



A Look Back

Chapters 2 and 3 described costing systems used by companies to accumulate product costing information for the reporting of inventories and cost of goods sold.



A Look at This Chapter

This chapter introduces the activity-based costing (ABC) system with the potential for greater accuracy of cost allocations. ABC provides managers with cost information for strategic decisions that is not readily available with other costing methods.



A Look Ahead

Chapter 5 discusses the importance of information on both costs and sales behavior for managers in performing cost-volume-profit (CVP) analysis, which is a valuable managerial tool.

4

Chapter

Activity-Based Costing and Analysis

Learning Objectives

CAP

Conceptual

- C1** Distinguish between the plantwide overhead rate method, the departmental overhead rate method, and the activity-based costing method. (p. 130)
- C2** Explain cost flows for the plantwide overhead rate method. (p. 131)
- C3** Explain cost flows for the departmental overhead rate method. (p. 133)
- C4** Explain cost flows for activity-based costing. (p. 135)

Analytical

- A1** Identify and assess advantages and disadvantages of the plantwide overhead rate method. (p. 132)
- A2** Identify and assess advantages and disadvantages of the departmental overhead rate method. (p. 134)
- A3** Identify and assess advantages and disadvantages of activity-based costing. (p. 142)

Procedural

- P1** Allocate overhead costs to products using the plantwide overhead rate method. (p. 131)
- P2** Allocate overhead costs to products using the departmental overhead rate method. (p. 133)
- P3** Allocate overhead costs to products using activity-based costing. (p. 136)



Decision Feature

Creaming Success



EUGENE, OR—Shortly after taking over a small ice cream company, owner Tom Gleason was distressed to keep finding a competitor's ice cream in his refrigerator. His wife, Julie, wanted something different. Julie asked Tom to make ice cream “pure, from the best ingredients, no preservatives, no pesticides, child friendly, and . . . indulgent.” From that directive, began a new path for his **Oregon Ice Cream Company** (OregonIceCream.com).

Tom's company now offers many exotic temptations: Espresso Explosion, Huckleberry Heaven, Mt. St. Helen's Mud Pie, and Extreme Moose Tracks, to name just a few. However, product quality, innovation, and production efficiency are key ingredients in its success. And, a special line, labeled *Julie's Organic Ice Cream*, uses certified organic cream and organically grown fresh fruit and sugar. To make it all happen, Tom uses a state-of-the-art information system to monitor and regulate its production machinery. In the spirit of continuous improvement, Tom explains that they “developed an extrusion process that produces an [ice cream] texture that is better than molded alternatives.”

With its new, extensive line of products, the managers must be adept at interpreting product cost summaries. As Brian Cobb, director of production puts it, “I'm all about dollars, gallons, and time.” Tom insists that without good cost and production process controls, his income would

“We're ice cream guys . . . we can be successful!”
—Tom Gleason

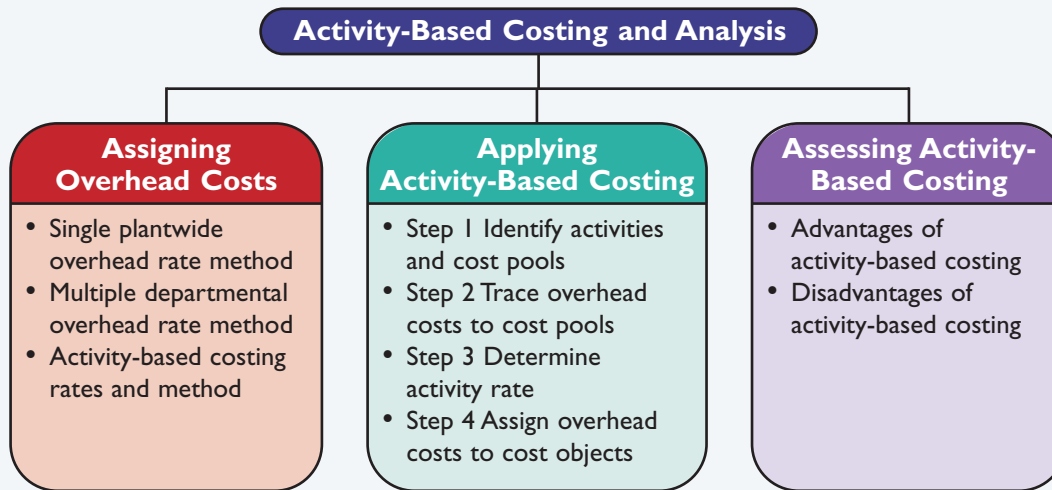
quickly evaporate. Activity-based costing (ABC) procedures help his managers monitor and control costs and ensure product quality. ABC is especially useful in companies such as Tom's, where different products require different processes and varying levels of overhead. For example, *Julie's Organic* is made in small batches, while chocolate and vanilla are made in large production runs. Further, ice cream sandwiches and dessert bars require different machine and labor activities, and ABC helps in allocating overhead costs, such as research and development, plant maintenance and clean-up crew costs, to the different products.

The Oregon Ice Cream Company recipe is working. Each week, cream, sugar, skim milk, powder and wafers arrive at the company's ice cream assembly plant. There, the company runs two production shifts per day, six days per week, all year long, to meet increasing customer demand. Sales of *Julie's Organic Ice Cream* have increased ten-fold in recent years, making Oregon Ice Cream Company the top ice cream producer in the Northwest and the number one organic ice cream maker in the country. Importantly, Tom no longer finds competitors' ice cream in his freezer. “[But] we are just getting started,” proclaims Tom. “Our goal is to be the predominant super-premium organic ice cream.”

[Sources: *Oregon Ice Cream Company Website*, January 2009; *The Register-Guard*, December 2007; *Mail Tribune*, September 2004; *Dairyfoods.com*, January 2008]

Prior chapters described costing systems used to assign costs to product units. This discussion emphasized the valuation of inventory and the cost of goods sold. Although the information from these prior costing systems conform to generally

accepted accounting principles (GAAP) for external reporting, it has limitations. This chapter introduces the activity-based costing (ABC) system, which is used by managers who desire more accurate product cost information.



Assigning Overhead Costs

C1 Distinguish between the plantwide overhead rate method, the departmental overhead rate method, and the activity-based costing method.

Managerial activities such as product pricing, product mix decisions, and cost control depend on accurate product cost information. Distorted product cost information can result in poor decisions. Knowing accurate costs for producing, delivering, and servicing products helps managers set a price to cover product costs and yield a profit.

In competitive markets, price is established through the forces of supply and demand. In these situations, managers must understand product costs to assess whether the market price is high enough to justify the cost of entering the market. Disparities between market prices and producer costs give managers insight into their efficiency relative to competitors.

Product costs consist of direct materials, direct labor, and overhead (indirect costs). Since the physical components of a product (direct materials) and the work of making a product (direct labor) can be traced to units of output, the assignment of costs of these factors is usually straightforward. Overhead costs, however, are not directly related to production volume, and therefore cannot be traced to units of product in the same way that direct materials and direct labor can.

For example, we can trace the cost of putting tires on a car because we know there is a logical relation between the number of cars produced and the number of tires needed for each car. The cost to heat an automobile manufacturing factory, however, is not readily linked with the number of cars made. Consequently, we must use an allocation system to assign overhead costs such as utilities and factory maintenance. This chapter introduces three methods of overhead allocation: (1) the single plantwide overhead rate method, (2) the departmental overhead rate method, and (3) the activity-based costing method. It then explains the activity-based system in detail.

The *plantwide overhead rate method* uses a single rate for allocating overhead costs to products. This rate is a volume-based measure such as direct labor hours, direct labor dollars, or machine hours. The *departmental overhead rate method* uses multiple volume-based measures to allocate overhead costs to products. This method arguably improves on the single rate allocations of the plantwide method. *Activity-based costing* focuses on activities and the costs of carrying out activities (organized into cost pools). Rates based on these activities are

then used to assign overhead to products in proportion to the amount of activity required to produce them.

Plantwide Overhead Rate Method

Cost Flows under Plantwide Overhead Rate Method The first method is known as the *single plantwide overhead rate method*, or simply the *plantwide overhead rate method*, for allocating overhead costs to products. For this method, the target of the cost assignment, or **cost object**, is the unit of product—see Exhibit 4.1. The rate is determined using volume-related measures such as direct labor hours, direct labor cost dollars, or machine hours, which are readily available in most manufacturing settings. In some industries, overhead costs are closely related to these volume-related measures. In such cases it is logical to use this method as a basis for assigning indirect manufacturing costs to products.

C2 Explain cost flows for the plantwide overhead rate method.

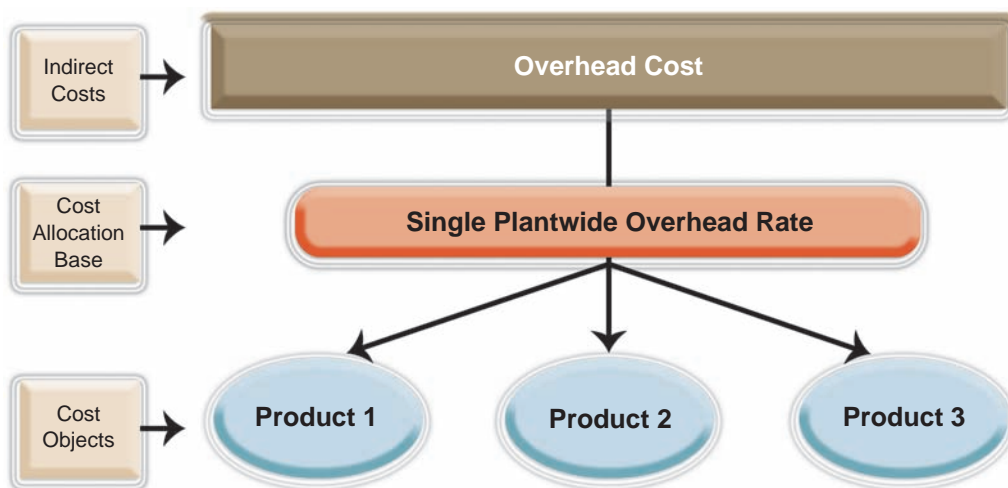


EXHIBIT 4.1
Plantwide Overhead Rate Method

Applying the Plantwide Overhead Rate Method Under the single plantwide overhead rate method, total budgeted overhead costs are combined into one overhead cost pool. This cost pool is then divided by the chosen allocation base, such as total direct labor hours, to arrive at a single plantwide overhead rate. This rate then is applied to assign costs to all products based on the allocation base such as direct labor hours required to manufacture each product.

P1 Allocate overhead costs to products using the plantwide overhead rate method.

To illustrate, consider data from KartCo, a go-kart manufacturer that produces both standard and custom go-karts for amusement parks. The standard go-kart is a basic model sold primarily to amusement parks that service county and state fairs. Custom go-karts are produced for theme parks who want unique go-karts that coordinate with their respective themes.

Assume that KartCo applies the plantwide overhead rate method and uses direct labor hours (DLH) as its overhead allocation base. KartCo’s DLH information is in Exhibit 4.2.

	Number of Units	Direct Labor Hours per Unit	Total Direct Labor Hours
Standard go-kart . . .	5,000	15	75,000
Custom go-kart . . .	1,000	25	<u>25,000</u>
Total			<u>100,000</u>

EXHIBIT 4.2
KartCo’s Budgeted Direct Labor Hours

KartCo’s overhead cost information is in Exhibit 4.3. Its overhead cost consists of indirect labor and factory utilities.

Indirect labor cost	\$4,000,000
Factory utilities	<u>800,000</u>
Total overhead cost	<u>\$4,800,000</u>

EXHIBIT 4.3
KartCo’s Budgeted Overhead Cost

The single plantwide overhead rate for KartCo is computed as follows.

$$\begin{aligned}
 \text{Plantwide overhead rate} &= \frac{\text{Total budgeted overhead cost}}{\text{Total budgeted direct labor hours}} \\
 &= \frac{\$4,800,000}{100,000 \text{ DLH}} \\
 &= \$48 \text{ per DLH}
 \end{aligned}$$

This plantwide overhead rate is then used to allocate overhead cost to products based on the number of direct labor hours required to produce each unit as follows.

$$\text{Overhead allocated to each product unit} = \text{Plantwide overhead rate} \times \text{DLH per unit}$$

For KartCo, overhead cost is allocated to its two products as follows (on a per-unit basis).

$$\begin{aligned}
 \text{Standard go-kart: } & \$48 \text{ per DLH} \times 15 \text{ DLH} = \$ 720 \\
 \text{Custom go-kart: } & \$48 \text{ per DLH} \times 25 \text{ DLH} = \$1,200
 \end{aligned}$$

KartCo uses these per-unit overhead costs to compute the total unit cost of each product as follows.

