unacceptable for GAAP, certain nonfactory overhead costs must be assigned to products for tax purposes.

**normal cost system****predetermined overhead rate**

An alternative to an actual cost system is a **normal cost system**, which uses actual direct material and direct labor costs and a predetermined overhead (OH) rate or rates. A **predetermined overhead rate** (or overhead application rate) is a budgeted and constant charge per unit of activity that is used to assign overhead cost from an Overhead Control account to Work in Process Inventory for the period's production or services.

Three primary reasons exist for using predetermined overhead rates in product costing. First, a predetermined rate allows overhead to be assigned during the period to the goods produced or services rendered. Thus, a predetermined overhead rate improves the timeliness (though it reduces the precision) of information.

Second, predetermined overhead rates compensate for fluctuations in actual overhead costs that are unrelated to activity. Overhead may vary monthly because of seasonal or calendar factors. For example, factory utility costs may be highest in the summer. If monthly production were constant and actual overhead were assigned to production, the increase in utilities would cause product cost per unit to be higher in the summer than in the rest of the year. If a company produced 3,000 units of its sole product in each of the months of April and July but utilities were \$600 in April and \$900 in July, then the average actual utilities cost per unit for April would be \$0.20 ( $\$600 \div 3,000$  units) and \$0.30 ( $\$900 \div 3,000$ ) in July. Although one such cost difference may not be significant, numerous differences of this type could cause a large distortion in unit cost.

Third, predetermined overhead rates overcome the problem of fluctuations in activity levels that have no impact on actual fixed overhead costs. Even if total production overhead were the same for each period, changes in activity would cause a per-unit change in cost because of the fixed cost element of overhead. If a company incurred \$600 utilities cost in each of October and November but produced 3,750 units of product in October and 3,000 units of product in November, its average actual unit cost for utilities would be \$0.16 ( $\$600 \div 3,750$  units) in October but \$0.20 ( $\$600 \div 3,000$  units) in November. Although one such overhead cost difference caused by fluctuation in production activity may not be significant, numerous differences of this type could cause a large distortion in unit cost. Use of an annual, predetermined overhead rate would overcome the variations demonstrated by the examples above through application of a uniform rate of overhead to all units produced throughout the year.

To calculate a predetermined OH rate, divide the total budgeted overhead cost at a specific activity level by the related activity level for a specific period:

$$\text{Predetermined OH Rate} = \frac{\text{Total Budgeted OH Cost at a Specified Activity Level}}{\text{Volume of Specified Activity Level}}$$

Overhead cost and its related activity measure are typically budgeted for one year "unless the production/marketing cycle of the entity is such that the use of a longer or shorter period would clearly provide more useful information."<sup>13</sup> For example, the use of a longer period would be appropriate in a company engaged in activities such as constructing ships, bridges, or high-rise office buildings.

A company should use an activity base that is logically related to overhead cost incurrence. The activity base that may first be considered is production volume, but this base is reasonable if the company manufactures only one type of product or renders only one type of service. If multiple products or services exist, a summation of production volumes cannot be made to determine "activity" because of the heterogeneous nature of the items.

To most effectively allocate overhead to heterogeneous products, a measure of activity must be determined that is common to all output. The activity base

<sup>13</sup> Institute of Management Accountants, *Statements on Management Accounting Number 2G: Accounting for Indirect Production Costs* (Montvale, N.J.: NAA, June 1, 1987), p. 11.

should be a cost driver that directly causes the incurrence of overhead costs. Direct labor hours and direct labor dollars have been commonly used measures of activity; however, the deficiencies caused by using these bases are becoming more apparent as companies become increasingly automated. Using direct labor to allocate overhead costs in automated plants results in extremely high overhead rates because the costs are applied over a smaller number of labor hours (or dollars). In automated plants, machine hours may be more appropriate for allocating overhead than either direct labor base. Other traditional measures include number of purchase orders and product-related physical characteristics such as tons or gallons. Additionally, innovative new measures for overhead allocation include number or time of machine setups, number of parts, quantity of material handling time, and number of product defects.

**APPLYING OVERHEAD TO PRODUCTION**

The predetermined overhead rates are used throughout the year to apply overhead to Work in Process Inventory. Overhead may be applied as production occurs, when goods or services are transferred out of Work in Process Inventory, or at the end of each month. Under real-time systems in use today, overhead is frequently applied continuously. **Applied overhead** is the amount of overhead assigned to Work in Process Inventory as a result of incurring the activity that was used to develop the application rate. Application is made using the predetermined rate(s) and the actual level(s) of activity.

**applied overhead**

Overhead can be recorded either in separate accounts for actual and applied overhead or in a single account. If actual and applied accounts are separated, the applied account is a contra account to the actual overhead account and is closed against it at year-end. The alternative, more convenient, recordkeeping option is to maintain one general ledger account that is debited for actual overhead costs and credited for applied overhead. This method is used throughout the text.

Additionally, overhead may be recorded in a single overhead account or in separate accounts for the variable and fixed components. Exhibit 3-8 presents the alternative overhead recording possibilities.

If separate rates are used to apply variable and fixed overhead, the general ledger would most commonly contain separate variable and fixed overhead accounts. When separate accounts are used, mixed costs must be separated into their variable and fixed components or assigned to either the variable or fixed overhead general ledger account. Because overhead costs in an automated factory represent an ever larger part of product cost, the benefits of separating costs according to their behavior are thought to be greater than the time and effort expended to make that separation.

**EXHIBIT 3-8**

*Cost Accounting System Possibilities for Manufacturing Overhead*

Separate Accounts For Actual & Applied and For Variable & Fixed		Combined Accounts For Actual & Applied; Separate Accounts For Variable & Fixed		Combined Account For Actual & Applied and For Variable & Fixed	
<b>VOH Actual</b>		<b>VOH Applied</b>		<b>VOH</b>	
XXX			YYY	Actual XXX	Applied YYY
<b>FOH Actual</b>		<b>FOH Applied</b>		<b>FOH</b>	
XX			YY	Actual XX	Applied YY
				<b>Manufacturing Overhead</b>	
				Total actual XXX	Total applied YYY
				XX	YY

Regardless of the number (combined or separate) or type (plantwide or departmental) of predetermined overhead rates used, actual overhead costs are debited to the appropriate overhead general ledger account(s) and credited to the various sources of overhead costs. Applied overhead is debited to Work in Process Inventory and credited to the overhead general ledger account(s). Actual activity causes actual overhead costs to be incurred and overhead to be applied to Work in Process Inventory. Thus, actual and applied overhead costs are both related to actual activity, and only by actual activity are they related to each other.

Assume that during March 2001, the Cutting and Mounting Department incurs 5,000 machine hours. Actual variable and fixed overhead costs for the month were \$10,400 and \$7,300, respectively. Assume also that applied variable overhead for March is \$10,000 ( $5,000 \times \$2.00$ ) and applied fixed overhead is \$7,150 ( $5,000 \times \$1.43$ ). The journal entries to record actual and applied overhead for March 2001 are

Variable Manufacturing Overhead	10,400	
Fixed Manufacturing Overhead	7,300	
Various Accounts		17,700
To record actual manufacturing overhead.		
Work in Process Inventory	17,150	
Variable Manufacturing Overhead		10,000
Fixed Manufacturing Overhead		7,150
To apply variable and fixed manufacturing overhead to WIP.		

**underapplied overhead**

**overapplied overhead**

At year-end, actual overhead will differ from applied overhead and the difference is referred to as underapplied or overapplied overhead. **Underapplied overhead** means that the overhead applied to Work in Process Inventory is less than actual overhead; **overapplied overhead** means that the overhead applied to Work in Process Inventory is greater than actual overhead. Underapplied or overapplied overhead must be closed at year-end because a single year's activity level was used to determine the overhead rate(s).

7

What causes underapplied or overapplied overhead and how is it treated at the end of a period?

#### DISPOSITION OF UNDERAPPLIED AND OVERAPPLIED OVERHEAD

Disposition of underapplied or overapplied overhead depends on the significance of the amount involved. If the amount is immaterial, it is closed to Cost of Goods Sold. When overhead is underapplied (debit balance), an insufficient amount of overhead was applied to production and the closing process causes Cost of Goods Sold to increase. Alternatively, overapplied overhead (credit balance) reflects the fact that too much overhead was applied to production, so closing overapplied overhead causes Cost of Goods Sold to decrease. To illustrate this entry, note that the Cutting and Mounting Department has an overhead credit balance at year-end of \$40,000 in Manufacturing Overhead as presented in the upper left section of Exhibit 3-9; we first assume this amount to be immaterial for *illustrative purposes*. The journal entry to close overapplied overhead that is assumed to be immaterial is

Manufacturing Overhead	40,000	
Cost of Goods Sold		40,000

If the amount of underapplied or overapplied overhead is significant, it should be allocated among the accounts containing applied overhead: Work in Process Inventory, Finished Goods Inventory, and Cost of Goods Sold. A significant amount of underapplied or overapplied overhead means that the balances in these accounts are quite different from what they would have been if actual overhead costs had been assigned to production. Allocation restates the account balances to conform more closely to actual historical cost as required for external reporting by generally accepted accounting principles. Exhibit 3-9 uses assumed data for the Cutting and Mounting Department to illustrate the proration of overapplied overhead among the necessary accounts; had the amount been underapplied, the accounts debited

**EXHIBIT 3-9***Proration of Overapplied Overhead*

Manufacturing Overhead		Account Balances	
Actual	\$220,000	Work in Process Inventory	\$ 45,640
Applied	<u>260,000</u>	Finished Goods Inventory	78,240
Overapplied	<u>\$ 40,000</u>	Cost of Goods Sold	528,120

1. Add balances of accounts and determine proportional relationships:

	Balance	Proportion	Percentage
Work in Process	\$ 45,640	$\$45,640 \div \$652,000$	7
Finished Goods	78,240	$\$78,240 \div \$652,000$	12
Cost of Goods Sold	<u>528,120</u>	$\$528,120 \div \$652,000$	<u>81</u>
Total	<u>\$652,000</u>		<u>100</u>

2. Multiply percentages times overapplied overhead amount to determine the amount of adjustment needed:

	Account %	×	Overapplied OH	=	Adjustment Amount
Work in Process	7	×	\$40,000	=	\$ 2,800
Finished Goods	12	×	\$40,000	=	\$ 4,800
Cost of Goods Sold	81	×	\$40,000	=	\$32,400

3. Prepare journal entry to close manufacturing overhead account and assign adjustment amount to appropriate accounts:

Manufacturing Overhead	40,000	
Work in Process Inventory		2,800
Finished Goods Inventory		4,800
Cost of Goods Sold		32,400

and credited in the journal entry would be the reverse of that presented for overapplied overhead. A single overhead account is used in this illustration.