	Direct Materials	Direct Labor	Overhead	Total Cost per Unit
Standard go-kart	\$400	\$350	\$ 720	\$1,470
Custom go-kart	600	500	1,200	2,300



During the most recent period, KartCo sold its standard model go-karts for \$2,000 and its custom go-karts for \$3,500. A recent report from its marketing staff indicates that competitors are selling go-karts similar to KartCo’s standard model for as low as \$1,200. KartCo management believes it must be competitive, but management is concerned that meeting this lower price would result in a loss of \$270 (\$1,200 – \$1,470) on each standard go-kart sold.

In the case of its custom go-kart, KartCo has been swamped with orders and is unable to meet demand. Accordingly, management is considering a change in strategy. Some discussion has ensued about dropping its standard model and concentrating on its custom model. Yet management recognizes that its pricing and cost decisions are influenced by its cost assignments. Thus, before making any strategic marketing decisions, management has directed its cost analysts to further review production costs for both the standard and custom go-kart models. To pursue this analysis, we need additional knowledge about this method’s advantages and disadvantages, and some insights into alternative cost allocation methods.

A1 Identify and assess advantages and disadvantages of the plantwide overhead rate method.

Advantages and Disadvantages of Plantwide Overhead Rate Method The major advantages of using a single plantwide overhead rate relate to the readily available information needed to implement this method and its ease of implementation. Also, the plantwide overhead rate method is often sufficient to meet external financial reporting needs.

The usefulness of overhead allocations based on a single plantwide overhead rate for managerial decisions depends on two crucial assumptions: (1) overhead costs correlate (change) with the allocation base such as direct labor hours; and (2) all products use overhead costs in the same proportions.

The reasonableness of these assumptions varies. For companies that manufacture few products or whose operations are labor intensive, overhead allocations based on a single plantwide overhead rate can yield reasonably useful information for managerial decisions. However, for many other companies, such as those with many different products or those with products that use resources in very different ways, the assumptions are dubious. There is also evidence that over the past few decades overhead costs have steadily increased while direct labor costs have decreased as a percentage of total manufacturing cost, which places greater importance on accurate cost allocations.

When overhead costs, such as machinery depreciation, bear little if any relation to direct labor hours used, allocating overhead cost using a single plantwide overhead rate based on direct labor hours can distort product cost and lead to poor managerial decisions. Despite such shortcomings, some companies continue to allocate overhead cost using a single plantwide overhead rate, largely because of its simplicity. Good management decisions often require a more refined allocation method.

Departmental Overhead Rate Method

Cost Flows under Departmental Overhead Rate Method Many companies have several departments that produce various products and consume overhead resources in substantially different ways. Under such circumstances, use of a single plantwide overhead rate can produce cost assignments that fail to accurately reflect the cost to manufacture a specific product. In these cases, use of multiple overhead rates can result in better overhead cost allocations and improve management decisions.

The *departmental overhead rate method* uses a different overhead rate for each production department. This is usually done through a two-stage assignment process, each with its different cost objects (target of cost assignment). In the first stage the departments are the cost objects and in the second stage the products are the cost objects (see Exhibit 4.4).

C3 Explain cost flows for the departmental overhead rate method.

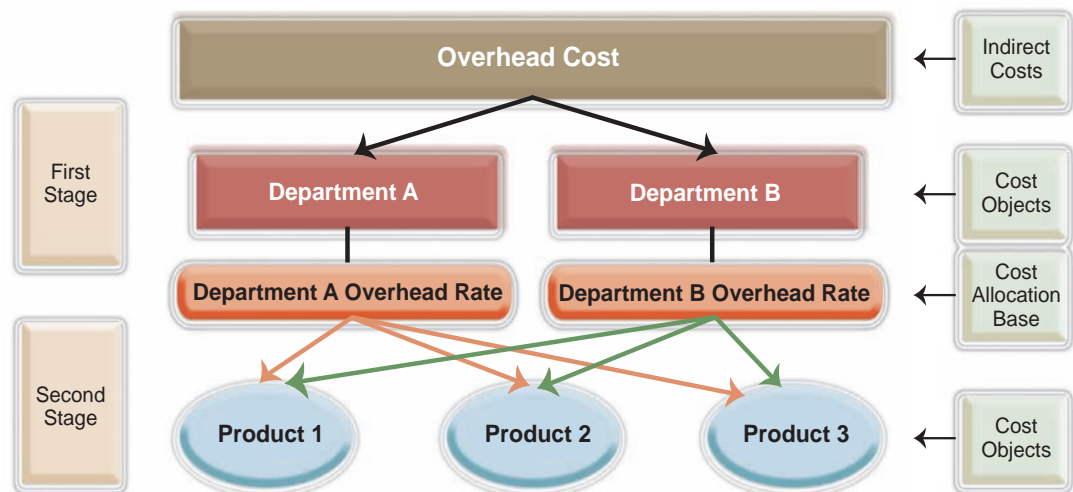


EXHIBIT 4.4
Departmental Overhead Rate Method

Exhibit 4.4 shows that under the departmental overhead rate method, overhead costs are first determined separately for each production department. Next, an overhead rate is computed for each production department to allocate the overhead costs of each department to products passing through that department. The departmental overhead rate method allows each department to have its own overhead rate and its own allocation base. For example, an assembly department can use direct labor hours to allocate its overhead cost while the machining department can use machine hours as its base.

Applying the Departmental Overhead Rate Method To illustrate the departmental overhead rate method, let's return to KartCo. KartCo has two production departments, the machining department and the assembly department. The first stage requires that KartCo assign its \$4,800,000 overhead cost to its two production departments. KartCo determines from an analysis of its indirect labor and factory utilities that \$4,200,000 of overhead costs are traceable to its machining department and the remaining \$600,000 are traceable to its assembly department. In some cases it is difficult for companies to trace overhead costs to distinct departments as some overhead costs can be common to several departments. In these cases, companies must allocate overhead to departments applying reasonable allocation bases.

P2 Allocate overhead costs to products using the departmental overhead rate method.

The second stage demands that after overhead costs are assigned to departments, each department determines an allocation base for its operations. For KartCo, the machining department uses machine hours (MH) as a base for allocating its overhead and the assembly department uses direct labor hours (DLH) as the base for allocating its overhead. For this stage, the relevant information for the machining and assembly departments is in Exhibit 4.5.

	Number of Units	Machining Department		Assembly Department	
		Hours per Unit	Total Hours	Hours per Unit	Total Hours
Standard go-kart	5,000	10 MH per unit	50,000 MH	5 DLH per unit	25,000 DLH
Custom go-kart	1,000	20 MH per unit	20,000 MH	5 DLH per unit	5,000 DLH
Totals			70,000 MH		30,000 DLH

EXHIBIT 4.5
Allocation Information for Machining and Assembly Departments

Each department computes its own overhead rate using the following formula.

$$\text{Departmental overhead rate} = \frac{\text{Total departmental overhead cost}}{\text{Total units in departmental allocation base}}$$

For KartCo, its departmental overhead rates are computed as follows.

$$\text{Machining department overhead rate} = \frac{\$4,200,000}{70,000 \text{ MH}} = \$60 \text{ per MH}$$

$$\text{Assembly department overhead rate} = \frac{\$600,000}{30,000 \text{ DLH}} = \$20 \text{ per DLH}$$

The final part of the second stage is to apply overhead costs to each product based on departmental overhead rates. For KartCo, since each standard go-kart requires 10 MH from the machining department and five DLH from the assembly department, the overhead cost allocated to each standard go-kart is \$600 from the machining department (10 MH × \$60 per MH) and \$100 from the assembly department (5 DLH × \$20 per DLH). The same procedure is applied for its custom go-kart. The allocation of overhead costs to KartCo’s standard and custom go-karts is summarized in Exhibit 4.6.

EXHIBIT 4.6

Overhead Allocation Using Departmental Overhead Rates

	Departmental Overhead Rate	Standard Go-Kart		Custom Go-Kart	
		Hours per Unit	Overhead Allocated	Hours per Unit	Overhead Allocated
Machining department	\$60 per MH	10 MH per unit	\$600	20 MH per unit	\$1,200
Assembly department	\$20 per DLH	5 DLH per unit	100	5 DLH per unit	100
Totals			<u>\$700</u>		<u>\$1,300</u>

A2 Identify and assess advantages and disadvantages of the departmental overhead rate method.

Advantages and Disadvantages of Departmental Overhead Rate Method

Allocated overhead costs vary depending upon the allocation methods used. Exhibit 4.7 summarizes and compares the allocated overhead costs for standard and custom go-karts under the single plantwide overhead rate and the departmental overhead rate methods. The overhead cost allocated to each standard go-kart decreased from \$720 under the plantwide overhead rate method to \$700 under the departmental overhead rate method, whereas overhead cost allocated to each custom go-kart increased from \$1,200 to \$1,300. These differences occur because the custom go-kart requires more hours in the machining department (20 MH) than the standard go-kart requires (10 MH).

EXHIBIT 4.7

Comparison of Plantwide Overhead Rate and Departmental Overhead Rate Methods

	Standard Go-Kart	Custom Go-Kart
Overhead under plantwide overhead rate method	\$720	\$1,200
Overhead under departmental overhead rate method	\$700	\$1,300

Compared to the plantwide overhead rate method, the departmental overhead rate method usually results in more accurate overhead allocations. When cost analysts are able to logically trace costs to cost objects, costing accuracy is improved. For KartCo, costs are traced to departments and then assigned to units based on how long they spend in each department. The single plantwide overhead rate of \$48 per hour is a combination of the \$60 per hour machining department rate and the \$20 per hour assembly department rate.

While the departmental overhead rate method is more refined than the plantwide overhead rate method, it has limitations that can distort product costs. Even though the departmental overhead rate method allows each department to have its own overhead rate, it relies on the premise that different products are similar in volume, complexity, and batch size, and that departmental overhead costs are directly proportional to the department allocation base (such as direct labor hours and machine hours for KartCo). When products differ in batch size and complexity, they usually consume different amounts of overhead resources in terms of machine

setup costs, engineering modification costs, and other overhead costs. This is likely the situation for KartCo with its high-volume standard model with basic features vis-à-vis its low-volume custom model built to customer specifications.

More generally, overhead costs are often affected by many issues and are frequently too complex to be explained by one factor like direct labor hours or machine hours. Technological advances also affect direct labor costs, often lowering them as a percentage of total costs. (In some companies, direct labor cost is such a small part of total cost that it is treated as overhead.) Computing multiple overhead rates is an improvement over a single allocation rate based on direct labor. However, because departmental overhead costs are still allocated based on measures closely related to production volume (such as labor hours or machine hours), they too fail to accurately assign many overhead costs that are not driven by production volume such as machine depreciation or utility costs. When the number of jobs, products, and departments increases, the possibility of improperly assigning overhead costs also increases. This can lead to poor managerial decisions and a company's eventual failure.

For KartCo, using the multiple departmental overhead rate method yields the following total costs for its products.

	Direct Materials	Direct Labor	Overhead Total	Cost per Unit
Standard go-kart	\$400	\$350	\$ 700	\$1,450
Custom go-kart	600	500	1,300	2,400

These costs per unit under the departmental overhead rate method are different from those under the plantwide overhead rate method. Further, this information suggests that KartCo management seriously review future production for its standard go-kart product. Specifically, these cost data imply that KartCo cannot make a profit on its standard go-kart if it meets competitors' \$1,200 price.

Decision Ethics

Department Manager Three department managers jointly decide to hire a consulting firm for advice on increasing departmental effectiveness and efficiency. The consulting firm spends 50% of its efforts on department "A" and 25% on each of the other two departments. The manager for department "A" suggests that the three departments equally share the consulting fee. As a manager of one of the other two departments, do you believe equal sharing is fair? [Answer—p. 147]



Activity-Based Costing Rates and Method

Cost Flows under Activity-Based Costing Method Activity-based costing (ABC) attempts to more accurately assign overhead costs to the users of overhead by focusing on *activities*. The premise of ABC is that it takes activities to make products and provide services. These activities drive costs. For instance, costs are incurred when we perform actions; cutting raw materials, inspecting parts, and processing invoices all cause resources to be used.

There are two basic stages to ABC as shown in Exhibit 4.8. The first stage of ABC cost assignment is to identify the activities (cost objects) involved in manufacturing products and match those activities with the costs they cause (drive). To reduce the total number of activities that must be assigned costs, the homogeneous activities (those caused by the same factor such as cutting metal) are grouped into activity cost *pools*. The second stage of ABC is to compute an activity rate for each cost pool and then use this rate to allocate overhead costs to products, which are the cost objects of this second stage.

The basic principle underlying activity-based costing is that an **activity**, which is a task, operation, or procedure, is what causes costs to be incurred. For example, warehousing products consumes resources (costs) such as employee time for driving a forklift, the electricity to power the forklift, and the wear and tear on a forklift. Also, training employees drives costs such as fees or salaries paid to trainers and the training supplies required. Generally, all activities of an organization can be linked to use of resources. An **activity cost pool** is a collection of costs that are related to the same or similar activity. Pooling costs to determine an **activity overhead (pool) rate** for all costs incurred by the same activity reduces the number of cost assignments required.

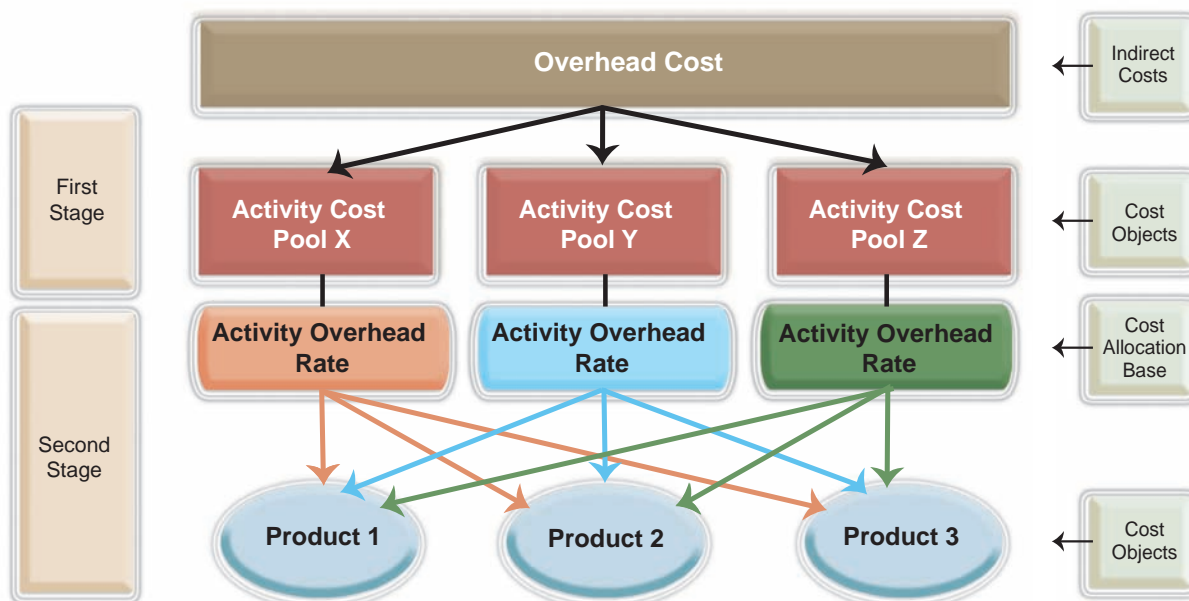
C4 Explain cost flows for activity-based costing.

Point: Homogeneous means similar.



EXHIBIT 4.8

Activity-Based Costing Method



Differences between ABC and Multiple Departmental Rates Using ABC differs from using multiple departmental rates in how overhead cost pools are identified and in how overhead cost in each pool is allocated. When using multiple departmental rates, each department is a cost pool, and overhead cost allocated to each department is assigned to products using a volume-based factor (such as direct labor hours or machine hours). This assumes that overhead costs in each department are directly proportional to the volume-based factor. ABC, on the other hand, recognizes that overhead costs are more complex. For example, purchasing costs might make up one activity cost pool (spanning more than one department) that would include activities such as the number of invoices. ABC emphasizes activities and costs of carrying out these activities. Under ABC, only costs related to the same activity are grouped into a cost pool. Therefore, ABC arguably better reflects the complex nature of overhead costs and how these costs are used in making products.

Quick Check

Answers—p. 148

- Which method of cost assignment requires more than one overhead rate? (a) Plantwide overhead rate method (b) Departmental overhead rate method (c) ABC (d) Both b and c.
- Which method of overhead costing is the most accurate when products differ in level of complexity? (a) ABC (b) Plantwide overhead rate method (c) Departmental overhead rate method.
- ABC assumes that costs are incurred because of what? (a) Management decisions (b) Activities (c) Financial transactions.

Applying Activity-Based Costing

Activity-based costing accumulates overhead costs into activity cost pools and then uses activity rates to allocate those costs to products. This involves four steps: (1) identify activities and the costs they cause; (2) group similar activities into activity cost pools; (3) determine an activity rate for each activity cost pool; and (4) allocate overhead costs to products using those activity rates. To illustrate, let's return to KartCo and apply steps 1 through 4.

Step 1: Identify Activities and Cost Pools

P3 Allocate overhead costs to products using activity-based costing.

Step 1 in applying ABC is to identify activities. This is commonly done through discussions with employees in production departments and through reviews of production activities. The more activities that ABC tracks, the more accurately overhead costs are assigned. However, tracking too many activities makes the system cumbersome and costly to maintain. Consequently, we try to reach a balance where it is often necessary to reduce the number of activities tracked by

combining similar activities. An activity can also involve several related tasks. The aim of this first step is to understand actions performed in the organization that drive costs.

Activities causing overhead cost can be separated into four levels of types of activities: (1) **unit level activities**, (2) **batch level activities**, (3) **product level activities**, and (4) **facility level activities**. These four activities are described as follows.



Activity Levels

Unit level activities are performed on each product unit. For example, the machining department needs electricity to power the machinery to produce each unit of product. Unit level costs tend to change with the number of units produced.

Batch level activities are performed only on each batch or group of units. For example, machine setup is needed only for each batch regardless of the units in that batch, and customer order processing must be performed for each order regardless of the number of units ordered. Batch level costs do not vary with the number of units, but instead with the number of batches.

Product level activities are performed on each product line and are not affected by either the numbers of units or batches. For example, product design is needed only for each product line. Product level costs do not vary with the number of units or batches produced.

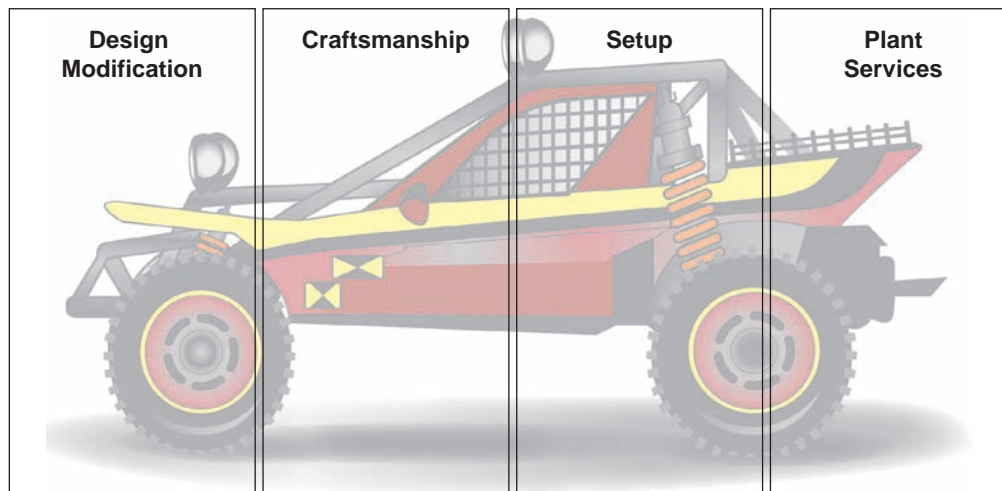
Facility level activities are performed to sustain facility capacity as a whole and are not caused by any specific product. For example, rent and factory maintenance costs are incurred no matter what is being produced. Facility level costs do not vary with what is manufactured, how many batches are produced, or the output quantity.

Additional examples of activities commonly found within each of the four activity levels are shown in the following table. This is not a complete list, but reviewing it can help in understanding this hierarchy of production activities. This list also includes common measures used to reflect the specific activity identified. Knowing this hierarchy can help us simplify and understand activity-based costing.

Activity Level	Examples of Activity	Activity Driver (Measure)
Unit level	Cutting parts	Machine hours
	Assembling components	Direct labor hours
	Printing checks	Number of checks
Batch level	Calibrating machines	Number of batches
	Receiving shipments	Number of orders
	Sampling product quality	Number of lots produced
Product level	Designing modifications	Change requests
	Organizing production	Engineering hours
	Controlling inventory	Parts per product
Facility level	Cleaning workplace	Square feet of floors*
	Providing electricity	Kilowatt hours*
	Providing personnel support	Number of employees*

* Facility level costs are not traceable to individual product lines, batches, or units. They are normally assigned to units using a unit-level driver such as direct labor hours or machine hours even though they are caused by another activity.

Once activities are identified, a company sets up activity cost pools. It is crucial that activities in each cost pool be similar and reflect a similar activity level. After a review of its overhead activities, KartCo set up the following four activity cost pools.



Decision Maker

Cost Analyst Your employer is exploring the possibility of implementing an activity-based costing system in the plant where you are newly assigned as a cost analyst. Your responsibilities are to identify manufacturing activities and link them to the costs they drive. You have never worked in this type of manufacturing operation and you are unsure about what activities are performed and their costs. What steps should you pursue to yield a quality report? [Answer—p. 147]

Step 2: Trace Overhead Costs to Cost Pools

Step 2 in applying ABC is to assign overhead costs to cost pools. Overhead costs are commonly accumulated by each department in a traditional accounting system. Some of these overhead costs are traced directly to a specific activity cost pool. At KartCo, for example, the assembly department supervisor’s salary is assigned to its design modification cost pool and its machine repair costs are traced to its setup cost pool. Companies try to trace as many overhead costs to specific activity cost pools as possible to improve costing accuracy.

Recall that a premise of ABC is that operations are a series of activities that cause costs to be incurred. Instead of combining costs from different activities into one plantwide pool or multiple departmental pools, ABC focuses on activities as the cost object in the first step of cost assignment. We are then able to *trace* costs to a cost object and then combine activities that are used by products in similar ways to reduce the number of cost allocations.

KartCo has total overhead cost of \$4,800,000 consisting of \$4,000,000 indirect labor costs and \$800,000 factory utilities costs. Details gathered by KartCo about its overhead costs are shown in Exhibit 4.9. Column totals for indirect labor and factory utilities correspond to amounts in Exhibit 4.3. Activity-based costing provides more detail about the activities and the costs they cause than is provided from traditional costing methods.

EXHIBIT 4.9

KartCo Overhead Cost Details

Activity	Indirect Labor	Factory Utilities	Total Overhead
Replacing tools	\$ 700,000	—	\$ 700,000
Machine repair	1,300,000	—	1,300,000
Factory maintenance	800,000	—	800,000
Engineer salaries	1,200,000	—	1,200,000
Assembly line power	—	\$600,000	600,000
Heating and lighting	—	200,000	200,000
Totals	<u>\$4,000,000</u>	<u>\$800,000</u>	<u>\$4,800,000</u>

After a review and analysis of its activities, KartCo management assigns its overhead costs into its four activity cost pools as shown in Exhibit 4.10. To assign costs to pools, management looks for costs that are caused by the activities of that pool and activity level. For KartCo there is only one activity driver within each activity level, but that is not always the case. It is common to see several different activity drivers within each activity level. We pool only those costs that are related to the same driver.

Activity Pools	Activity Cost	Pool Cost	Activity Driver
Craftsmanship			30,000 direct labor hours
Assembly line power	\$ 600,000	\$ 600,000	
Setup			200 batches
Replacing tools	700,000		
Machine repair	<u>1,300,000</u>	2,000,000	
Design modification			10 designs
Engineer salaries	1,200,000	1,200,000	
Plant services			
Factory maintenance	800,000		20,000 square feet
Heating and lighting	<u>200,000</u>	<u>1,000,000</u>	
Total overhead cost		<u>\$4,800,000</u>	

EXHIBIT 4.10

Assigning Overhead to Activity Cost Pools

Exhibit 4.10 shows that \$600,000 of overhead costs are assigned to the craftsmanship cost pool; \$2,000,000 to the setup cost pool; \$1,200,000 to the design-modification cost pool; and \$1,000,000 to the plant services cost pool. This reduces the potential number of overhead rates from six (one for each of its six activities) to four (one for each pool). For KartCo, the craftsmanship pool reflects unit level costs, the setup pool reflects batch level costs, the design-modification pool reflects product level costs, and plant services reflect facility level costs.