*Theoretically*, underapplied or overapplied overhead should be allocated based on the amounts of applied overhead contained in each account rather than on total account balances. Use of total account balances could cause distortion because they contain direct material and direct labor costs that are not related to actual or applied overhead. In spite of this potential distortion, use of total balances is more common *in practice* for two reasons. First, the theoretical method is complex and requires detailed account analysis. Second, overhead tends to lose its identity after leaving Work in Process Inventory, thus making more difficult the determination of the amount of overhead in Finished Goods Inventory and Cost of Goods Sold account balances.

### ALTERNATIVE CAPACITY MEASURES

One primary cause of underapplied or overapplied overhead is a difference in budgeted and actual costs. Another cause is a difference in the level of activity or capacity chosen to compute the predetermined overhead and the actual activity incurred. **Capacity** refers to a measure of production volume or some other activity base. Alternative measures of activity include theoretical, practical, normal, and expected capacity.

The estimated maximum potential activity for a specified time is the **theoretical capacity**. This measure assumes that all factors are operating in a technically and humanly perfect manner. Theoretical capacity disregards realities such as machinery breakdowns and reduced or stopped plant operations on holidays. Choice of this level of activity provides a probable outcome of a material amount of underapplied overhead cost.

**capacity**

**theoretical capacity**

**practical capacity****normal capacity****expected capacity**

Reducing theoretical capacity by ongoing, regular operating interruptions (such as holidays, downtime, and start-up time) provides the **practical capacity** that could be achieved during regular working hours. Consideration of historical and estimated future production levels and the cyclical fluctuations provides a **normal capacity** measure that encompasses the long run (5 to 10 years) average activity of the firm. This measure represents a reasonably attainable level of activity, but will not provide costs that are most similar to actual historical costs. Thus, many firms use expected annual capacity as the selected measure of activity. **Expected capacity** is a short-run concept that represents the anticipated activity level of the firm for the upcoming period, based on projected product demand. It is determined during the budgeting process conducted in preparation of the master budget for that period. The process for preparing the master budget is presented in Chapter 13. If actual results are close to budgeted results (in both dollars and volume), this measure should result in product costs that most closely reflect actual costs and, thus, an immaterial amount of underapplied or overapplied overhead.<sup>14</sup>

## ACCUMULATION OF PRODUCT COSTS—ACTUAL COST SYSTEM

---

Product costs can be accumulated using either a perpetual or a periodic inventory system. In a perpetual inventory system, all product costs flow through Work in Process Inventory to Finished Goods Inventory and, ultimately, to Cost of Goods Sold. The perpetual system continuously provides current information for financial statement preparation and for inventory and cost control. Because the costs of maintaining a perpetual system have diminished significantly as computerized production, bar coding, and information processing have become more pervasive, this text assumes that all companies discussed use a perpetual system.

The Midwestern Polyethylene Products Corporation is used to illustrate the flow of product costs in a manufacturing organization. The April 1, 2001, inventory account balances for Midwestern were as follows: Raw Material Inventory (all direct), \$73,000; Work in Process Inventory, \$145,000; and Finished Goods Inventory, \$87,400. Midwestern uses separate variable and fixed accounts to record the incurrence of overhead. In this illustration, actual overhead costs are used to apply overhead to Work in Process Inventory. However, an additional, brief illustration applying predetermined overhead in a normal cost system is presented in the section following the current illustration. The following transactions keyed to the journal entries in Exhibit 3–10 represent Midwestern's activity for April.

During the month, Midwestern's purchasing agent bought \$280,000 of direct materials on account (entry 1), and the warehouse manager transferred \$284,000 of materials into the production area (entry 2). Production wages for the month totaled \$530,000, of which \$436,000 was for direct labor (entry 3). April salaries for the production supervisor was \$20,000 (entry 4). April utility cost of \$28,000 was accrued; analyzing this cost indicated that \$16,000 was variable and \$12,000 was fixed (entry 5). Supplies costing \$5,200 were removed from inventory and placed into the production process (entry 6). Also, Midwestern paid \$7,000 for April's property taxes on the factory (entry 7), depreciated the factory assets \$56,880 (entry 8), and recorded the expiration of \$3,000 of prepaid insurance on the factory assets (entry 9). Entry 10 shows the application of actual overhead to Work in Process Inventory for, respectively, variable and fixed overhead for Midwestern during April. During April, \$1,058,200 of goods were completed and transferred to

<sup>14</sup> Except where otherwise noted in the text, expected annual capacity has been chosen as the basis to calculate the predetermined fixed manufacturing overhead rate because it is believed to be the most prevalent practice. This choice, however, may not be the most effective for planning and control purposes as is discussed further in Chapter 10 with regard to standard cost variances.

**EXHIBIT 3-10**

*Midwestern Polyethylene  
Products Corporation—  
April 2001 Journal Entries*

(1)	Raw Materials Inventory	280,000	
	Accounts Payable		280,000
	To record cost of direct materials purchased on account.		
(2)	Work in Process Inventory	284,000	
	Raw Materials Inventory		284,000
	To record direct materials transferred to production.		
(3)	Work in Process Inventory	436,000	
	Variable Overhead Control	94,000	
	Salaries & Wages Payable		530,000
	To accrue factory wages for direct and indirect labor.		
(4)	Fixed Overhead Control	20,000	
	Salaries & Wages Payable		20,000
	To accrue production supervisors salaries.		
(5)	Variable Overhead Control	16,000	
	Fixed Overhead Control	12,000	
	Utilities Payable		28,000
	To record mixed utility cost in its variable and fixed amounts.		
(6)	Variable Overhead Control	5,200	
	Supplies Inventory		5,200
	To record supplies used.		
(7)	Fixed Overhead Control	7,000	
	Cash		7,000
	To record payment for factory property taxes for the period.		
(8)	Fixed Overhead Control	56,880	
	Accumulated Depreciation—Equipment		56,880
	To record depreciation on factory assets for the period.		
(9)	Fixed Overhead Control	3,000	
	Prepaid Insurance		3,000
	To record expiration of prepaid insurance on factory assets.		
(10)	Work in Process Inventory	214,080	
	Variable Overhead Control		115,200
	Fixed Overhead Control		98,880
	To record the application of actual overhead costs to Work in Process Inventory.		
(11)	Finished Goods Inventory	1,058,200	
	Work in Process Inventory		1,058,200
	To record the transfer of work completed during the period.		
(12)	Accounts Receivable	1,460,000	
	Sales		1,460,000
	To record the selling price of goods sold on account during the period.		
(13)	Cost of Goods Sold	1,054,000	
	Finished Goods Inventory		1,054,000
	To record cost of goods sold for the period.		

Finished Goods Inventory (entry 11). Sales of \$1,460,000 on account were recorded during the month (entry 12); the goods that were sold had a total cost of \$1,054,000 (entry 13). An abbreviated presentation of the cost flows is shown in selected T-accounts in Exhibit 3-11.

**EXHIBIT 3-11**

Selected T-Accounts for  
Midwestern Polyethylene  
Products Corporation

<b>Raw Materials Inventory</b>				<b>Variable Overhead Control</b>			
Beg. bal.	73,000	(2)	284,000	(3)	94,000	(10)	115,200
(1)	280,000			(5)	16,000		
				(6)	5,200		
End. bal.	69,000						
<b>Work in Process Inventory</b>				<b>Fixed Overhead Control</b>			
Beg. bal.	145,000	(11)	1,058,200	(4)	20,000	(10)	98,880
(2) DM	284,000			(5)	12,000		
(3) DL	436,000			(7)	7,000		
(10) OH	214,080			(8)	56,880		
				(9)	3,000		
End. bal.	20,880						
<b>Finished Goods Inventory</b>				<b>Cost of Goods Sold</b>			
Beg. bal.	87,400	(13) CGS	1,054,000	(13) CGS	1,054,000		
(11) CGM	1,058,200						
End. bal.	91,600						

## COST OF GOODS MANUFACTURED AND SOLD

8

How is cost of goods  
manufactured calculated?

### cost of goods manufactured

The T-accounts in Exhibit 3-11 provide detailed information about the cost of materials used, goods transferred from work in process, and goods sold. This information is needed to prepare financial statements. Because most managers do not have access to the detailed accounting records, they need to have the flow of costs and the calculation of important income statement amounts presented in a formalized manner. Therefore, a schedule of **cost of goods manufactured** (CGM) is prepared as a preliminary step to the determination of cost of goods sold (CGS).<sup>15</sup> CGM is the total production cost of the goods that were completed and transferred to Finished Goods Inventory during the period. This amount is similar to the cost of net purchases in the cost of goods sold schedule for a retailer.

Formal schedules of cost of goods manufactured and cost of goods sold are presented in Exhibit 3-12 using the amounts shown in Exhibits 3-10 and 3-11. The schedule of cost of goods manufactured starts with the beginning balance of Work in Process (WIP) Inventory and details all product cost components. The cost of materials used in production during the period is equal to the beginning balance of Raw Materials Inventory plus raw materials purchased minus the ending balance of Raw Materials Inventory. If Raw Materials Inventory includes both direct and indirect materials, the cost of direct material used is assigned to WIP Inventory and the cost of indirect materials used is included in variable overhead. Because direct labor cannot be warehoused, all charges for direct labor during the period are part of WIP Inventory. Variable and fixed overhead costs are added to direct material and direct labor costs to determine total manufacturing costs.

Beginning Work in Process Inventory cost is added to total current period manufacturing costs to obtain a subtotal amount that can be referred to as "total costs to account for." The value of ending WIP Inventory is calculated (through techniques discussed later in the text) and subtracted from the subtotal to provide the cost of goods manufactured during the period. The schedule of cost of

<sup>15</sup> A service business prepares a schedule of cost of services rendered.

**EXHIBIT 3-12**

*Cost of Goods Manufactured  
and Cost of Goods Sold  
Schedules*

**MIDWESTERN POLYETHYLENE PRODUCTS CORPORATION**  
Schedule of Cost of Goods Manufactured  
For the Month Ended April 30, 2001

Beginning balance of Work in Process, 4/1/01			\$ 145,000
Manufacturing costs for the period:			
Raw materials (all direct):			
Beginning balance	\$ 73,000		
Purchases of materials	280,000		
Raw materials available	<u>\$353,000</u>		
Ending balance	<u>69,000</u>		
Total raw materials used		\$284,000	
Direct labor		436,000	
Variable overhead:			
Indirect labor	\$ 94,000		
Utilities	16,000		
Supplies	<u>5,200</u>	115,200	
Fixed overhead:			
Supervisor's salary	\$ 20,000		
Utilities	12,000		
Factory property taxes	7,000		
Factory asset depreciation	56,880		
Factory insurance	<u>3,000</u>	<u>98,880</u>	
Total current period manufacturing costs			<u>934,080</u>
Total costs to account for			\$1,079,080
Ending work in process, 4/30/01			(20,880)
Cost of goods manufactured			<u>\$1,058,200</u>

**MIDWESTERN POLYETHYLENE PRODUCTS CORPORATION**  
Schedule of Cost of Goods Sold  
For the Month Ended April 30, 2001

Beginning Finished Goods, 4/1/01	\$ 87,400
Cost of Goods Manufactured	<u>1,058,200</u>
Cost of Goods Available for Sale	\$1,145,600
Ending Finished Goods, 4/30/01	(91,600)
Cost of Goods Sold	<u>\$1,054,000</u>

goods manufactured is usually prepared only as an internal schedule and is not provided to external parties.