Decision Insight

Measuring Health Activity-based costing is used in many settings. Its only requirements are existence of costs and demand for reliable cost information. A study found that activity-based costing improves health care costing accuracy, enabling improved profitability analysis and decision making. Identifying cost drivers in a health care setting is challenging and fraught with ethical concerns.

Step 3: Determine Activity Rate

Step 3 is to compute activity rates used to assign overhead costs to final cost objects such as products. Proper determination of activity rates depends on (1) proper identification of the factor that drives the cost in each activity cost pool and (2) proper measures of activities.

Identifying the factor that drives cost, the **activity cost driver**, is that activity causing costs in the pool to be incurred. For KartCo’s overhead, craftsmanship costs are mainly driven (caused) by assembling products, setup costs are driven by system repairs and retooling, design-modification costs are driven by new features, and plant service costs are driven by building occupancy. The activity cost driver, a measure of activity level, serves as the allocation base. KartCo uses direct labor hours as the activity driver for the craftsmanship cost pool, the number of batches as the activity driver for its setup cost pool, the number of products devised or modified for its design-modification cost pool, and the number of square feet occupied for its plant services cost pool.

To compute the activity rate, total cost in an activity cost pool is divided by the measure of the activity. For KartCo, recall that overhead costs allocated to setup and craftsmanship cost pools were \$2,000,000 and \$600,000, respectively (see Exhibit 4.10). Also, total direct labor hours of craftsmanship equal 30,000, and 200 batches of go-karts were produced during the period. Thus, activity rates for those two cost pools are computed as follows.



Craftsmanship cost pool activity rate = \$600,000 ÷ 30,000 DLH = \$20 per DLH
 Setup cost pool activity rate = \$2,000,000 ÷ 200 batches = \$10,000 per batch

To compute its activity rate for the design-modification cost pool, KartCo estimates the number of design modifications to be 10 for the period. For its plant services cost pool, KartCo plans to use 20,000 square feet of floor space. Recall that overhead costs allocated to design modification and to the plant services cost pools were \$1,200,000 and \$1,000,000, respectively. Activity rates for those two cost pools are computed as follows.

$$\begin{aligned} \text{Design modification cost pool activity rate} &= \$1,200,000 \div 10 \text{ designs} &&= \$120,000 \text{ per design} \\ \text{Plant services cost pool activity rate} &= \$1,000,000 \div 20,000 \text{ square feet} &&= \$50 \text{ per sq. ft.} \end{aligned}$$

The activity rate computations for KartCo are summarized in Exhibit 4.11.

EXHIBIT 4.11

Activity Rates for KartCo

Activity Cost Pools	Overhead Costs Assigned to Pool	Activity Measure Chosen	Number of Activities	Activity Rate
Craftsmanship	\$ 600,000	DLH	30,000 DLH	\$20 per DLH
Setup	2,000,000	Batches	200 batches	\$10,000 per batch
Design modification	1,200,000	Number of designs	10 designs	\$120,000 per design
Plant services	1,000,000	Square feet	20,000 sq. ft.	\$50 per sq. ft.

Step 4: Assign Overhead Costs to Cost Objects

Step 4 is to assign overhead costs in each activity cost pool to final cost objects using activity rates. (This is referred to as the *second-stage assignment*; where steps 1 through 3 make up the *first-stage assignment*.) To accomplish this, overhead costs in each activity cost pool are allocated to product lines based on the level of activity for each product line. After costs in all cost pools are allocated, the costs for each product line are totaled and then divided by the number of units of that product line to arrive at overhead cost per product unit.

For KartCo, overhead costs in each pool are allocated to the standard go-karts and the custom go-karts using the activity rates from Exhibit 4.11. The activities used by each product line and the overhead costs allocated to standard and custom go-karts under ABC for KartCo are summarized in Exhibit 4.12. To illustrate, the \$500,000 of overhead costs in the craftsmanship cost pool is allocated to standard go-karts as follows.

$$\begin{aligned} \text{Overhead allocated to standard go-kart} &= \text{Activities consumed} \times \text{Activity rate} \\ &= 25,000 \text{ DLH} \times \$20 = \$500,000 \end{aligned}$$

We know that standard go-karts require 25,000 direct labor hours and the activity rate for craftsmanship is \$20 per direct labor hour. Multiplying the number of direct labor hours by the activity rate yields the craftsmanship costs assigned to standard go-karts. Custom go-karts consumed 5,000 direct labor hours, so we assign \$100,000 (5,000 DLH × \$20 per DLH) to that product line. We similarly allocate overhead to setup, design modification, and plant services pools for each type of go-kart.

EXHIBIT 4.12

Overhead Allocated to Go-Karts for KartCo

	Standard Go-Karts			Custom Go-Karts		
	Activities Consumed	Activity Rate	Activity Cost Allocated	Activities Consumed	Activity Rate	Activity Cost Allocated
Craftsmanship	25,000 DLH	\$20 per DLH	\$ 500,000	5,000 DLH	\$20 per DLH	\$ 100,000
Setup	40 batches	\$10,000 per batch	400,000	160 batches	\$10,000 per batch	1,600,000
Design modification	0 designs	\$120,000 per design	0	10 designs	\$120,000 per design	1,200,000
Plant services	12,000 sq. ft.	\$50 per sq. ft.	600,000	8,000 sq. ft.	\$50 per sq. ft.	400,000
Total cost			<u>\$1,500,000</u>			<u>\$3,300,000</u>

In assigning overhead costs to products, KartCo assigned no design modification costs to standard go-karts because standard go-karts are sold as “off-the-shelf” items.

Overhead cost per unit is computed by dividing total overhead cost allocated to each product line by the number of product units. KartCo’s overhead cost per unit for its standard and custom go-karts is computed and shown in Exhibit 4.13.

	(A) Total Overhead Cost Allocated	(B) Budgeted Units of Production	(A ÷ B) Overhead Cost perUnit
Standard go-kart	\$1,500,000	5,000 units	\$ 300 per unit
Custom go-kart	3,300,000	1,000 units	\$3,300 per unit

EXHIBIT 4.13

Overhead Cost per Unit for Go-Karts Using ABC

Total cost per unit for KartCo using ABC for its two products follows.

	Direct Materials	Direct Labor	Overhead	Total Cost per Unit
Standard go-kart . . .	\$400	\$350	\$ 300	\$1,050
Custom go-kart . . .	600	500	3,300	4,400

Assuming that ABC more accurately assigns costs, we now are able to help KartCo’s management understand how its competitors can sell their standard models at \$1,200 and why KartCo is flooded with orders for custom go-karts. Specifically, if the cost to produce a standard go-kart is \$1,050, as shown above (and not \$1,470 as computed using the plantwide rate), a profit of \$150 (\$1,200 – \$1,050) occurs on each standard unit sold at the competitive \$1,200 market price. Further, selling its custom go-kart at \$3,500 is a mistake by KartCo management because it is losing \$900 (\$3,500 – \$4,400) on each custom go-kart sold. That is, KartCo has underpriced its custom go-kart relative to its production costs and competitors’ prices, which explains why the company has more custom orders than it can supply.

Point: Accurately assigning costs to products is key to setting many product prices. If product costs are inaccurate and result in prices that are too low, the company loses money on each item sold. Likewise, if product prices are improperly set too high, the company loses business to competitors. ABC can be used to more accurately set prices.

Overhead allocation per go-kart under the single plantwide rate method, multiple departmental rate method, and ABC is summarized in Exhibit 4.14. Overhead cost allocated to standard go-karts is much less under ABC than under either of the volume-based costing methods. One reason for this difference is the large design modification costs that were spread over all go-karts under both the plantwide rate and the departmental rate methods even though standard go-karts require no engineering modification. When ABC is used, overhead costs commonly shift from standardized, large-volume products to low-volume, customized specialty products that consume disproportionate resources.

Allocation Method	Overhead Cost per Go-Kart	
	Standard Go-Kart	Custom Go-Kart
Plantwide overhead rate method	\$720	\$1,200
Departmental overhead rate method	700	1,300
ABC overhead rate method	300	3,300

EXHIBIT 4.14

Comparison of Overhead Allocations by Method

Decision Insight

ABCs of Banking **First Tennessee National Corporation**, a bank, applied ABC to reveal that 30% of its CD customers provided nearly 90% of its profits from CDs. Further, another 30% of its CD customers were actually losing money for the bank. Management used ABC to correct this problem.

Quick Check

Answers—p. 148

4. What is a cost driver? Provide an example of a typical cost driver.
5. What is an activity driver? Provide an example of a typical activity driver.
6. Traditional volume-based costing methods tend to: (a) overstate the cost of low-volume products, (b) overstate the cost of high-volume products, or (c) both a and b.

Assessing Activity-Based Costing

A3 Identify and assess advantages and disadvantages of activity-based costing.

Point: ABC can allocate the selling and administrative costs expensed by GAAP to activities; such costs can include marketing costs, costs to process orders, and costs to process customer returns.

While activity-based costing improves the accuracy of overhead cost allocations to products, it too has limitations. This section describes the major advantages and disadvantages of activity-based costing.

Advantages of Activity-Based Costing

More Accurate Overhead Cost Allocation Companies have typically used either a plantwide overhead rate or multiple departmental overhead rates because these methods are more straightforward than ABC and are acceptable under GAAP for external reporting. Under these traditional systems, overhead costs are pooled in a few large pools and are spread uniformly across high- and low-volume products. With ABC, overhead costs are grouped into activity pools. There are usually more activity pools under ABC than cost pools under traditional costing, which usually increases costing accuracy. More important is that overhead costs in each ABC pool are caused by a single activity. This means that overhead costs in each activity pool are allocated to products based on the cost of resources consumed by a product (input) rather than on how many units are produced (output). In sum, overhead cost allocation under ABC is more accurate because (1) there are more cost pools, (2) costs in each pool are more similar, and (3) allocation is based on activities that cause overhead costs.

More Effective Overhead Cost Control In traditional costing, overhead costs are usually allocated to products based on either direct labor hours or machine hours. Such allocation typically leads management to focus attention on direct labor cost or machine hours. Yet, direct labor or machine hours are often not the cause of overhead costs and often not even linked with these volume-related measures. As we saw with KartCo, design modifications markedly affect its overhead costs. Consequently, a plantwide overhead rate or departmental overhead rate based on direct labor or machine hours can mislead managers, preventing effective control of overhead costs and leading to product mispricing. ABC, on the other hand, can be used to identify activities that can benefit from process improvement. ABC can also help managers effectively control overhead cost by focusing on processes or activities such as batching setups, order processing, and design modifications instead of focusing only on direct labor or machine hours. For KartCo, identification of large design-modification costs would allow managers to work on initiatives to improve this process. Besides controlling overhead costs, KartCo's better assignment of overhead costs (particularly design-modification costs) for its go-karts helps its managers make better production and pricing decisions.

Focus on Relevant Factors Basing cost assignment on activities is not limited to determining product costs, as illustrated by KartCo. ABC can be used to assign costs to any cost object that is of management interest. For instance, a marketing manager often wants to determine the profitability of various market segments. Activity-based costing can be used to accurately assign costs of shipping, advertising, order-taking, and customer service that are unrelated to sales and costs of products sold. Such an activity-based analysis can reveal to the marketing department some customers that are better left to the competition if they consume a larger amount of marketing resources than the gross profit generated by sales to those customers. Generally, ABC provides better customer profitability information by including all resources consumed to serve a customer. This allows managers to make better pricing decisions on custom orders and to better manage customers by focusing on those that are most profitable.

Better Management of Activities Being competitive requires that managers be able to use resources efficiently. Understanding how costs are incurred is a first step toward controlling costs. One important contribution of ABC is helping managers identify the causes of costs, that is, the activities driving them. *Activity-based management (ABM)* is an outgrowth of ABC that draws on the link between activities and cost incurrence for better management. The way to control a cost requires changing how much of an activity is performed.



Point: The *Demonstration Problem* illustrates how ABC is applied for a services company.

Decision Maker



Entrepreneur You are the entrepreneur of a startup pharmaceutical company. You are assigning overhead to product units based on machine hours in the packaging area. Profits are slim due to increased competition. One of your larger overhead costs is \$10,000 for cleaning and sterilization that occurs each time the packaging system is converted from one product to another. These overhead costs average \$0.10 per product unit. Can you reduce cleaning and sterilizing costs by reducing the number of units produced? If not, what should you do to control these overhead costs? [Answer—p. 147]

Disadvantages of Activity-Based Costing

Costs to Implement and Maintain ABC Designing and implementing an activity-based costing system requires management commitment and financial resources. For ABC to be effective, a thorough analysis of cost activities must be performed and appropriate cost pools must be determined. Collecting and analyzing cost data are expensive and so is maintaining an ABC system. While technology, such as bar coding, has made it possible for many companies to use ABC, it is still too costly for some. Managers must weigh the cost of implementing and maintaining an ABC system against the potential benefits of ABC in light of company circumstances.