In the schedule of cost of goods sold, cost of goods manufactured is added to the beginning balance of Finished Goods (FG) Inventory to find the cost of goods available for sale during the period. The ending FG Inventory is calculated by multiplying a physical unit count times a unit cost. If a perpetual inventory system is used, the actual amount of ending FG Inventory can be compared to that which should be on hand based on the finished goods account balance recorded at the end of the period. Any differences can be attributed to losses that might have arisen from theft, breakage, evaporation, or accounting errors. Ending Finished Goods Inventory is subtracted from the cost of goods available for sale to determine cost of goods sold.

## **ACCUMULATION OF PRODUCT COSTS—NORMAL COST SYSTEM**

In a normal cost system, only entry 10, which applies overhead to WIP Inventory, is different from that presented in Exhibit 3-10. Assume, for the purpose of illustrating what happens using a normal cost system, that the predetermined variable

overhead rate is \$2.40 per machine hour, that the predetermined fixed overhead rate is \$2.04 per machine hour and that 48,000 machine hours were incurred by Midwestern in April. These statistics are used to exactly match the information in the actual cost illustration above and for simplifying the illustration by precluding the presence of under- or overapplied overhead for April at Midwestern.

However, predetermined overhead most often does not match actual overhead. Monthly under- or overapplied overhead that does occur is accumulated and disposed of at year-end in the manner described earlier in this chapter. In a normal cost system, entry 10 of Exhibit 3–10 is the only entry that is different from its counterpart in an actual cost system because, instead of applying actual overhead, predetermined overhead is applied to WIP Inventory. Although the numbers appear to be the same amounts in this simplified case as in the original entry 10, the manner in which they are derived is entirely different (and in a realistic setting, the dollar amounts are virtually always different). In a normal cost setting, the credits to the variable and fixed overhead accounts are calculated as follows:

$$\begin{aligned}\text{Variable overhead credit} &= \$2.40 \times 48,000 \text{ machine hours} \\ &= \underline{\$115,200}\end{aligned}$$

$$\begin{aligned}\text{Fixed overhead credit} &= \$2.06 \times 48,000 \text{ machine hours} \\ &= \underline{\$98,880}\end{aligned}$$

The debit to WIP Inventory is the sum of these two credits:

$$\text{WIP Inventory debit} = \$115,200 + \$98,880 = \underline{\underline{\$214,080}}$$

The complete entry follows:

10) Work in Process Inventory	214,080	
Variable Overhead Control		115,200
Fixed Overhead Control		98,880
To record the application of <i>predetermined</i> overhead costs to WIP Inventory.		

Some accountants prefer to streamline the presentation of the Schedule of Cost of Goods Manufactured and Sold when perpetual inventory accounting is used. Such an alternative is presented in Exhibit 3–13; in addition, the use of normal costing supports condensing the overhead presentation further.

### EXHIBIT 3-13

*Cost of Goods Manufactured and Cost of Goods Sold Schedules*

MIDWESTERN POLYETHYLENE PRODUCTS CORPORATION	
Schedule of Cost of Goods Manufactured	
For the Month Ended April 30, 2001	
Beginning balance of Work in Process, 4/1/01	\$ 145,000
Manufacturing costs for the period:	
Total raw materials used	\$284,000
Direct labor	436,000
Variable overhead applied	115,200
Fixed overhead applied	<u>98,880</u>
Total current period manufacturing costs	934,080
Total costs to account for	\$1,079,080
Ending Work in Process, 4/30/01	<u>(20,880)</u>
Cost of goods manufactured	<u>\$1,058,200</u>
	<i>(continued)</i>

**MIDWESTERN POLYETHYLENE PRODUCTS CORPORATION**  
 Schedule of Cost of Goods Sold  
 For the Month Ended April 30, 2001

Beginning Finished Goods, 4/1/01	\$ 87,400
Cost of Goods Manufactured	1,058,200
Cost of Goods Available for Sale	<u>\$1,145,600</u>
Ending Finished Goods, 4/30/01	(91,600)
Cost of Goods Sold	<u>\$1,054,000</u>

**EXHIBIT 3-13***(Concluded)***REVISITING****Wisconsin  
Film & Bag**

**W**isconsin Film & Bag has grown 500 percent since Jack Riopelle, president and chief operating officer, helped purchase the firm in 1993. The workforce has expanded from 43 employees in 1993 to 285 employees in 1999 currently. At that time WF&B annual sales exceed \$30 million.

WF&B's vision statement is as follows:

*Wisconsin Film & Bag will become the standard by which our competitors measure themselves. We intend to be known as the company people want to work for, buy from and sell to. This will be accomplished by achieving the following:*

1. *We will maintain a consistent attitude toward employee involvement and incorporate unconditional integrity in all interactions with customers, suppliers, employees, shareholders and the community.*
2. *We are committed to sustained, profitable growth with a dedication toward excellence in quality, service and creativity. We will also commit human and capital resources to improve our quality, control costs, and expand our capabilities to meet our customers' needs.*
3. *We will strive for preferred vendor status from each of our customers and universal respect from all our competitors.*
4. *We will become an industry leader by making environmentally conscious decisions in everything we do.*

There is much evidence that the firm is progressing toward this vision. Not only has the firm grown at a fast pace, but it has also tried to be a good environmental neighbor and a good citizen.

The firm's first repelletizer, which repelletizes production scrap and purchased film scrap, was installed in May 1995. This has allowed the firm to reuse its own internally generated scrap and to use purchased scrap from outside sources, saving over \$100,000 annually in raw material cost for production of "non-food-grade" products.

When WF&B recently opened its Hartland, Wisconsin facility, it had trouble staffing manufacturing operations because Western Waukesha County is a white-collar community. So the firm tapped into the area's long-term unemployed, providing assistance in locating competent day care, reliable transportation, and training in life skills such as reading a ruler, using a calculator, looking someone in the eyes while talking, and budgeting paychecks. New employees receive company T-shirts so they're dressed the same as the old-timers. WF&B assigns a 24-hour "Retention Specialist" to each new hire to help resolve personal issues.

In 1999, WF&B received two awards: "Employer of the Year" from the Private Industry Council of Waukesha-Ozaukee-Washington counties and one of the 15 "Exemplary Employers" in the State of Wisconsin at the Sixth Annual Governor's Employment and Training Conference.

## CHAPTER SUMMARY

This chapter presents a variety of definitions and classifications of cost.

Historical, replacement, and budgeted costs are typically associated with time. Historical costs are used for external financial statements; replacement and budgeted costs are more often used by managers in conducting their planning, controlling, and decision-making functions.

Variable, fixed, mixed, and step costs describe cost behavior within the context of a relevant range. Total variable cost varies directly and proportionately with changes in activity; variable costs are constant on a per-unit basis. Costs that remain constant in total, regardless of changes in activity, are fixed. On a per-unit basis, fixed costs vary inversely with activity changes. Mixed costs contain both a variable and fixed component and are usually separated (using the high-low method or least squares regression analysis) into these components for product costing and management's uses. Step costs can be variable or fixed, depending on the size of the "step" change (small or large, respectively) that occurs relative to the change in activity. Accountants select a relevant range that allows step variable costs to be treated as variable and step fixed costs to be treated as fixed.

For financial statements, costs are either considered unexpired and reported on the balance sheet as assets, or expired and reported on the income statement as expenses or losses. Costs may also be viewed as product or period costs. Product costs are inventoried and include direct material, direct labor, and manufacturing overhead. When the products are sold, these costs expire and become cost of goods sold expense. Period costs are incurred outside the production area and are usually associated with the functions of selling, administrating, and financing.

Costs are also said to be direct or indirect relative to a cost object. The material and labor costs of production that are physically and conveniently traceable to products are direct costs. All other costs incurred in the production area are indirect and are referred to as manufacturing overhead.

The extensive activity required to convert raw materials into finished goods distinguishes manufacturers and service companies from retailers. This conversion process necessitates that all factory costs be accumulated and reported as product costs under accrual accounting.

A predetermined overhead rate is calculated by dividing the upcoming period's budgeted overhead costs by a selected level of activity. (Budgeted overhead costs at various levels of activity are shown on a flexible budget, which is discussed in Chapter 10 on standard costing.) Predetermined overhead rates eliminate the problems caused by delays in obtaining actual cost data, make the overhead allocation process more effective, and allocate a uniform amount of overhead to goods or services based on related production efforts.

The activity base chosen to compute a predetermined overhead rate should be logically related to cost changes and be a direct causal factor of that cost (a cost driver) rather than simply a predictor. Units of output are a valid measure only if the company produces a single product.

When a company uses a predetermined overhead rate, underapplied or overapplied overhead results at the end of the year. This amount (if insignificant) should be closed to Cost of Goods Sold or (if significant) allocated among Work in Process Inventory, Finished Goods Inventory, and Cost of Goods Sold.

An internal management report, known as the cost of goods manufactured schedule, traces the flow of costs into the production area and through conversion into finished goods. This report provides the necessary information to prepare the cost of goods sold section of a manufacturer's income statement.

## APPENDIX

### Plantwide versus Departmental Overhead Application Rates

The Indianapolis Division of Alexander Polymers International is used to illustrate the calculation of a single, plantwide overhead application rate. This division contains two departments (Cutting and Mounting, and Packaging). At the end of 2000, division management budgets its 2001 activity level at 75,000 machine hours and manufacturing overhead costs at \$399,750. If a plantwide predetermined overhead application rate is calculated on per machine hour:

$$\begin{aligned}\text{Plantwide OH Rate} &= \frac{\text{Total Budgeted OH Cost at a Specific Activity Level}}{\text{Volume of Specified Activity Level}} \\ &= \frac{\$399,750}{75,000 \text{ MH}} \\ &= \$5.33\end{aligned}$$

Although a single plantwide overhead rate can be computed, such a process is frequently not adequate. In most companies, work is performed differently in different departments or organizational units. For example, although machine hours may be an appropriate activity base in a highly automated department, direct labor hours (DLHs) may be better for assigning overhead in a labor-intensive department. In the quality control area, number of defects may provide the best allocation base. Thus, because homogeneity is more likely within a department than among departments, separate departmental rates are generally thought to provide managers more useful information than plantwide rates.

Exhibit 3–14 presents the calculations of separate departmental and plantwide overhead rates for the Indianapolis Division of Alexander Polymers International. The Cutting and Mounting Department is highly automated and, therefore, uses machine hours as its overhead cost driver. In contrast, the Packaging Department is more labor intensive and uses DLHs.

### Least Squares Regression Analysis

**Least squares regression analysis** is a statistical technique that analyzes the relationship between dependent and independent variables. Least squares is used to develop an equation that predicts an unknown value of a **dependent variable**

**least squares regression analysis**  
**dependent variable**

	Cutting and Mounting	Packaging
Budgeted annual overhead	\$240,100	\$159,650
Budgeted annual direct labor hours (DLHs)	5,400	20,600
Budgeted annual machine hours (MHs)	70,000	5,000
Departmental overhead rates:		
Cutting and Mounting (automated): \$240,100 ÷ 70,000 MHs = \$3.43 per MH		
Packaging (manual): \$159,650 ÷ 20,600 DLHs = \$7.75 per DLH		
Total plantwide overhead = \$240,100 + \$159,650 = \$399,750		
Plantwide overhead rate (using DLHs): \$399,750 ÷ 26,000 DLHs = \$15.375 per DLH		
Plantwide overhead rate (using MHs): \$399,750 ÷ 75,000 MHs = \$5.33 per MH		

#### EXHIBIT 3-14

*Departmental versus Plantwide Overhead Rates*

**independent variable**

(cost) from the known values of one or more **independent variables** (activity). When multiple independent variables exist, least squares regression also helps to select the independent variable that is the best predictor of the dependent variable. For example, managers can use least squares to decide whether machine hours, direct labor hours, or pounds of material moved best explain and predict changes in a specific overhead cost.<sup>16</sup>

**simple regression**

**Simple regression** analysis uses one independent variable to predict the dependent variable. Simple linear regression uses the  $y = a + bX$  formula for a straight line. In **multiple regression**, two or more independent variables are used to predict the dependent variable. All examples in this appendix use simple regression and assume that a linear relationship exists between variables so that each one-unit change in the independent variable produces a constant unit change in the dependent variable.<sup>17</sup>

**multiple regression****regression line**

The least squares method mathematically fits the best possible regression line to observed data points. A **regression line** is any line that goes through the means (or averages) of the independent and dependent variables in a set of observations. Numerous straight lines can be drawn through any set of data observations, but most of these lines would provide a poor fit. Least squares regression analysis finds the line of “best fit” for the observed data.

This line of best fit is found by predicting the  $a$  and  $b$  values in a straight-line formula using the actual activity and cost values ( $y$  values) from the observations. The equations necessary to compute  $b$  and  $a$  values using the method of least squares are as follows<sup>18</sup>:

$$b = \frac{\sum xy - n(\bar{x})(\bar{y})}{\sum x^2 - n(\bar{x})^2}$$

$$a = \bar{y} - b\bar{x}$$

where

$\bar{x}$  = mean of the independent variable

$\bar{y}$  = mean of the dependent variable

$n$  = number of observations

Using the Cutting and Mounting Department data for the Indianapolis Division of Alexander Polymers International (presented in the chapter in Exhibit 3–7 and excluding the March outlier), the following calculations can be made:

$x$	$y$	$xy$	$x^2$
4,800	\$ 192	\$ 921,600	23,040,000
9,000	350	3,150,000	81,000,000
4,900	186	911,400	24,010,000
4,600	218	1,002,800	21,160,000
8,900	347	3,088,300	79,210,000
5,900	248	1,463,200	34,810,000
5,500	231	1,270,500	30,250,000
<u>43,600</u>	<u>\$1,772</u>	<u>\$11,807,800</u>	<u>293,480,000</u>

<sup>16</sup> Further discussion of finding independent variable(s) that best predict the value of the dependent variable can be found in most textbooks on statistical methods treating regression analysis under the headings of dispersion, coefficient of correlation, coefficient of determination, or standard error of the estimate.

<sup>17</sup> Curvilinear relationships between variables also exist. For example, quality defects (dependent variable) tend to increase at an increasing rate in relationship to machinery age (independent variable).

<sup>18</sup> These equations are derived from mathematical computations beyond the scope of this text, but which are found in many statistics books. The symbol  $\sum$  means “the summation of.”

The mean of  $x$  ( $\bar{x}$ ) is 6,228.57 ( $43,600 \div 7$ ) and the mean of  $y$  ( $\bar{y}$ ) is \$253.14 ( $\$1,772 \div 7$ ). Thus,

$$\begin{aligned} b &= \frac{11,807,800 - 7(6,228.57)(\$253.14)}{293,480,000 - 7(6,228.57)(6,228.57)} \\ &= \frac{\$770,898.53}{21,914,410.29} \\ &= \$0.035 \\ a &= \$253.14 - \$0.035(6,228.57) \\ &= \$35.14 \end{aligned}$$

Thus, the  $b$  (variable cost) and  $a$  (fixed cost) values for the department's utility costs are \$0.035 and \$35.14, respectively.

By using these values, predicted costs ( $y_c$  values) can be computed for each actual activity level. The line that is drawn through all of the  $y_c$  values will be the line of best fit for the data. Because actual costs do not generally fall directly on the regression line and predicted costs naturally do, there are differences between these two costs at their related activity levels. It is acceptable for the regression line not to pass through any or all of the actual observation points because the line has been determined to mathematically "fit" the data.

## KEY TERMS

- |  |                                     |
|--|-------------------------------------|
| actual cost system (p. 95)                 | manufacturer (p. 79)                |
| applied overhead (p. 97)                   | mixed cost (p. 86)                  |
| capacity (p. 99)                           | multiple regression (p. 108)        |
| conversion cost (p. 78)                    | normal capacity (p. 100)            |
| cost (p. 77)                               | normal cost system (p. 96)          |
| cost allocation (p. 95)                    | outlier (p. 88)                     |
| cost driver (p. 87)                        | overapplied overhead (p. 98)        |
| cost object (p. 90)                        | overhead (p. 78)                    |
| cost of goods manufactured (p. 102)        | period cost (p. 78)                 |
| dependent variable (p. 107)                | practical capacity (p. 100)         |
| direct cost (p. 89)                        | predetermined overhead rate (p. 96) |
| direct labor (p. 78)                       | predictor (p. 87)                   |
| direct material (p. 78)                    | product cost (p. 78)                |
| distribution cost (p. 78)                  | regression line (p. 108)            |
| expected capacity (p. 100)                 | relevant range (p. 84)              |
| expired cost (p. 77)                       | service company (p. 79)             |
| fixed cost (p. 85)                         | simple regression (p. 108)          |
| high-low method (p. 88)                    | step cost (p. 86)                   |
| historical cost (p. 98)                    | theoretical capacity (p. 99)        |
| independent variable (p. 108)              | underapplied overhead (p. 98)       |
| indirect cost (p. 90)                      | unexpired cost (p. 77)              |
| inventoriable cost (p. 78)                 | variable cost (p. 84)               |
| least squares regression analysis (p. 107) |                                     |

## SOLUTION STRATEGIES

### Predetermined Overhead Rate

$$\text{Predetermined OH Rate} = \frac{\text{Total Budgeted Overhead Cost}}{\text{Total Budgeted Level of Volume or Activity}}$$

(Can be separate variable and fixed rates or a combined rate)

### High-Low Method

(Using assumed amounts)

	(Independent Variable) Activity	(Dependent Variable) Associated Total Cost	–	Total Variable Cost – (Rate × Activity)	=	Total Fixed Cost
“High” level	14,000	\$18,000	–	\$11,200	=	\$6,800
“Low” level	9,000	14,000	–	7,200	=	6,800
Differences	5,000	\$ 4,000				

\$0.80 variable cost per unit of activity

### Least Squares Regression Analysis

The equations necessary to compute  $b$  and  $a$  values using the method of least squares are as follows:

$$b = \frac{\sum xy - n(\bar{x})(\bar{y})}{\sum x^2 - n(\bar{x})^2}$$

$$a = \bar{y} - b\bar{x}$$

where

$\bar{x}$  = mean of the independent variable

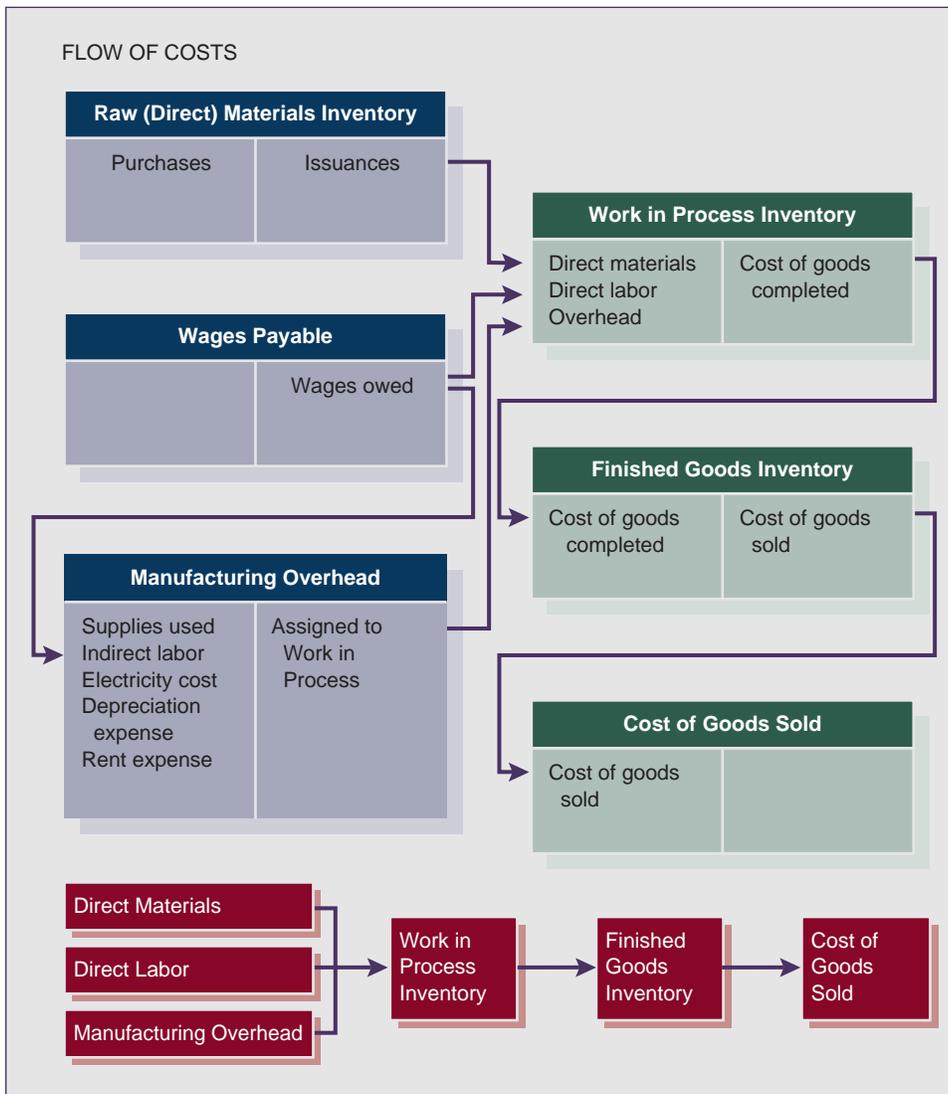
$\bar{y}$  = mean of the dependent variable

$n$  = number of observations

### Underapplied and Overapplied Overhead

Overhead Control	XXX	
Various accounts		XXX
Actual overhead is debited to the overhead general ledger account.		
Work in Process Inventory	YYY	
Overhead Control		YYY
Applied overhead is debited to WIP and credited to the overhead general ledger account.		