Uncertainty with Decisions Remains As with all cost information, managers must interpret ABC data with caution in making managerial decisions. In the KartCo case, given the huge design-modification costs for custom go-karts determined under the ABC system, a manager might be tempted to decline some custom go-kart orders to save overhead costs. However, in the short run, some or all of the design-modification costs cannot be saved even if some custom go-kart orders are rejected. Managers must examine carefully the controllability of costs before making decisions.

Quick Check

Answers—p. 148

7. What are three advantages of ABC over traditional volume-based allocation methods?
8. What is the main advantage of traditional volume-based allocation methods compared to activity-based costing? How should a manager decide which method to use?

Customer Profitability

Decision Analysis

Are all customers equal? To help answer this, let's return to the KartCo case and assume that costs of providing customer support (such as delivery, installation, and warranty work) are related to the distance a technician must travel to provide services. If the annual cost of customer services is expected to be \$250,000 and the distance traveled by technicians is 100,000 miles annually, KartCo would want to link the cost of customer services with individual customers to make efficient marketing decisions.

Using these data, an activity rate of \$2.50 per mile (\$250,000/100,000 miles) is computed for assigning customer service costs to individual customers. For KartCo, it would compute a typical customer profitability report for one of its customers, Six Flags, as follows.

Customer Profitability Report—Six Flags

Sales (10 standard go-karts × \$1,200)		\$12,000
Less: Product costs		
Direct materials (10 go-karts × \$400 per go-kart)	\$4,000	
Direct labor (10 go-karts × \$350 per go-kart)	3,500	
Overhead (10 go-karts × \$300 per go-kart, Exhibit 4.13)	<u>3,000</u>	<u>10,500</u>
Product profit margin		1,500
Less: Customer service costs (200 miles × \$2.50 per mile)		<u>500</u>
Customer profit margin		<u>\$ 1,000</u>

Analysis indicates that a total profit margin of \$1,000 is generated from this customer. The management of KartCo can see that if this customer requires service technicians to travel more than 600 miles ($\$1,500 \div \2.50 per mile), the sale of 10 standard go-karts to this customer would be unprofitable. ABC encourages management to consider all resources consumed to serve a customer, not just manufacturing costs that are the focus of traditional costing methods.

Demonstration Problem

Silver Law Firm provides litigation and mediation services to a variety of clients. Attorneys keep track of the time they spend on each case, which is used to charge fees to clients at a rate of \$300 per hour. A management advisor commented that activity-based costing might prove useful in evaluating the costs of its legal services, and the firm has decided to evaluate its fee structure by comparing ABC to its alternative cost allocations. The following data relate to a typical month at the firm. During a typical month the firm handles seven mediation cases and three litigation cases.

	Activity Driver	Total Amount	Consumption By Service Type		Activity Cost
			Litigation	Mediation	
Providing legal advice	Billable hours	200	75	125	<u>\$30,000</u>
Overhead costs					
Internal support departments					
Preparing documents	Documents	30	16	14	\$ 4,000
Occupying office space	Billable hours	200	75	125	1,200
Heating and lighting of office	Billable hours	200	75	125	350
External support departments					
Registering court documents	Documents	30	16	14	1,250
Retaining consultants					
(investigators, psychiatrists)	Court dates	6	5	1	10,000
Using contract services					
(couriers, security guards)	Court dates	6	5	1	<u>5,000</u>
Total overhead costs					<u>\$21,800</u>

Required

1. Determine the cost of providing legal services to each type of case using activity-based costing (ABC).
2. Determine the cost of each type of case using a single plantwide rate for nonattorney costs based on billable hours.
3. Determine the cost of each type of case using multiple departmental overhead rates for the internal support department (based on number of documents) and external support department (based on billable hours).
4. Compare and discuss the costs assigned under each method for management decisions.

Planning the Solution

- Compute pool rates and assign costs to cases using ABC.
- Compute costs for the cases using the volume-based methods and discuss differences between these costs and the costs computed using ABC.

Solution to Demonstration Problem

1. We need to set up activity pools and compute pool rates for ABC. All activities except “occupying office space” and “heating and lighting” are unit level (meaning they are traceable to the individual cases handled by the law firm). “Preparing documents” and “registering documents” are both driven by the number of documents associated with each case. We can therefore combine these activities and their costs into a single pool, which we call “clerical support.” Similarly, “retaining consultants” and “using services” are related to the number of times the attorneys must go to court (court dates).

We combine these activities and their costs into another activity cost pool labeled “litigation support.” The costs associated with occupying office space and the heating and lighting are facility level activities and are not traceable to individual cases. Yet they are costs that must be covered by fees charged to clients. We assign these costs using a convenient base—in this example we use the number of billable hours, which attorneys record for each client. Providing legal advice is the direct labor for a law firm.

Activity Pool	Activity Cost	Pool Cost	Activity Driver	Pool Rate (Pool Cost ÷ Activity Driver)
Providing legal advice	\$30,000	\$30,000	200 billable hours	\$150 per billable hour
Clerical support				
Preparing documents	4,000			
Registering documents	<u>1,250</u>	5,250	30 documents	\$175 per document
Litigation support				
Retaining consultants	10,000			
Using services	<u>5,000</u>	15,000	6 court dates	\$2,500 per court date
Facility costs				
Occupying office space	1,200			
Heating and lighting	<u>350</u>	1,550	200 billable hours	\$7.75 per billable hour

We next determine the cost of providing each type of legal service as shown in the following table. Specifically, the pool rates from above are used to assign costs to each type of service provided by the law firm. Since litigation consumed 75 billable hours of attorney time, we assign \$11,250 (75 billable hours × \$150 per billable hour) of the cost of providing legal advice to this type of case. Mediation required 125 hours of attorney time, so \$18,750 (125 billable hours × \$150 per billable hour) of the cost to provide legal advice is assigned to mediation cases. Clerical support cost \$175 per document, so the costs associated with activities in this cost pool are assigned to litigation cases (16 documents × \$175 per document = \$2,800) and mediation cases (14 documents × \$175 per document = \$2,450). The costs of activities in the litigation support and the facility cost pools are similarly assigned to the two case types.

We compute the total cost of litigation (\$27,131.25) and mediation (\$24,668.75) and divide these totals by the number of cases of each type to determine the average cost of each case type: \$9,044 for litigation and \$3,524 for mediation. This analysis shows that charging clients \$300 per billable hour without regard to the type of case results in litigation clients being charged less than the cost to provide that service (\$7,500 versus \$9,044).

	Pool Rate	Litigation		Mediation	
Providing legal advice	\$150 per billable hour	75 hours	\$11,250.00	125 hours	\$18,750.00
Clerical support	\$175 per document	16 docs	2,800.00	14 docs	2,450.00
Litigation support	\$2,500 per court date	5 court dates	12,500.00	1 court date	2,500.00
Facility costs	\$7.75 per billable hour	75 hours	<u>581.25</u>	125 hours	<u>968.75</u>
Total cost			<u>\$27,131.25</u>		<u>\$24,668.75</u>
÷ Number of cases			3 cases	7 cases	
Average cost per case			\$9,044	\$3,524	
Average fee per case			\$7,500*	\$5,357†	

* (75 billable hours × \$300 per hour) ÷ 3 cases

† (125 billable hours × \$300 per hour) ÷ 7 cases

- The cost of each type of case using a single plantwide rate for nonattorney costs (that is, all costs except for those related to providing legal advice) based on billable hours is as follows.

$$\text{Total overhead cost/ Total billable hours} = \$21,800/200 \text{ billable hours} = \underline{\underline{\$109 \text{ per hour}}}$$

We then determine the cost of providing each type of legal service as follows.

		Litigation		Mediation	
Providing legal advice	\$150 per billable hour	75 hours	\$11,250	125 hours	\$18,750
Overhead (from part 2)	\$109 per billable hour	75 hours	8,175	125 hours	13,625
Total cost			<u>\$19,425</u>		<u>\$32,375</u>
÷ Number of cases			3 cases		7 cases
Average cost per case			\$6,475		\$4,625
Average fee per case (from part 1)			\$7,500		\$5,357

3. The cost of each type of case using multiple departmental overhead rates for the internal support department (based on number of documents) and external support department (based on billable hours) is determined as follows.

	Departmental Cost	Base	Departmental Rate (Departmental Cost ÷ Base)
Internal support departments			
Preparing documents	\$ 4,000		
Occupying office space	1,200		
Heating and lighting of office	<u>350</u>	\$ 5,550	30 documents
External support departments			
Registering documents	1,250		
Retaining consultants	10,000		
Using contract services	<u>5,000</u>	16,250	200 billable hours

The departmental overhead rates computed above are used to assign overhead costs to the two types of legal services. For the internal support department we use the overhead rate of \$185 per document to assign \$2,960 ($\185×16 documents) to litigation and \$2,590 ($\185×14 documents) to mediation. For the external support department we use the overhead rate of \$81.25 per hour to assign \$6,093.75 ($\81.25×75 hours) to litigation and \$10,156.25 ($\81.25×125 hours) to mediation. As shown below, the resulting average costs of litigation cases and mediation cases are \$6,768 and \$4,499, respectively. Using this method of cost assignment, it *appears* that the fee of \$300 per billable hour is adequate to cover costs associated with each case.

		Litigation		Mediation	
Attorney fees	\$150 per billable hour	75 hours	\$11,250.00	125 hours	\$18,750.00
Internal support	\$185 per document	16 documents	2,960.00	14 documents	2,590.00
External support	\$81.25 per hour	75 hours	<u>6,093.75</u>	125 hours	<u>10,156.25</u>
Total cost			<u>\$20,303.75</u>		<u>\$31,496.25</u>
÷ Number of cases			3 cases		7 cases
Average cost per case			\$6,768		\$4,499
Average fee per case (from part 1)			\$7,500		\$5,357

4. A comparison and discussion of the costs assigned under each method follows.

Average Cost per Case	Method of Assigning Overhead Costs		
	Activity-Based Costing	Plantwide Overhead Rate	Departmental Overhead Rates
Litigation cases	\$9,044	\$6,475	\$6,768
Mediation cases	3,524	4,625	4,499

The departmental and plantwide overhead rate methods assign overhead on the basis of volume-related measures (billable hours and document filings). Litigation costs *appear* profitable under these methods,

because the average costs are below the average revenue of \$7,500. ABC, however, focuses attention on activities that drive costs. A large part of overhead costs was for consultants and contract services, which were unrelated to the number of cases, but related to the type of cases consuming those resources. Using ABC, the costs shift from the high-volume cases (mediation) to the low-volume cases (litigation). When the firm considers the consumption of resources for these cases using ABC, it finds that the fees charged to litigate cases is insufficient (average revenue of \$7,500 versus average cost of \$9,044). The law firm is charging too little for the complex cases that require litigation.

Summary

C1 Distinguish between the plantwide overhead rate method, the departmental overhead rate method, and the activity-based costing method. Overhead costs can be assigned to cost objects using a plantwide rate that combines all overhead costs into a single rate, usually based on direct labor hours, machine hours, or direct labor cost. Multiple departmental overhead rates that include overhead costs traceable to departments are used to allocate overhead based on departmental functions. ABC links overhead costs to activities and assigns overhead based on how much of each activity is required for a product.

C2 Explain cost flows for the plantwide overhead rate method. All overhead costs are combined in the plantwide overhead rate to form a single rate that is then used to assign overhead to each product. It is a one-step allocation.

C3 Explain cost flows for the departmental overhead rate method. When using departmental overhead rates, overhead costs are first traced to specific departments where various costs are incurred. Overhead rates for each department are then used to assign overhead to products that pass through each department.

C4 Explain cost flows for activity-based costing. With ABC, overhead costs are first traced to the activities that cause them, and then cost pools are formed combining costs caused by the same activity. Overhead rates based on these activities are then used to assign overhead to products in proportion to the amount of activity required to produce them.

A1 Identify and assess advantages and disadvantages of the plantwide overhead rate method. A single plantwide overhead rate is a simple way to assign overhead cost. A disadvantage is that it can inaccurately assign costs when costs are caused by multiple factors and when different products consume different amounts of inputs.