A debit balance in Manufacturing Overhead at the end of the period is underapplied overhead; a credit balance is overapplied overhead. The debit or credit balance in the overhead account is closed at the end of the period to CGS or prorated to WIP, FG, and CGS.



### Cost of Goods Manufactured

Beginning balance of Work in Process Inventory			\$XXX
Manufacturing costs for the period:			
Raw materials (all direct):			
Beginning balance	\$XXX		
Purchases of materials	XXX		
Raw materials available for use	<u>\$XXX</u>		
Ending balance	(XXX)		
Direct materials used		\$XXX	
Direct labor		XXX	
Variable overhead		XXX	
Fixed overhead		<u>XXX</u>	
Total current period manufacturing costs			XXX
Total costs to account for			<u>\$XXX</u>
Ending balance of Work in Process Inventory			(XXX)
Cost of goods manufactured			<u>\$XXX</u>

### Cost of Goods Sold

Beginning balance of Finished Goods Inventory	\$XXX
Cost of goods manufactured	<u>XXX</u>
Cost of goods available for sale	\$XXX
Ending balance of Finished Goods Inventory	<u>(XXX)</u>
Cost of goods sold	<u>\$XXX</u>

### DEMONSTRATION PROBLEM

BagsSoStrong Company had the following account balances as of August 1, 2001:

Raw Materials (direct and indirect) Inventory	\$ 9,300
Work in Process Inventory	14,000
Finished Goods Inventory	18,000

During August, the company incurred the following factory costs:

- Purchased \$82,000 of raw materials on account.
- Issued \$90,000 of raw materials, of which \$67,000 were direct to the product.
- Factory payroll of \$44,000 was accrued; \$31,000 was for direct labor and the rest was for supervisors.
- Utility costs were accrued at \$3,500; of these costs, \$800 were fixed.
- Property taxes on the factory were accrued in the amount of \$1,000.
- Prepaid insurance of \$800 on factory equipment expired in August.
- Straight-line depreciation on factory equipment was \$20,000.
- Predetermined overhead of \$62,500 (\$28,000 variable and \$34,500 fixed) was applied to Work in Process Inventory.
- Goods costing \$170,000 were transferred to Finished Goods Inventory.
- Sales on account totaled \$350,000.
- Cost of goods sold was \$175,000.
- Selling and administrative costs were \$140,000 (credit "Various Accounts").
- Ending Work in Process Inventory is \$3,300.

#### Required:

- a. Journalize the transactions for August.
- b. Prepare a schedule of cost of goods manufactured for August using normal costing.
- c. Prepare an income statement, including a detailed schedule of cost of goods sold.

#### Solution to Demonstration Problem

a. (1)	Raw Materials Inventory	82,000	
	Accounts Payable		82,000
(2)	Work in Process Inventory	67,000	
	Variable Overhead Control	23,000	
	Raw Materials Inventory		90,000
(3)	Work in Process Inventory	31,000	
	Fixed Overhead Control	13,000	
	Salaries and Wages Payable		44,000
(4)	Variable Overhead Control	2,700	
	Fixed Overhead Control	800	
	Utilities Payable		3,500

(5) Fixed Overhead Control	1,000	
Property Taxes Payable		1,000
(6) Fixed Overhead Control	800	
Prepaid Insurance		800
(7) Fixed Overhead Control	20,000	
Accumulated Depreciation—Factory Equipment		20,000
(8) Work in Process Inventory	62,500	
Variable Overhead Control		28,000
Fixed Overhead Control		34,500
(9) Finished Goods Inventory	171,200	
Work in Process Inventory		171,200
(10) Accounts Receivable	350,000	
Sales		350,000
(11) Cost of Goods Sold	175,000	
Finished Goods Inventory		175,000
(12) Selling & Administrative Expenses	140,000	
Various Accounts		140,000

**b.** **BAGSSOSTRONG**  
Cost of Goods Manufactured Schedule  
For Month Ended August 31, 2001

Balance of Work in Process Inventory, 8/1/01		\$ 14,000
Manufacturing costs for the period:		
Raw materials:		
Beginning balance	\$ 9,300	
Purchases of materials	82,000	
Raw materials available	<u>\$91,300</u>	
Indirect materials used	\$23,000	
Ending balance	<u>1,300</u>	(24,300)
Total direct materials used		<u>\$67,000</u>
Direct labor		31,000
Variable overhead		28,000
Fixed overhead		<u>34,500</u>
Total current period manufacturing costs		<u>160,500</u>
Total costs to account for		<u>\$174,500</u>
Balance of Work in Process Inventory, 8/31/01		(3,300)
Cost of goods manufactured*		<u>\$171,200</u>

\*During August, factory overhead was overapplied by \$1,200. Underapplied or overapplied overhead is accumulated throughout the year and disposed of at year end.

**c.** **BAGSSOSTRONG**  
Income Statement  
For the Month Ended August 31, 2001

Sales		\$350,000
Cost of Goods Sold		
Finished Goods, 8/1/01	\$ 18,000	
Cost of Goods Manufactured	<u>171,200</u>	
Cost of Goods Available	<u>\$189,200</u>	
Finished Goods, 8/31/01	<u>(13,000)</u>	
Cost of Goods Sold		<u>(176,200)</u>
Gross Margin		<u>\$173,800</u>
Selling & Administrative Expenses		<u>(140,000)</u>
Income from Operations		<u>\$ 33,800</u>

**QUESTIONS**

1. Distinguish among the cost accounting uses of historical costs, replacement costs, and budgeted costs.
2. How does a company determine its relevant range of activity? Of what use to managers is the concept of a relevant range of activity?
3. Why is a cost referred to as variable if it remains constant per unit for all volume levels within the relevant range?
4. Would it be true that fixed costs will never change in an organization? Explain the rationale for your answer.
5. What is the difference between a variable and a mixed cost, given that each changes in total with changes in activity levels?
6. How do predictors and cost drivers differ? Why is such a distinction important?
7. The high-low method of analyzing mixed costs uses only two observation points: the high and the low points of activity. Are these always the best points for prediction purposes? Why or why not?
8. Relative to a set of data observations, what is an outlier? Why is it inappropriate to use outliers to determine the cost formula for a mixed cost?
9. What is a product cost? What types of costs are included in product costs for retailers, manufacturers, and service companies?
10. What is a period cost? What types of costs are included in period costs for retailers, manufacturers, and service companies?
11. Are all product costs unexpired costs and all period costs expired costs? Explain.
12. How is the concept of a direct cost related to that of a cost object?
13. Why are some material and labor costs that should, in theory, be considered direct costs instead accounted for as indirect costs?
14. What is the process of conversion and why does this process create a need for cost accounting?
15. What inventory accounts are shown on the balance sheet of a manufacturer and what information is contained in each of these accounts?
16. Is allocation of manufacturing overhead to products necessary for external reporting purposes? Internal purposes? Provide explanations for your answers.
17. Compare and contrast a normal cost system and an actual cost system. Relative to an actual cost system, what are the advantages associated with the use of a normal cost system? What are the disadvantages?
18. Discuss the reasons a company would use a predetermined overhead rate rather than apply actual overhead to products or services.
19. When a normal cost system is used, how are costs removed from a single Manufacturing Overhead account and charged to Work in Process Inventory?
20. What recordkeeping options are available to account for overhead costs in a normal cost system? Which would be easiest? Which would provide the best information and why?
21. If overhead was materially underapplied for a year, how would it be treated at year-end? Why is this treatment appropriate?
22. What factors can cause overhead to be underapplied or overapplied? Are all of these factors controllable by management? Why or why not?
23. Why can it be said that the cost of goods manufactured schedule shows the flow of production costs in a manufacturing company?
24. Why is the amount of cost of goods manufactured different from the amount of cost of goods sold? Could there be a situation in which these amounts are equal? If so, explain.
25. (*Appendix*) Why are departmental overhead rates more useful for managerial decision making than plantwide rates? Separate variable and fixed rates rather than total rates?

26. (*Appendix*) Why would regression analysis provide a more accurate cost formula for a mixed cost than the high-low method?
27. Using the Internet, find an article about costs. List and define as many different types of costs from the article as you can.



## EXERCISES

28. (*Terminology*) Match the following lettered terms on the left with the appropriate numbered description on the right.
- |                       |   |
|-----------------------|---|
| a. Budgeted cost      | 1. An expense or loss   |
| b. Direct cost        | 2. A cost that remains constant on a per-unit basis                                     |
| c. Distribution cost  | 3. A cost associated with a specific cost object  |
| d. Expired cost       | 4. Direct material, direct labor, and manufacturing overhead                            |
| e. Fixed cost         | 5. Product cost   |
| f. Inventoriable cost | 6. A cost that varies inversely on a per-unit basis with changes in activity            |
| g. Period cost        | 7. A cost primarily associated with the passage of time rather than production activity |
| h. Product cost       | 8. An expected future cost  |
| i. Variable cost      | 9. A cost of transporting a product   |
29. (*Cost classifications*) Indicate whether each item listed below is a variable (V), fixed (F), or mixed (M) cost and whether it is a product or service (PT) cost or a period (PD) cost. If some items have alternative answers, indicate the alternatives and the reasons for them.
- Wages of forklift operators who move finished goods from a central warehouse to the loading dock.
  - Paper towels used in factory restrooms.
  - Insurance premiums paid on the headquarters of a manufacturing company.
  - Columnar paper used in an accounting firm.
  - Cost of labels attached to shirts made by a company.
  - Wages of factory maintenance workers.
  - Property taxes on a manufacturing plant.
  - Salaries of secretaries in a law firm.
  - Freight costs of acquiring raw materials from suppliers.
  - Cost of wax to make candles.
  - Cost of radioactive material used to generate power in a nuclear power plant.
30. (*Company type*) Indicate whether each of the following terms is associated with a manufacturing (Mfg.), a retailing or merchandising (Mer.), or a service (Ser.) company. There can be more than one correct answer for each term.
- Prepaid rent
  - Merchandise inventory
  - Cost of goods sold
  - Sales salaries expense
  - Finished goods inventory
  - Depreciation—factory equipment
  - Cost of services rendered
  - Auditing fees expense
  - Direct labor wages

31. (*Degrees of conversion*) Indicate whether each of the following types of organizations is characterized by a high, low, or moderate degree of conversion.
- Bakery in a grocery store
  - Convenience store
  - Christmas tree farm
  - Textbook publisher
  - Sporting goods retailer
  - Auto manufacturer
  - Cranberry farm
  - Custom print shop
  - Italian restaurant
  - Concert ticket seller

32. (*Cost behavior*) O'Malley Company produces baseball caps. The company incurred the following costs to produce 2,000 caps last month:

Cardboard for the bills	\$ 1,200
Cloth materials	2,000
Plastic for headband straps	1,500
Straight-line depreciation	1,800
Supervisors' salaries	4,800
Utilities	900
Total	<u>\$12,200</u>

- What did each cap component cost on a per-unit basis?
  - What is the probable type of behavior that each of the costs exhibits?
  - The company expects to produce 2,500 caps this month. Would you expect each type of cost to increase or decrease? Why? Why can't the total cost of 2,500 caps be determined?
33. (*Cost behavior*) The Hudson Company manufactures high-pressure garden hoses. Costs incurred in the production process include a rubber material used to make the hoses, steel mesh used in the hoses, depreciation on the factory building, and utilities to run production machinery. Graph the most likely cost behavior for each of these costs and show what type of cost behavior is indicated by each cost.
34. (*Total cost determination with mixed cost*) Heathcliff Accounting Services pays \$400 per month for a tax software license. In addition, variable charges average \$15 for every tax return the firm prepares.
- Determine the total cost and the cost per unit if the firm expects to prepare the following number of tax returns in March 2000:
    - 150
    - 300
    - 600
  - Why does the cost per unit change in each of the three cases above?
35. (*High-low method*) Information about Brightman Corporation's utility cost for the first six months of 2001 follows. The company's cost accountant wants to use the high-low method to develop a cost formula to predict future charges and believes that the number of machine hours is an appropriate cost driver.