A2 Identify and assess advantages and disadvantages of the departmental overhead rate method. Overhead costing

accuracy is improved by use of multiple departmental rates because differences across departmental functions can be linked to costs incurred in departments. Yet, accuracy of cost assignment with departmental rates suffers from the same problems associated with plantwide rates because activities required for each product are not identified with costs of providing those activities.

A3 Identify and assess advantages and disadvantages of activity-based costing. ABC improves product costing accuracy and draws management attention to relevant factors to control. The cost of constructing and maintaining an ABC system can sometimes outweigh its value.

P1 Allocate overhead costs to products using the plantwide overhead rate method. The plantwide overhead rate equals total budgeted overhead divided by budgeted plant volume, the latter often measured in direct labor hours or machine hours. This rate multiplied by the number of direct labor hours (or machine hours) required for each product provides the overhead assigned to each product.

P2 Allocate overhead costs to products using the departmental overhead rate method. When using multiple departmental rates, overhead cost must first be traced to each department and then divided by the measure of output for that department to yield the departmental overhead rate. Overhead is applied to products using this rate as products pass through each department.

P3 Allocate overhead costs to products using activity-based costing. With ABC, overhead costs are matched to activities that cause them. If there is more than one cost with the same activity, these costs are combined into pools. An overhead rate for each pool is determined by dividing total cost for that pool by its activity measure. Overhead costs are assigned to products by multiplying the ABC pool rate by the amount of the activity required for each product.

Guidance Answers to **Decision Maker** and **Decision Ethics**



Department Manager When dividing a bill, common sense suggests fairness. That is, if one department consumes more services than another, we attempt to share the bill in proportion to consumption. Equally dividing the bill among the number of departments is fair if each consumed equal services. This same notion applies in assigning costs to products and services. For example, dividing overhead costs by the number of units is fair if all products consumed overhead in equal proportion.

Cost Analyst Before the accounting system can report information, relevant and accurate data must be collected. One step is to ask questions—it is a good way to leverage others' experience and

knowledge to quickly learn operations. A cost analyst must also understand the manufacturing operation to itemize activities for ABC. Thus, step two might be to tour the manufacturing facility, observing manufacturing operations, asking probing questions, and requesting recommendations from the people who work in those operations. We must remember that these employees are the experts who can provide the data we need to implement an activity-based costing system.

Entrepreneur Cleaning and sterilizing costs are not directly related to the volume of product manufactured. Thus, changing the number of units produced does not necessarily reduce these costs. Further, expressing costs of cleaning and sterilizing on a per unit basis is often

misleading for the person responsible for controlling costs. Costs of cleaning and sterilizing are related to changing from one product line to another. Consequently, the way to control those costs is to control

the number of times the packing system has to be changed for a different product line. Thus, efficient product scheduling would help reduce those overhead costs and improve profitability.

Guidance Answers to Quick Checks

1. d
2. a
3. b
4. A cost driver is an activity that causes costs to be incurred. Setup costs, design modifications, and plant services such as maintenance and utilities are examples of typical cost drivers.
5. An activity driver is the measurement used for cost drivers. An example is machine hours.
6. b
7. Three advantages of ABC over traditional methods are: (a) more accurate product costing; (b) more effective cost control; and (c) focus on relevant factors for decision making.
8. Traditional volume-based methods are easier and less costly to implement and maintain. The choice of accounting method should be made by comparing the costs of alternatives with their benefits.



Key Terms

mhhe.com/wildMA2e

Key Terms are available at the book's Website for learning and testing in an online Flashcard Format.

- | | | |
|---------------------------------------|--|------------------------------------|
| Activity (p. 135) | Activity driver (p. 139) | Facility level activities (p. 137) |
| Activity-based costing (ABC) (p. 135) | Activity overhead (pool) rate (p. 135) | Product level activities (p. 137) |
| Activity-based management (p. 142) | Batch level activities (p. 137) | Unit level activities (p. 137) |
| Activity cost driver (p. 139) | Cost driver (p. 139) | |
| Activity cost pool (p. 135) | Cost object (p. 131) | |



Multiple Choice Quiz

Answers on p. 165

mhhe.com/wildMA2e

Additional Quiz Questions are available at the book's Website.

1. In comparison to a traditional cost system, and when there are batch level or product level costs, an activity-based costing system usually:
 - a. Shifts costs from low-volume to high-volume products.
 - b. Shifts costs from high-volume to low-volume products.
 - c. Shifts costs from standardized to specialized products.
 - d. Shifts costs from specialized to standardized products.
2. Which of the following statements is (are) true?
 - a. An activity-based costing system is generally easier to implement and maintain than a traditional costing system.
 - b. One of the goals of activity-based management is the elimination of waste by allocating costs to products that waste resources.
 - c. Activity-based costing uses a number of activity cost pools, each of which is allocated to products on the basis of direct labor hours.
 - d. Activity rates in activity-based costing are computed by dividing costs from the first-stage allocations by the activity measure for each activity cost pool.
3. All of the following are examples of batch level activities except:
 - a. Purchase order processing.
 - b. Setting up equipment.
 - c. Clerical activity associated with processing purchase orders to produce an order for a standard product.
 - d. Employee recreational facilities.
4. A company has two products: A and B. It uses activity-based costing and prepares the following analysis showing budgeted cost and activity for each of its three activity cost pools.

Activity Cost Pool	Budgeted Overhead Cost	Budgeted Activity		
		Product A	Product B	Total
Activity 1	\$ 80,000	200	800	1,000
Activity 2	58,400	1,000	500	1,500
Activity 3	360,000	600	5,400	6,000

Annual production and sales level of Product A is 18,188 units, and the annual production and sales level of Product B is 31,652 units. The approximate overhead cost per unit of Product B under activity-based costing is:






- \$2.02
 - \$5.00
 - \$12.87
 - \$22.40
5. A company uses activity-based costing to determine the costs of its two products: A and B. The budgeted cost and activity for each of the company's three activity cost pools follow.

Activity Cost Pool	Budgeted Cost	Budgeted Activity		
		Product A	Product B	Total
Activity 1	\$19,800	800	300	1,100
Activity 2	16,000	2,200	1,800	4,000
Activity 3	14,000	400	300	700

The activity rate under the activity-based costing method for Activity 3 is approximately:

- \$4.00
- \$8.59
- \$18.00
- \$20.00

Discussion Questions

- Why are overhead costs allocated to products and not traced to products as direct materials and direct labor are?
- What are three common methods of assigning overhead costs to a product?
- What is a cost object?
- Why are direct labor hours and machine hours commonly used as the bases for overhead allocation?
- What are the advantages of using a single plantwide overhead rate?
- The usefulness of a single plantwide overhead rate is based on two assumptions. What are those assumptions?
-  Explain why a single plantwide overhead rate can distort the cost of a particular product.
-  If plantwide overhead rates are allowed for reporting costs to external users, why might a company choose to use a more complicated and more expensive method for assigning overhead costs to products?
-  Why are multiple departmental overhead rates more accurate for product costing than a single plantwide overhead rate?
- In what way are departmental overhead rates similar to a single plantwide overhead rate? How are they different?
- What is the first step in applying activity-based costing?
- What is a cost driver?
- What is an activity driver?
- What are the four activity levels associated with activity-based costing? Define each.
-  Activity-based costing is generally considered more accurate than other methods of assigning overhead. If this is so, why do all manufacturing companies not use it?
-  "Activity-based costing is only useful for manufacturing companies." Is this a true statement? Explain.



Denotes Discussion Questions that involve decision making.

connect Most materials in this section are available in McGraw-Hill's Connect

In the blank next to the following terms, place the letter A through G corresponding to the best description of that term.

- | | |
|----------------------------------|---|
| 1. _____ unit level activity | A. A task that must be performed for each unit produced. |
| 2. _____ activity driver | B. A group of costs that have the same activity drivers. |
| 3. _____ batch level activity | C. Anything to which costs will be assigned. |
| 4. _____ cost object | D. Tasks that are performed for each group of units such as a production run or lot. |
| 5. _____ plantwide overhead rate | E. An activity that causes a cost to be incurred. |
| 6. _____ cost pool | F. Measurement associated with an activity. |
| | G. A single factor used to apply indirect manufacturing costs in all departments. |

QUICK STUDY

QS 4-1

Costing terminology

C1

QS 4-2

Identify activity control levels

C4

Identify each of the following activities as unit level (U), batch level (B), product level (P), or facility level (F) to indicate the way each is incurred with respect to production.

1. _____ Sampling cookies to determine quality.
2. _____ Paying real estate taxes on the factory building.
3. _____ Attaching labels to collars of shirts.
4. _____ Mixing of bread dough in a commercial bakery.
5. _____ Polishing of gold wedding rings.
6. _____ Cleaning the assembly department.
7. _____ Redesigning a bicycle seat in response to customer feedback.

QS 4-3

Compute and apply plantwide and departmental overhead rates

P1 P2

Fortel Manufacturing identified the following data in its two production departments.

	Assembly	Finishing
Manufacturing overhead costs	\$600,000	\$1,200,000
Direct labor hours worked	12,000 DLH	20,000 DLH
Machine hours used	6,000 MH	16,000 MH

Required

1. What is the company's single plantwide overhead rate based on direct labor hours?
2. What are the company's departmental overhead rates if the assembly department assigns overhead based on direct labor hours and the finishing department assigns overhead based on machine hours?

QS 4-4

Comparing plantwide overhead rate to ABC

P3

Chen Company identified the following activities, costs, and activity drivers.

Activity	Expected Costs	Expected Activity
Handling materials	\$625,000	100,000 parts in stock
Inspecting product	900,000	1,500 batches
Processing purchase orders	105,000	700 orders
Paying suppliers	175,000	500 invoices
Insuring the factory	300,000	40,000 square feet
Designing packaging	375,000	10 models

Required

1. Compute the activity rate for each activity.
2. Compute a single plantwide overhead rate assuming that the company assigns overhead based on 100,000 budgeted direct labor hours.

QS 4-5

Assigning costs using ABC

P1 P3

Refer to the data in QS4-4. Assume that the following information is available for the company's two products.

	Fast Model	Standard Model
Production volume	10,000 units	30,000 units
Parts required	20,000 parts	30,000 parts
Batches made	250 batches	100 batches
Purchase orders	50 orders	20 orders
Invoices	50 invoices	10 invoices
Space occupied	10,000 sq. ft.	7,000 sq. ft.
Models	1 model	1 model

Required

1. Assign overhead costs to each product model using activity-based costing (ABC). What is the cost per unit of each model?
2. Assign overhead costs to each product model using the single plantwide overhead rate assuming the fast model requires 25,000 direct labor hours and the standard model requires 60,000 direct labor hours. What is the overhead cost per unit for each model?

Qinto Company sells two types of products, Basic and Deluxe. The company provides technical support for users of its products, at an expected cost of \$250,000 per year. The company expects to process 10,000 customer service calls per year.

QS 4-6

Assigning costs using ABC
P3

Required

1. Determine the company's cost of technical support per service call.
2. During the month of January, Qinto received 650 calls for customer service on its Deluxe model, and 150 calls for customer service on its Basic model. Assign technical support costs to each model using ABC.

connect Most materials in this section are available in McGraw-Hill's Connect

Following are activities in providing medical services at Healthcare Clinic.

- | | |
|---------------------------------------|--------------------------------------|
| A. Ordering medical equipment | E. Registering patients |
| B. Heating the clinic | F. Cleaning beds |
| C. Filling prescriptions | G. Washing linens |
| D. Providing security services | H. Stocking examination rooms |

EXERCISES

Exercise 4-1

Activity classification
C4

Required

1. Classify each activity as unit level (U), batch level (B), product level (P), or facility level (F).
2. Identify an activity driver that might be used to measure these activities at the clinic.

Teradyne Crystal makes fine tableware in its Ireland factory. The following data are taken from its production plans for 2009.

Direct labor costs	€5,870,000
Setup costs	630,000

Exercise 4-2

Comparing costs under ABC to traditional plantwide overhead rate
P1 P3 A1 A3

	Wine Glasses	Commemorative Vases
Expected production	211,000 units	17,000 units
Direct labor hours required	254,000 DLH	16,400 DLH
Machine setups required	200 setups	800 setups

Required

1. Determine the setup cost per unit for the wine glasses and for the commemorative vases if setup costs are assigned using a single plantwide overhead rate based on direct labor hours.
2. Determine setup costs per unit for the wine glasses and for the commemorative vases if the setup costs are assigned based on the number of setups.
3. Which method is better for assigning costs to each product? Explain.

Check (2) Vases, €29.65 per unit

Exercise 4-3

Comparing plantwide overhead rate to departmental overhead rates

P1 P2 A1 A2

Supertronic Plastics produces parts for a variety of small machine manufacturers. Most products go through two operations, molding and trimming, before they are ready for packaging. Expected costs and activities for the molding department and for the trimming department for 2009 follow.

	Molding	Trimming
Direct labor hours	52,000 DLH	48,000 DLH
Machine hours	30,500 MH	3,600 MH
Overhead costs	\$730,000	\$590,000

Data for two special order parts to be manufactured by the company in 2009 follow:

	Part A27C	Part X82B
Number of units	9,800 units	54,500 units
Machine hours		
Molding	5,100 MH	1,020 MH
Trimming	2,600 MH	650 MH
Direct labor hours		
Molding	5,500 DLH	2,150 DLH
Trimming	700 DLH	3,500 DLH

Required

1. Compute the plantwide overhead rate using direct labor hours as the base.
2. Determine the overhead cost assigned to each product line using the plantwide rate computed in requirement 1.
3. Compute a departmental overhead rate for the molding department based on machine hours and a department overhead rate for the trimming department based on direct labor hours.
4. Determine the total overhead cost assigned to each product line using the departmental overhead rates from requirement 3.
5. Determine the overhead cost per unit for each product line using the plantwide rate. Compare these costs to the cost per unit if departmental rates were used.

Exercise 4-4

Multiple choice overhead questions

C4 A3

1. With ABC, overhead costs should be traced to which cost object first?
 - a. Units of product
 - b. Activities
 - c. Departments
 - d. Product lines
2. When using departmental overhead rates, which of the following cost objects is the first in the cost assignment process?
 - a. Activities
 - b. Units of product
 - c. Departments
 - d. Product lines
3. Which costing method tends to overstate the cost of high-volume products?
 - a. Traditional volume-based costing
 - b. Activity-based costing
 - c. Job order costing
 - d. Differential costing
4. If management wants the most accurate product cost, which of the following costing methods should be used?
 - a. Volume-based costing using departmental overhead rates
 - b. Volume-based costing using a plantwide overhead rate
 - c. Normal costing using a plantwide overhead rate
 - d. Activity-based costing

Rayol produces lamps and home lighting fixtures. Its most popular product is a brushed aluminum desk lamp. This lamp is made from components shaped in the fabricating department and assembled in its implementation department. Information related to the 35,000 desk lamps produced annually follow.

Exercise 4-5

Assigning overhead costs using the plantwide rate and departmental rates

P1 P2

Direct materials	\$280,000
Direct labor	
Fabricating department (7,000 DLH × \$20 per DLH)	\$140,000
Implementation department (16,000 DLH × \$29 per DLH)	\$464,000
Machine hours	
Fabricating department	15,040 MH
Implementation department	21,000 MH

Expected overhead cost and related data for the two production departments follow.

	Fabricating	Implementation
Direct labor hours	75,000 DLH	125,000 DLH
Machine hours	80,000 MH	62,500 MH
Overhead cost	\$300,000	\$200,000

Required

- Determine the plantwide overhead rate for Rayol using direct labor hours as a base.
- Determine the total manufacturing cost per unit for the aluminum desk lamp using the plantwide overhead rate. Check (2) \$26.90 per unit
- Compute departmental overhead rates based on machine hours in the fabricating department and direct labor hours in the implementation department.
- Use departmental overhead rates from requirement 3 to determine the total manufacturing cost per unit for the aluminum desk lamps. Check (4) \$27.60 per unit

Real Cool produces two different models of air conditioners. The company produces the mechanical systems in their components department. The mechanical systems are combined with the housing assembly in its finishing department. The activities, costs, and drivers associated with these two manufacturing processes and the production support process follow.

Exercise 4-6

Using the plantwide overhead rate to assess prices

C2 A1 P1

Process	Activity	Overhead Cost	Driver	Quantity
Components	Changeover	\$ 500,000	Number of batches	800
	Machining	279,000	Machine hours	6,000
	Setups	225,000	Number of setups	120
		<u>\$1,004,000</u>		
Finishing	Welding	\$ 180,300	Welding hours	3,000
	Inspecting	210,000	Number of inspections	700
	Rework	75,000	Rework orders	300
		<u>\$ 465,300</u>		
Support	Purchasing	\$ 135,000	Purchase orders	450
	Providing space	32,000	Number of units	5,000
	Providing utilities	65,000	Number of units	5,000
		<u>\$ 232,000</u>		

Additional production information concerning its two product lines follows.

	Model 145	Model 212
Units produced	1,500	3,500
Welding hours	800	2,200
Batches	400	400
Number of inspections	400	300
Machine hours	1,800	4,200
Setups	60	60
Rework orders	160	140
Purchase orders	300	150

Required

- Using a plantwide overhead rate based on machine hours, compute the overhead cost per unit for each product line.
- Determine the total cost per unit for each product line if the direct labor and direct materials costs per unit are \$250 for Model 145 and \$180 for Model 212.
- If the market price for Model 145 is \$800 and the market price for Model 212 is \$470, determine the profit or loss per unit for each model. Comment on the results.

Check (3) Model 212, \$(50.26) per unit loss

Exercise 4-7

Using departmental overhead rates to assess prices

C3 A2 P2

Refer to the information in Exercise 4-6 to answer the following requirements.

Required

- Determine departmental overhead rates and compute the overhead cost per unit for each product line. Base your overhead assignment for the components department on machine hours. Use welding hours to assign overhead costs to the finishing department. Assign costs to the support department based on number of purchase orders.
- Determine the total cost per unit for each product line if the direct labor and direct materials costs per unit are \$250 for Model 145 and \$180 for Model 212.
- If the market price for Model 145 is \$800 and the market price for Model 212 is \$470, determine the profit or loss per unit for each model. Comment on the results.

Check (3) Model 212, \$(30.38) per unit loss

Exercise 4-8

Using ABC to assess prices

C4 A3 P3

Refer to the information in Exercise 4-6 to answer the following requirements.

Required

- Using ABC, compute the overhead cost per unit for each product line.
- Determine the total cost per unit for each product line if the direct labor and direct materials costs per unit are \$200 for Model 145 and \$180 for Model 212.
- If the market price for Model 145 is \$800 and the market price for Model 212 is \$470, determine the profit or loss per unit for each model. Comment on the results.

Check (3) Model 212, \$24.88 per unit profit

Exercise 4-9

Using ABC for strategic decisions

P1 P3

Consider the following data for two products of Rowena Manufacturing.

	Overhead Cost	Product A	Product B
Number of units produced		10,000 units	2,000 units
Direct labor cost (@ \$24 per DLH)		0.20 DLH per unit	0.25 DLH per unit
Direct materials cost		\$2 per unit	\$3 per unit
Activity			
Machine setup	\$121,000		
Materials handling	48,000		
Quality control	80,000		
	<u>\$249,000</u>		

Required

- Using direct labor hours as the basis for assigning overhead costs, determine the total production cost per unit for each product line.
- If the market price for Product A is \$20 and the market price for Product B is \$60, determine the profit or loss per unit for each product. Comment on the results.
- Consider the following additional information about these two product lines. If ABC is used for assigning overhead costs to products, what is the cost per unit for Product A and for Product B?

Check (2) Product B, \$26.10 per unit profit

	Product A	Product B
Number of setups required for production	10 setups	12 setups
Number of parts required	1 part/unit	3 parts/unit
Inspection hours required	40 hours	210 hours

- Determine the profit or loss per unit for each product. Should this information influence company strategy? Explain.

(4) Product B, (\$24.60) per unit loss

Kumar & Knight is an architectural firm that provides services for residential construction projects. The following data pertain to a recent reporting period.

Exercise 4-10
Using ABC in a service company
P3

	Activities	Costs
Design department		
Client consultation	1,500 contact hours	\$270,000
Drawings	2,000 design hours	115,000
Modeling	40,000 square feet	30,000
Project management department		
Supervision	600 days	\$120,000
Billings	8 jobs	10,000
Collections	8 jobs	12,000

Required

- Using ABC, compute the firm’s activity overhead rates. Form activity cost pools where appropriate.
- Assign costs to a 9,200 square foot job that requires 450 contact hours, 340 design hours, and 200 days to complete.

Check (2) \$150,200

connect Most materials in this section are available in McGraw-Hill’s Connect

Health Drinks Company produces two beverages, PowerPunch and SlimLife. Data about these products follow.

PROBLEM SET A

Problem 4-1A
Evaluating product line costs and prices using ABC

P3

	PowerPunch	SlimLife
Production volume	12,500 bottles	180,000 bottles
Liquid materials	1,400 gallons	37,000 gallons
Dry materials	620 pounds	12,000 pounds
Bottles	12,500 bottles	180,000 bottles
Labels	3 labels per bottle	1 label per bottle
Machine setups	500 setups	300 setups
Machine hours	200 MH	3,750 MH

Additional data from its two production departments follow.

Department	Driver	Cost
Mixing department		
Liquid materials	Gallons	\$ 2,304
Dry materials	Pounds	6,941
Utilities	Machine hours	1,422
Bottling department		
Bottles	Units	\$77,000
Labeling	Labels per bottle	6,525
Machine setup	Setups	20,000

Required

- Determine the cost of each product line using ABC.
- What is the cost per bottle for PowerPunch? What is the cost per bottle of SlimLife? (*Hint:* Your answer should draw on the total cost for each product line computed in requirement 1.)
- If PowerPunch sells for \$3.75 per bottle, how much profit does the company earn per bottle of PowerPunch that it sells?
- What is the minimum price that the company should set per bottle of SlimLife? Explain.

Check (3) \$2.22 profit per bottle

Problem 4-2A

Applying activity-based costing

C1 C4 A1 A3 P3

Crafton Manufacturing produces machine tools for the construction industry. The following details about overhead costs were taken from its company records.

Production Activity	Indirect Labor	Indirect Materials	Other Overhead
Grinding	\$320,000		
Polishing		\$135,000	
Product modification	600,000		
Providing power			\$255,000
System calibration	500,000		

Additional information on the drivers for its production activities follows.

Grinding	13,000 machine hours
Polishing	13,000 machine hours
Product modification	1,500 engineering hours
Providing power	17,000 direct labor hours
System calibration	400 batches

Required

- Classify each activity as unit level, batch level, product level, or facility level.
- Compute the activity overhead rates using ABC. Form cost pools as appropriate.
- Determine overhead costs to assign to the following jobs using ABC.

	Job 3175	Job 4286
Number of units	200 units	2,500 units
Machine hours	550 MH	5,500 MH
Engineering hours	26 eng. hours	32 eng. hours
Batches	30 batches	90 batches
Direct labor hours	500 DLH	4,375 DLH

4. What is the overhead cost per unit for Job 3175? What is the overhead cost per unit for Job 4286?
5. If the company used a plantwide overhead rate based on direct labor hours, what is the overhead cost for each unit of Job 3175? Of Job 4286?
6. Compare the overhead costs per unit computed in requirements 4 and 5 for each job. Which method more accurately assigns overhead costs?

Check (4) Job 3175, \$373.25 per unit

Maxlon Company manufactures custom-made furniture for its local market and produces a line of home furnishings sold in retail stores across the country. The company uses traditional volume-based methods of assigning direct materials and direct labor to its product lines. Overhead has always been assigned by using a plantwide overhead rate based on direct labor hours. In the past few years, management has seen its line of retail products continue to sell at high volumes, but competition has forced it to lower prices on these items. The prices are declining to a level close to its cost of production.

Problem 4-3A

Assessing impacts of using a plantwide overhead rate versus ABC

A1 A2 A3

Meanwhile, its custom-made furniture is in high demand and customers have commented on its favorable (lower) prices compared to its competitors. Management is considering dropping its line of retail products and devoting all of its resources to custom-made furniture.

Required

1. What reasons could explain why competitors are forcing the company to lower prices on its high-volume retail products?
2. Why do you believe the company charges less for custom-order products than its competitors?
3. Does a company's costing method have any effect on its pricing decisions? Explain.
4. Aside from the differences in volume of output, what production differences do you believe exist between making custom-order furniture and mass-market furnishings?
5. What information might the company obtain from using ABC that it might not obtain using volume-based costing methods?

The following data are for the two products produced by Aplan Company.

	Product A	Product B
Direct materials	\$15 per unit	\$24 per unit
Direct labor hours	0.3 DLH per unit	1.6 DLH per unit
Machine hours	0.1 MH per unit	1.2 MH per unit
Batches	125 batches	225 batches
Volume	10,000 units	2,000 units
Engineering modifications	12 modifications	58 modifications
Number of customers	500 customers	400 customers
Market price	\$30 per unit	\$120 per unit

Problem 4-4A

Comparing costs using ABC with the plantwide overhead rate

C1 P1 P3 A1 A3

The company's direct labor rate is \$20 per direct labor hour (DLH). Additional information follows.