Month	Machine Hours	Utility Expense
January	68,000	\$1,220
February	62,000	1,172
March	66,300	1,014
April	64,000	1,195
May	67,500	1,300
June	62,500	1,150

- a. What is the cost formula for utility expense?
- b. What would be the budgeted utility cost for September 2001 if 64,750 machine hours are projected?
36. (*High-low method*) The Evanstonian builds tabletop replicas of some of the most famous lighthouses in North America. The company is highly automated and, thus, maintenance cost is a significant organizational expense. The company's owner has decided to use machine hours as a basis for predicting maintenance costs and has gathered the following data from the prior eight months of operations:

Number of Machine Hours	Maintenance Costs
3,000	\$980
4,500	690
8,000	510
7,000	600
6,000	550
9,000	440
3,500	840
5,500	600

- a. Using the high-low method, determine the cost formula for maintenance costs.
- b. What aspect of the estimated equation is bothersome? Provide an explanation for this situation.
- c. Within the relevant range, can the formula be reliably used to predict maintenance costs? Can the  $a$  and  $b$  values in the cost formula be interpreted as fixed and variable costs? Why or why not?
37. (*Predictors and cost drivers; team activity*) Accountants often use factors that change in a consistent pattern with costs to explain or predict cost behavior.
- a. As a team of three or four, select factors to predict or explain the behavior of the following costs:
- Salesperson's travel expenses
  - Raw material costs at a pizza restaurant
  - Paper costs in a College of Business
  - Maintenance costs for a lawn service company
- b. Prepare a presentation of your chosen factors that also addresses whether the factors could be used as cost drivers in addition to predictors.
38. (*Direct vs. indirect costs*) Babin Cutlery Inc. manufactures kitchen knives. Following are some costs incurred in the factory in 2000 for knife production:

Material Costs:	
Stainless steel	\$400,000
Equipment oil and grease	8,000
Plastic and fiberglass for handles	15,000
Wooden knife racks for customer storage	9,200
Labor Costs:	
Equipment operators	\$200,000
Equipment mechanics	50,000
Factory supervisors	118,000

- a. What is the direct material cost for 2000?
- b. What is the direct labor cost for 2000?
- c. What are the indirect material and total indirect labor overhead costs for 2000?
39. (*Direct vs. indirect costs*) Midwestern State University's College of Business has five departments: Accounting, Finance, Management, Marketing, and Decision Sciences. Each department chairperson is responsible for the department's

budget preparation. Indicate whether each of the following costs incurred in the Marketing Department is direct or indirect to the department:

- a. Chairperson's salary
  - b. Cost of computer time of campus mainframe used by members of the department
  - c. Marketing faculty salaries
  - d. Cost of equipment purchased by the department from allocated state funds
  - e. Cost of travel by department faculty paid from externally generated funds contributed directly to the department
  - f. Cost of secretarial salaries (secretaries are shared by the entire college)
  - g. Depreciation allocation of the college building cost for the number of offices used by department faculty
  - h. Cost of periodicals/books purchased by the department
40. (*Labor cost classification*) House & Home Inc. produces a variety of household products. The firm operates 24 hours per day with three daily work shifts. The first-shift workers receive "regular pay." The second shift receives a 10 percent pay premium, and the third shift receives a 20 percent pay premium. In addition, when production is scheduled on weekends, the firm pays an overtime premium of 50 percent (based on the pay rate for first-shift employees). Labor premiums are included in overhead. The August 2001 factory payroll is as follows:

Total wages for August for 18,000 hours	\$168,000
Normal hourly wage for Shift #1 employees	\$8
Total regular hours worked, split evenly among the three shifts	15,000

- a. How many overtime hours were worked in August?
  - b. How much of the total labor cost should be charged to direct labor? To overhead?
  - c. What amount of overhead was for second- and third-shift premiums? For overtime premiums?
41. (*Product and period costs*) Alexander Company incurred the following costs in August 2000:
- Paid a six-month premium for insurance of company headquarters, \$12,000.
  - Paid three months of property taxes on its factory building, \$7,500.
  - Paid a \$40,000 bonus to the company president.
  - Accrued \$10,000 of utility costs, of which 30 percent was for the headquarters and the remainder for the factory.
- a. What expired period cost is associated with the August information?
  - b. What unexpired period cost is associated with the August information?
  - c. What product cost is associated with the August information?
  - d. Discuss why the product cost cannot be described specifically as expired or unexpired in this situation.
42. (*Essay*) A portion of the costs incurred by business organizations is designated as direct labor cost. As used in practice, the term *direct labor cost* has a wide variety of meanings. Unless the meaning intended in a given context is clear, misunderstanding and confusion are likely to ensue. If a user does not understand the elements included in direct labor cost, erroneous interpretations of the numbers may occur and could result in poor management decisions.
- In addition to understanding the conceptual definition of direct labor cost, management accountants must understand how direct labor cost should be measured.
- Write a paper that discusses the following issues:
- a. Distinguish between direct labor and indirect labor.
  - b. Discuss why some nonproductive labor time (such as coffee breaks, personal time) can be and often is treated as direct labor, whereas other nonproductive time (such as downtime or training) is treated as indirect labor.

- c. Following are labor cost elements that a company has classified as direct labor, manufacturing overhead, or either direct labor or manufacturing overhead, depending on the situation.
- *Direct labor:* Included in the company's direct labor are cost production efficiency bonuses and certain benefits for direct labor workers such as FICA (employer's portion), group life insurance, vacation pay, and workers' compensation insurance.
  - *Manufacturing overhead:* Included in the company's overhead are costs for wage continuation plans in the event of illness, the company-sponsored cafeteria, the personnel department, and recreational facilities.
  - *Direct labor or manufacturing overhead:* Included in the "situational" category are maintenance expense, overtime premiums, and shift premiums.

Explain the rationale used by the company in classifying the cost elements in each of the three presented categories.

- d. The two aspects of measuring direct labor costs are (1) the quantity of labor effort that is to be included, that is, the types of hours that are to be counted; and (2) the unit price by which each of these quantities is multiplied to arrive at a monetary cost. Why are these considered separate and distinct aspects of measuring labor cost? *(CMA adapted)*
43. (*Predetermined overhead rate*) Walton Company has developed a monthly overhead cost formula of  $\$2,760 + \$4$  per direct labor hour for 2000. The firm's 2000 expected annual capacity is 24,000 direct labor hours, to be incurred evenly each month. Two direct labor hours are required to make one unit of the company's product.
- a. Determine the total overhead to be applied to each unit of product in 2000.
  - b. Prepare journal entries to record the application of overhead to Work in Process Inventory and the incurrence of \$10,430 of actual overhead in a month in which 1,850 direct labor hours were worked.
44. (*Overhead application*) Brooke & Associates applies overhead at a combined rate for fixed and variable overhead of 175 percent of professional labor costs. During the first three months of 2000, the following professional labor costs and actual overhead costs were incurred:



Month	Professional Labor Cost	Actual Overhead
January	\$270,000	\$480,000
February	247,500	427,800
March	255,000	450,000

- a. How much overhead was applied to the services provided each month by the firm?
  - b. What was underapplied or overapplied overhead for each of the three months and for the quarter?
45. (*Underapplied or overapplied overhead*) At the end of 2000, Schmitt Corporation has the following account balances:

Manufacturing Overhead (credit)	\$ 20,000
Work in Process Inventory	128,000
Finished Goods Inventory	32,000
Cost of Goods Sold	240,000

- a. Prepare the necessary journal entry to close the overhead account if the balance is considered immaterial.
- b. Prepare the necessary journal entry to close the overhead account if the balance is considered material.
- c. Which method do you feel is more appropriate for the company and why?

46. (*Underapplied or overapplied overhead*) Hume Company uses a normal cost system. At year-end, the balance in the manufacturing overhead control account is a \$50,000 debit. Information concerning relevant account balances at year-end is as follows:

	Work in Process	Finished Goods	Cost of Goods Sold
Direct materials	\$20,000	\$ 40,000	\$ 60,000
Direct labor	10,000	20,000	25,000
Factory overhead	<u>20,000</u>	<u>40,000</u>	<u>50,000</u>
	<u>\$50,000</u>	<u>\$100,000</u>	<u>\$135,000</u>

- What overhead rate was used during the year?
  - Provide arguments to be used for deciding whether to prorate the balance in the overhead account at year-end.
  - Prorate the overhead account balance based on the relative balances of the appropriate accounts.
  - Prorate the overhead account balance based on the relative overhead components of the appropriate account balances.
  - Identify some possible reasons why the company had a debit balance in the overhead account at year-end.
47. (*CGM and CGS*) Holiday Products Company had the following inventory balances at the beginning and end of March 2000:

	March 1, 2000	March 31, 2000
Raw Materials Inventory	\$12,000	\$16,000
Work in Process Inventory	68,000	84,000
Finished Goods Inventory	32,000	24,000

All raw materials are direct to the production process. The following information is also available about March manufacturing costs:

Cost of raw materials used	\$128,000
Direct labor cost	162,000
Factory overhead	116,000

- Calculate the cost of goods manufactured for March.
  - Determine the cost of goods sold for March.
48. (*Cost of services rendered*) The following information is related to the Perrfect Veterinary Clinic for April 2001, the firm's first month in operation:

Veterinarian salaries for April	\$12,000
Assistants' salaries for April	4,200
Medical supplies purchased in April	1,800
Utilities for month (80 percent related to animal treatment)	900
Office salaries for April (20 percent related to animal treatment)	2,600
Medical supplies on hand at April 30	800
Depreciation on medical equipment for April	600
Building rental (70 percent related to animal treatment)	700

Compute the cost of services rendered.



49. (*CGM and CGS*) Cathy's Custom Clocks' August 2001 cost of goods sold was \$2,300,000. August 31 work in process was 40 percent of the August 1 work

in process. Overhead was 225 percent of direct labor cost. During August, \$768,500 of direct materials were purchased. Other August information follows:

Inventories	August 1, 2001	August 31, 2001
Direct materials	\$ 30,000	\$42,000
Work in process	90,000	?
Finished goods	125,000	98,000

- Prepare a schedule of the cost of goods sold for August.
  - Prepare the August cost of goods manufactured schedule.
  - What was the amount of direct production costs incurred in August?
  - What was the amount of conversion costs incurred in August?
50. (*Financial statement classifications*) Cajun Airboats purchased a plastics extruding machine for \$100,000 to make boat hulls. During its first operating year, the machine produced 5,000 units and depreciation was calculated to be \$12,500 on the machine. The company sold 4,000 of the hulls.
- What part of the \$100,000 machine cost is expired?
  - Where would each of the amounts related to this machine appear on the financial statements?
51. (*Appendix–Least squares*) Below are data on number of shipments received and the cost of receiving reports for Pacific Supply Company for the first seven weeks of 2000:

Number of Shipments Received	Cost of Receiving Report
100	\$175
87	162
80	154
70	142
105	185
115	200
120	202

- Using the least squares method, develop the equation for predicting weekly receiving report costs based on the number of shipments received.
  - What is the predicted amount of receiving report costs for a month (assume a month is exactly four weeks) in which 390 shipments are received?
52. (*Appendix–Least squares*) Tom's Charters operates a fleet of powerboats in Fort Myers, Florida. Tom wants to develop a cost formula for labor costs (a mixed cost). He has gathered the following data on labor costs and two potential predictive bases: number of charters and gross receipts:



Month	Labor Costs	Number of Charters	Gross Receipts
January	\$16,000	10	\$ 12,000
February	18,400	14	18,000
March	24,000	22	26,000
April	28,400	28	36,000
May	37,000	40	60,000
June	56,000	62	82,000
July	68,000	100	120,000
August	60,000	90	100,000
September	48,000	80	96,000

Using the least squares method, develop a labor cost formula using each prediction base.

## PROBLEMS

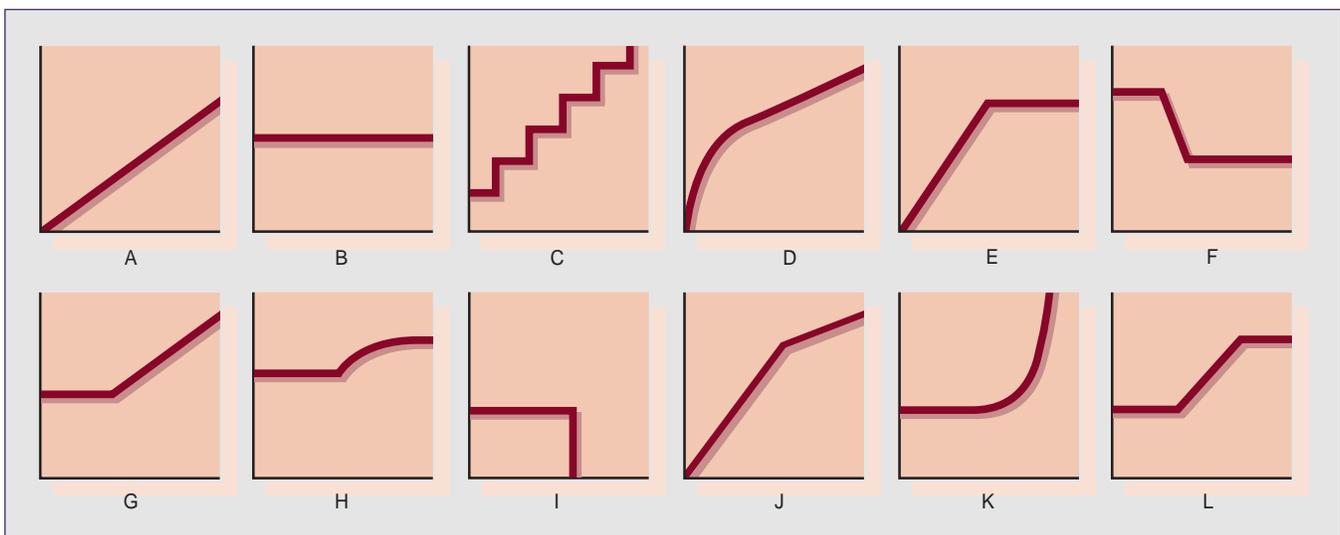
- 53.** (*Cost behavior*) Officestuff Ink makes stationery sets. In an average month, the firm produces 200,000 boxes of stationery; each box contains 50 pages of stationery and 40 envelope sets. Production costs are incurred for paper, ink, glue, and boxes. The company manufactures this product in batches of 500 boxes of a specific stationery design. The following data have been extracted from the company's accounting records for April 2000:

Cost of paper for each batch	\$10
Cost of ink and glue for each batch	1
Cost of 500 boxes for each batch	32
Direct labor for producing each batch	16
Labor costs for each batch design	40

Overhead charges total \$20,400 per month; these are considered fully fixed for purposes of cost estimation.

- a. What is the cost per box of stationery based on average production volume?
  - b. If sales volume increases to 300,000 boxes per month, what will be the cost per box (assuming that cost behavior patterns remain the same as in April)?
  - c. If sales are 300,000 boxes per month but the firm does not want the cost per box to exceed its current level [based on part (a) above], what amount can the company pay for labor design costs, assuming all other costs are the same as April levels?
  - d. Assume that Officestuff Ink is now able to sell, on average, each box of stationery at a price of \$5. If the company is able to increase its volume to 300,000 boxes per month, what sales price per box will generate the same gross margin that the firm is now achieving on 200,000 boxes per month?
  - e. Would it be possible to lower total costs by producing more boxes per batch, even if the total volume of 200,000 is maintained? Explain.
- 54.** (*Cost behavior*) A company's cost structure may contain numerous different cost behavior patterns. Below are descriptions of several different costs; match these to the appropriate graphs. On each graph, the vertical axis represents cost and the horizontal axis represents level of activity or volume.

Identify, by letter, the graph that illustrates each of the following cost behavior patterns. Graphs can be used more than once.



1. Cost of raw materials, where the cost decreases by \$0.06 per unit for each of the first 150 units purchased, after which it remains constant at \$2.75 per unit.
2. City water bill, which is computed as follows:

First 750,000 gallons or less	\$1,000 flat fee
Next 15,000 gallons	\$0.002 per gallon used
Next 15,000 gallons	\$0.005 per gallon used
Next 15,000 gallons	\$0.008 per gallon used
Etc.	Etc.

3. Rent on a factory building donated by the city, where the agreement provides for a fixed-fee payment, unless 250,000 labor hours are worked, in which case no rent needs to be paid.
  4. Cost of raw materials used.
  5. Electricity bill—a flat fixed charge of \$250 plus a variable cost after 150,000 kilowatt-hours are used.
  6. Salaries of maintenance workers if one maintenance worker is needed for every 1,000 hours or less of machine time.
  7. Depreciation of equipment using the straight-line method.
  8. Rent on a factory building donated by the county, where the agreement provides for a monthly rental of \$100,000 less \$1 for each labor hour worked in excess of 200,000 hours. However, a minimum rental payment of \$20,000 must be made each month.
  9. Rent on a machine that is billed at \$1,000 for up to 500 hours of machine time. After 500 hours of machine time, an additional charge of \$1 per hour is paid up to a maximum charge of \$2,500 per period. *(AICPA adapted)*
55. *(Cost classifications)* Donald Trumpett is a house painter who incurred the following costs during June 2001 when he painted four houses. He spent \$1,000 on paint, \$50 on mineral spirits, and \$100 on brushes. He also bought two pairs of coveralls for \$50 each; he wears coveralls only while he works. During the first week of June, Donald placed a \$60 ad for his business in the classifieds. He had to hire an assistant for one of the painting jobs; the assistant was paid \$12 per hour and worked 25 hours.

Being a very methodical person, Donald kept detailed records of his mileage to and from each painting job. His average operating cost per mile for his van is \$0.32. He found a \$15 receipt in his van for a metropolitan map that he purchased in June. The map is used as a part of contact file for referral work and for bids that he has made on potential jobs. He also had \$15 in receipts for bridge tolls (\$1 per trip) for a painting job he did across the river.

Near the end of June, Donald decided to go camping, and he turned down a job on which he had bid \$2,800. He called the homeowner long distance (at a cost of \$1.60) to explain his reasons for declining the job.

Using the headings below, indicate how each of the June costs incurred by Donald would be classified. Assume that the cost object is a house-painting job.

Type of Cost	Variable	Fixed	Direct	Indirect	Period	Product
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56. *(Analyzing mixed costs)* Frances' Dairy determined that the total overhead rate for costing purposes is \$6.70 per cow per day (referred to as an "animal day"). Of this, \$6.30 is the variable portion. Cost information for two levels of monthly activity within the relevant range follow:

	4,000 Animal Days	6,000 Animal Days
Overhead cost:		
Indirect materials	\$ 6,400	\$ 9,600
Indirect labor	14,000	20,000
Maintenance	2,600	3,400
Utilities	2,000	3,000
All other	3,800	5,400

- a. Determine the fixed and variable values for each of the above overhead items and determine the total overhead cost formula.
  - b. Assume that the total overhead rate is based on expected annual capacity. What is this level of activity for the company?
  - c. Determine expected overhead costs at the expected annual capacity.
  - d. If the company raises its expected capacity by 3,000 animal days above the present level, calculate a new total overhead rate for product costing.
57. (*High-low; least squares regression*) Andrews Company manufactures insulated windows. The firm has encountered a problem in budgeting repairs and maintenance. The cost is apparently a mixed cost and varies most directly with machine hours worked. However, management does not know the exact relationship between machine hours and repairs and maintenance. The following data have been gathered from recent operations and may help describe the relationship:

Month	Machine Hours	Repairs and Maintenance
May	1,400	\$ 9,000
June	1,700	9,525
July	2,000	10,900
August	1,900	10,719
September	2,300	11,670
October	2,700	13,154
November	2,500	13,000
December	2,200	11,578

- a. How can you tell from the data that repairs and maintenance is a mixed cost?
  - b. Use the high-low method to estimate a cost formula for repairs and maintenance.
  - c. Use least squares regression to estimate a cost formula for repairs and maintenance.
  - d. Does the answer to part (b) or (c) provide the better estimate of the relationship between repairs and maintenance costs and machine hours? Why?
58. (*Mixed costs and predetermined overhead rates; two bases*) King-O'Brien Enterprises makes fiberglass swimming pools in a two-department process: Production and Installation. Production is highly automated and machine hours are used as the basis for allocating departmental overhead. Installation is labor intensive and uses direct labor hours to apply overhead. Cost information for various activity levels follows for each department:

	ACTIVITY IN MACHINE HOURS (MHs)		
	Low 3,000	4,000	High 5,000
Production overhead costs:			
Variable	\$12,150	\$16,200	\$20,250
Fixed	7,950	7,950	7,950
Total	<u>\$20,100</u>	<u>\$24,150</u>	<u>\$28,200</u>

## ACTIVITY IN DIRECT LABOR HOURS (DLHs)

	Low 1,000	2,000	High 3,000
Installation overhead costs:			
Variable	\$14,250	\$28,500	\$42,750
Fixed	<u>6,150</u>	<u>6,150</u>	<u>6,150</u>
Total	<u>\$20,400</u>	<u>\$34,650</u>	<u>\$48,900</u>

Each pool is estimated to require 500 machine hours in Production and 250 hours of direct labor in Installation. Expected annual capacity is 120 pools. The company plans to produce and install 10 pools next month.

- a. Compute the variable and fixed values in the formula  $y = a + bX$  for each department.
  - b. Prepare a budget for next month's variable, fixed, and total overhead costs for each department assuming expected production is 10 pools.
  - c. Calculate the predetermined total overhead cost to be applied to each pool scheduled for production in the coming month if expected annual capacity is used to calculate the predetermined overhead rates.
59. (*Journal entries*) Ballyhoo Rags makes evening dresses. The following information has been gathered from the company records for 2001, the first year of company operations. Work in Process Inventory at the end of 2001 was \$25,500.

Direct material purchased on account	\$330,000
Direct material issued to production	294,000
Direct labor payroll accrued	215,000
Indirect labor payroll accrued	62,000
Factory insurance expired	2,500
Factory utilities paid	14,300
Depreciation on factory equipment recorded	21,700
Factory rent paid	84,000
Sales on account	958,000

The company's gross profit rate for the year was 35 percent.

- a. Compute the cost of goods sold for 2001.
  - b. What was the total cost of goods manufactured for 2001?
  - c. If net income was \$60,300, what were total selling and administrative expenses for the year?
  - d. Prepare journal entries to record the flow of costs for the year, assuming the company uses a perpetual inventory system.
60. (*Journal entries*) Mundell Company applies overhead at the rate of \$4 per direct labor hour. The following transactions occurred during April 2000:
1. Direct material issued to production, \$160,000.
  2. Direct labor cost paid, 35,000 hours at \$16 per hour.
  3. Indirect labor cost accrued, 7,500 hours at \$9 per hour.
  4. Depreciation on factory assets recorded, \$37,200.
  5. Supervisors' salaries paid, \$15,000.
  6. Indirect materials issued to production, \$9,000.
  7. Goods costing \$840,000 were completed and transferred to finished goods.
- a. Prepare journal entries for the above transactions using a single overhead account and assuming the Raw Materials Inventory account contains only direct materials.
  - b. If Work in Process Inventory had a beginning balance of \$55,620, what is the ending balance?
  - c. Was overhead underapplied or overapplied for the month? By how much?

61. (*CGM and CGS*) VitalStrength Inc. began business in October 2000. The firm makes an exercise machine for home and gym use. Below are data taken from the firm's accounting records that pertain to its first year of operations.

Direct material purchased on account	\$213,000
Direct material issued to production	192,000
Direct labor payroll accrued	114,000
Indirect labor payroll paid	45,300
Factory insurance expired	2,700
Factory utilities paid	8,900
Factory depreciation recorded	18,700
Ending Work in Process Inventory (48 units)	32,000
Ending Finished Goods Inventory (30 units)	45,600
Sales on account (\$1,060 per unit)	212,000

- How many units did the company sell in its first year? How many units were completed in the first year?
  - What was the cost of goods manufactured?
  - What was the per-unit cost of goods manufactured?
  - What was cost of goods sold in the first year?
  - What was the company's first-year gross margin?
62. (*Product and period costs, CGM and CGS*) At the beginning of August 2001, Brennan Corporation had the following account balances:

Raw Materials Inventory (both direct and indirect)	\$ 8,000
Work in Process Inventory	13,000
Finished Goods Inventory	5,000

During August, the following transactions took place.

- Raw materials were purchased on account, \$75,000.
  - Direct materials (\$21,200) and indirect materials (\$2,500) were issued to production.
  - Factory payroll consisted of \$50,000 for direct labor employees and \$7,000 for indirect labor employees.
  - Office salaries totaled \$21,100 for the month.
  - Utilities of \$8,700 were accrued; 70 percent of the utilities cost is for the factory area.
  - Depreciation of \$9,000 was recorded on plant assets; 80 percent of the depreciation is related to factory machinery and equipment.
  - Rent of \$12,000 was paid on the building. The factory occupies 60 percent of the building.
  - At the end of August, the Work in Process Inventory balance was \$8,300.
  - At the end of August, the balance in Finished Goods Inventory was \$8,900. Brennan uses an *actual* cost system and debits actual overhead costs incurred to Work in Process.
- Determine the total amount of product cost (cost of goods manufactured) and period cost incurred during August 2001.
  - Compute the cost of goods sold for August 2001.
  - What level of August sales would have generated net income of \$27,700?
63. (*CGM and CGS*) Catherine's Collectibles produces objets d'art. The company's Raw Materials Inventory account includes the costs of both direct and indirect materials. Account balances for the company at the beginning and end of July 2000 are shown below.



	July 1, 2000	July 31, 2000
Raw Materials Inventory	\$23,300	\$17,400
Work in Process Inventory	36,600	30,000
Finished Goods Inventory	18,000	26,200

During the month, Catherine's Collectibles purchased \$85,000 of raw materials; direct materials used during the period amounted to \$68,000. Factory payroll costs for July were \$91,300 of which 85 percent was related to direct labor. Overhead charges for depreciation, insurance, utilities, and maintenance totaled \$81,200 for July.

- a. Prepare a schedule of cost of goods manufactured.
- b. Prepare a schedule of cost of goods sold.

64. (*Plant vs. department OH rates*) Bass Fine Furniture has two departments: Fabrication and Finishing. Fabrication is composed of 2 workers and 25 machines, and Finishing has 25 workers and 3 machines. One of the company's products passes through both departments and uses the following quantities of direct labor and machine time:

	Fabrication	Finishing
Machine hours	8.00	0.15
Direct labor hours	0.02	2.00

Following are the budgeted overhead costs and volumes for each department for the upcoming year:

	Fabrication	Finishing
Estimated overhead	\$624,240	\$324,000
Estimated machine hours	72,000	9,300
Estimated direct labor hours	4,800	48,000

- a. What is the plantwide rate for overhead application based on machine hours for the upcoming year? How much overhead will be assigned to each unit using this rate?
- b. The company's auditors inform Bass that it would be more appropriate to use machine hours as the application base in Fabrication and direct labor hours in Finishing. What would the rates be for each department? How much overhead would have been assigned to each unit of product using departmental rates?

## CASE

65. (*Missing data*) The Hurlstone Company suffered major losses in a fire on April 18, 2000. In addition to destroying several buildings, the blaze destroyed the company's work in process for an entire product line. Fortunately, the company was insured. However, the company needs to substantiate the amount of the claim. To this end, the company has gathered the following information that pertains to production and sales of the affected product line:

1. The company's sales for the first 18 days of April amounted to \$230,000. Normally, this product line generates a gross profit equal to 30 percent of sales.
2. Finished Goods Inventory was \$29,000 on April 1 and \$42,500 on April 18.
3. On April 1, Work in Process Inventory was \$48,000.
4. During the first 18 days of April, the company incurred the following costs:

Direct materials used	\$76,000
Direct labor	44,000
Manufacturing overhead applied	42,000

- a. Determine the value of Work in Process Inventory that was destroyed by the fire.
- b. What other information might the insurance company require? How would management determine or estimate this information?

## REALITY CHECK

66. An extremely important and expensive variable cost per employee is health care provided by the employer. This cost is expected to rise each year as more and more expensive technology is used on patients and as the costs of that technology are passed along through the insurance company to the employer. One simple way to reduce these variable costs is to cut back on employee insurance coverage.
- a. Discuss the ethical implications of reducing employee health care coverage to cut back on the variable costs incurred by the employer.
  - b. Assume that you are an employer with 600 employees. You are forced to cut back on some insurance benefits. Your coverage currently includes the following items: mental health coverage, long-term disability, convalescent facility care, nonemergency but medically necessary procedures, dependent coverage, and life insurance. Select the two you would eliminate or dramatically reduce and provide reasons for your selections.
  - c. Prepare a plan that might allow you to “trade” some variable employee health care costs for a fixed or mixed cost.

67. *Outsourcing is a frequently used method of cost cutting or of eliminating organizational activities that are not viewed as core competencies. However, outsourcing also creates new costs and, sometimes, new problems.*

*Some companies have found themselves locked into long-term contracts with outside suppliers that are no longer competitive. Indeed, multimillion-dollar technology-outsourcing contracts are often so complex that companies are hiring consultants at very high fees simply to evaluate the proposals.*

SOURCE: John A. Byrne, “Has Outsourcing Gone Too Far?” *Business Week* (April 1, 1996), p. 27.

- a. Discuss some benefits and drawbacks to outsourcing the following activities: (1) finance function, (2) data-processing function, and (3) travel arrangements.
- b. How might outsourcing of manufacturing functions affect the (1) prevention, (2) appraisal, and (3) failure costs of a company?
- c. What effect might outsourcing of each of the activities in part (a) have on an organization’s corporate culture?



68. Frequently, corporations issue forecasts of earnings for the upcoming year. Such forecasts require estimations of both costs and revenues. Search the Internet for a discussion of a revision in the earnings forecast of any company. Relative to the original forecast, did the revision indicate earnings would be higher or lower? Discuss the reasons given for the revision in the forecasted earnings.
69. Global Tool & Die Maker is bidding on a contract with the government of Manatuka. The contract is a cost-plus situation, with an add-on profit margin of 50 percent. Direct material and direct labor are expected to total \$15 per unit. Variable overhead is estimated at \$4 per unit. Total fixed overhead to produce the 50,000 units needed by the government is \$1,400,000. By acquiring the machinery and supervisory support needed to produce the 50,000 units, Global Tool will obtain the actual capacity to produce 80,000 units.
- a. Should the price bid by Global Tool include a fixed overhead cost of \$28 per unit or \$17.50? How were these two amounts determined? Which of

these two amounts would be more likely to cause Global Tool to obtain the contract? Why?

- b.** Assume that Global Tool set a bid price of \$54.75 and obtained the contract. After producing the units, Global Tool submitted an invoice to the government of Manatuka for \$3,525,000. The minister of finance for the country requests an explanation. Can you provide one?
- c.** Global Tool uses the excess capacity to produce an additional 30,000 units while making the units for Manatuka. These units are sold to another buyer. Is it ethical to present a \$3,525,000 bill to Manatuka? Discuss.
- d.** Global Tool does not use the excess capacity while making the units for Manatuka. However, several months after that contract was completed, the company begins production of additional units. Was it ethical to present a \$3,525,000 bill to Manatuka? Discuss.
- e.** Global Tool does not use the excess capacity because no other buyer exists for units of this type. Was it ethical to make a bid based on a fixed overhead rate per unit of \$54.75? Discuss.