	Costs	Driver
Indirect manufacturing		
Engineering support	\$24,500	Engineering modifications
Electricity	34,000	Machine hours
Setup costs	52,500	Batches
Nonmanufacturing		
Customer service	81,000	Number of customers

Required

1. Compute the manufacturing cost per unit using the plantwide overhead rate based on direct labor hours. What is the gross profit per unit?
2. How much gross profit is generated by each customer of Product A using the plantwide overhead rate? How much gross profit is generated by each customer of Product B using the plantwide overhead rate? What is the cost of providing customer service to each customer? What information is provided by this comparison?

Check (1) Product A, \$26.37 per unit cost

(3) Product A, \$24.30 per unit cost

3. Determine the manufacturing cost per unit of each product line using ABC. What is the gross profit per unit?
4. How much gross profit is generated by each customer of Product A using ABC? How much gross profit is generated by each customer of Product B using ABC? Is the gross profit per customer adequate?
5. Which method of product costing gives better information to managers of this company? Explain why.

Problem 4-5A

Pricing analysis with ABC and a plantwide overhead rate

A1 A2 P1

Camper-Craft Corporation produces two lines of tents sold to outdoor enthusiasts. The tents are cut to specifications in department A. In department B the tents are sewn and folded. The activities, costs, and drivers associated with these two manufacturing processes and its production support activities follow.

Process	Activity	Overhead Cost	Driver	Quantity
Department A	Pattern alignment	\$ 64,400	Batches	560
	Cutting	50,430	Machine hours	12,300
	Moving product	<u>100,800</u>	Moves	2,400
		<u>\$215,630</u>		
Department B	Sewing	\$327,600	Direct labor hours	4,200
	Inspecting	24,000	Inspections	600
	Folding	<u>47,880</u>	Units	22,800
		<u>\$399,480</u>		
Support	Design	\$280,000	Modification orders	280
	Providing space	51,600	Square feet	8,600
	Materials handling	<u>184,000</u>	Square yards	920,000
		<u>\$515,600</u>		

Additional production information on the two lines of tents follows.

	Pup Tent	Pop-Up Tent
Units produced	15,200 units	7,600 units
Moves	800 moves	1,600 moves
Batches	140 batches	420 batches
Number of inspections	240 inspections	360 inspections
Machine hours	7,000 MH	5,300 MH
Direct labor hours	2,600 DLH	1,600 DLH
Modification orders	70 modification orders	210 modification orders
Space occupied	4,300 square feet	4,300 square feet
Material required	450,000 square yards	470,000 square yards

Required

1. Using a plantwide overhead rate based on direct labor hours, compute the overhead cost that is assigned to each pup tent and each pop-up tent.
2. Using the plantwide overhead rate, determine the total cost per unit for the two products if the direct materials and direct labor cost is \$25 per pup tent and \$32 per pop-up tent.
3. If the market price of the pup tent is \$65 and the market price of the pop-up tent is \$200, determine the gross profit per unit for each tent. What might management conclude about the pup tent?
4. Using ABC, compute the total cost per unit for each tent if the direct labor and direct materials cost is \$25 per pup tent and \$32 per pop-up tent.
5. If the market price is \$65 per pup tent and \$200 per pop-up tent, determine the gross profit per unit for each tent. Comment on the results.
6. Would your pricing analysis be improved if the company used, instead of ABC, departmental rates determined using machine hours in Department A and direct labor hours in Department B? Explain.

Check (4) Pup tent, \$58.46 per unit cost



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Mathtime Educational Products produces two electronic, handheld educational games: *Fun with Fractions* and *Count Calculus*. Data on these products follow.

PROBLEM SET B

Problem 4-1B

Evaluating product line costs and prices using ABC

P3

	Fun with Fractions	Count Calculus
Production volume	150,000 units	10,000 units
Components	450,000 parts	100,000 parts
Direct labor hours	15,000 DLH	2,000 DLH
Packaging materials	150,000 boxes	10,000 boxes
Shipping cartons	100 units per carton	25 units per carton
Machine setups	52 setups	52 setups
Machine hours	5,000 MH	2,000 MH

Additional data from its two production departments follow.

Department	Driver	Cost
Assembly department		
Component cost	Parts	\$495,000
Assembly labor	Direct labor hours	244,800
Maintenance	Machine hours	100,800
Wrapping department		
Packaging materials	Boxes	\$460,800
Shipping	Cartons	27,360
Machine setup	Setups	187,200

Required

- Using ABC, determine the cost of each product line.
- What is the cost per unit for Fun with Fractions? What is the cost per unit of Count Calculus?
- If Count Calculus sells for \$59.95 per unit, how much profit does the company earn per unit of Count Calculus sold?
- What is the minimum price that the company should set per unit of Fun with Fractions? Explain.

Check (3) \$32.37 profit per unit

Fancy Foods produces gourmet gift baskets that it distributes online as well as from its small retail store. The following details about overhead costs are taken from its records.

Problem 4-2B

Applying activity-based costing

C1 C4 A1 A3 P3

Production Activity	Indirect Labor	Indirect Materials	Other Overhead
Wrapping	\$300,000	\$200,000	
Assembling	400,000		
Product design	180,000		
Obtaining business licenses			\$100,000
Cooking	150,000	120,000	

Additional information on the drivers for its production activities follows.

Wrapping	100,000 units
Assembling	20,000 direct labor hours
Product design	3,000 design hours
Obtaining business licenses	20,000 direct labor hours
Cooking	1,000 batches

Required

1. Classify each activity as unit level, batch level, product level, or facility level.
2. Compute the activity overhead rates using ABC. Form cost pools as appropriate.
3. Determine the overhead cost to assign to the following jobs using ABC.

	Holiday Basket	Executive Basket
Number of units	8,000 units	1,000 units
Direct labor hours	2,000 DLH	500 DLH
Design hours	40 design hours	40 design hours
Batches	80 batches	200 batches

Check (4) Holiday Basket, \$14.25 per unit

(5) Holiday Basket, \$18.13 per unit

4. What is the cost per unit for the Holiday Basket? What is the cost per unit for the Executive Basket?
5. If the company used a plantwide overhead rate based on direct labor hours, what is the overhead cost for each Holiday Basket unit? What would be the overhead cost for each Executive Basket unit if a single plantwide overhead rate is used?
6. Compare the costs per unit computed in requirements 4 and 5 for each job. Which cost assignment method provides the most accurate cost? Explain.

Problem 4-3B

Assessing impacts of using a plantwide overhead rate versus ABC

A1 A2 A3

Lakeside Paper produces cardboard boxes. The boxes require designing, cutting, and printing. (The boxes are shipped flat and customers fold them as necessary.) Lakeside has a reputation for providing high-quality products and excellent service to customers, who are major U.S. manufacturers. Costs are assigned to products based on the number of machine hours required to produce them.

Three years ago, a new marketing executive was hired. She suggested the company offer custom design and manufacturing services to small specialty manufacturers. These customers required boxes for their products and were eager to have Lakeside as a supplier. Within one year Lakeside found that it was so busy with orders from small customers, that it had trouble supplying boxes to all its customers on a timely basis. Large, long-time customers began to complain about slow service and several took their business elsewhere. Within another 18 months, Lakeside was in financial distress with a backlog of orders to be filled.

Required

1. What do you believe are the major costs of making its boxes? How are those costs related to the volume of boxes produced?
2. How did Lakeside’s new customers differ from its previous customers?
3. Would the unit cost to produce a box for new customers be different from the unit cost to produce a box for its previous customers? Explain.
4. Could Lakeside’s fate have been different if it had used ABC for determining the cost of its boxes?
5. What information would have been available with ABC that might have been overlooked using a traditional volume-based costing method?

Problem 4-4B

Comparing costs using ABC with the plantwide overhead rate

C1 A1 A3 P1 P3

Davis Company makes two distinct products with the following information available for each.

	Standard	Deluxe
Direct materials	\$4 per unit	\$8 per unit
Direct labor hours	4 DLH per unit	5 DLH per unit
Machine hours	3 MH per unit	3 MH per unit
Batches	175 batches	75 batches
Volume	40,000 units	10,000 units
Engineering modifications	50 modifications	25 modifications
Number of customers	1,000 customers	1,000 customers
Market price	\$92 per unit	\$125 per unit

The company's direct labor rate is \$20 per direct labor hour (DLH). Additional information follows.

	Costs	Driver
Indirect manufacturing		
Engineering support	\$ 56,250	Engineering modifications
Electricity	112,500	Machine hours
Setup costs	41,250	Batches
Nonmanufacturing		
Customer service	250,000	Number of customers

Required

1. Compute the manufacturing cost per unit using the plantwide overhead rate based on machine hours. What is the gross profit per unit?
2. How much gross profit is generated by each customer of the standard product using the plantwide overhead rate? How much gross profit is generated by each customer of the deluxe product using the plantwide overhead rate? What is the cost of providing customer service to each customer? What information is provided by this comparison?
3. Determine the manufacturing cost per unit of each product line using ABC. What is the gross profit per unit?
4. How much gross profit is generated by each customer of the standard product using ABC? How much gross profit is generated by each customer of the deluxe product using ABC? Is the gross profit per customer adequate?
5. Which method of product costing gives better information to managers of this company? Explain.

Check (1) Gross profit per unit: Standard, \$3.80; Deluxe, \$12.80

(3) Gross profit per unit: Standard, \$4.09; Deluxe, \$11.64

Spicy Salsa Company produces its condiments in two types: Extra Fine for restaurant customers and Family Style for home use. Salsa is prepared in department 1 and packaged in department 2. The activities, overhead costs, and drivers associated with these two manufacturing processes and its production support activities follow.

Problem 4-5B

Pricing analysis with ABC and a plantwide overhead rate

A1 A2 P1

Process	Activity	Overhead Cost	Driver	Quantity
Department 1	Mixing	\$ 4,500	Machine hours	1,500
	Cooking	11,250	Machine hours	1,500
	Product testing	112,500	Batches	600
		<u>\$128,250</u>		
Department 2	Machine calibration	\$250,000	Production runs	400
	Labeling	12,000	Cases of output	120,000
	Defects	6,000	Cases of output	120,000
		<u>\$268,000</u>		
Support	Recipe formulation	\$ 90,000	Focus groups	45
	Heat, lights, and water	27,000	Machine hours	1,500
	Materials handling	65,000	Container types	8
		<u>\$182,000</u>		

Additional production information about its two product lines follows.

	Extra Fine	Family Style
Units produced	20,000 cases	100,000 cases
Batches	200 batches	400 batches
Machine hours	500 MH	1,000 MH
Focus groups	30 groups	15 groups
Container types	5 containers	3 containers
Production runs	200 runs	200 runs

Required

1. Using a plantwide overhead rate based on cases, compute the overhead cost that is assigned to each case of Extra Fine Salsa and each case of Family Style Salsa.
2. Using the plantwide overhead rate, determine the total cost per unit for the two products if the direct materials and direct labor cost is \$6 per case of Extra Fine and \$5 per case of Family Style.
3. If the market price of Extra Fine Salsa is \$18 per case and the market price of Family Style Salsa is \$9 per case, determine the gross profit per case for each product. What might management conclude about each product line?
4. Using ABC, compute the total cost per case for each product type if the direct labor and direct materials cost is \$6 per case of Extra Fine and \$5 per case of Family Style.
5. If the market price is \$18 per case of Extra Fine and \$9 per case of Family Style, determine the gross profit per case for each product. How should management interpret the market prices given your computations?
6. Would your pricing analysis be improved if the company used departmental rates based on machine hours in department 1 and number of cases in department 2, instead of ABC? Explain.

Check (2) Cost per case: Extra Fine, \$10.82; Family Style, \$9.82

(4) Cost per case: Extra Fine, \$20.02; Family Style, \$7.98

SERIAL PROBLEM



(This serial problem began in Chapter 1 and continues through most of the book. If previous chapter segments were not completed, the serial problem can begin at this point. It is helpful, but not necessary, to use the Working Papers that accompany the book.)

SP 4 After reading an article about activity-based costing in a trade journal for the furniture industry, Adriana Lopez wondered if it was time to critically analyze overhead costs at Success Systems. In a recent month, Lopez found that setup costs, inspection costs, and utility costs made up most of its overhead. Additional information about overhead follows.

Activity	Cost	Driver
Setting up machines	\$20,000	25 batches
Inspecting components	\$ 7,500	5,000 parts
Providing utilities	\$10,000	5,000 machine hours

Overhead has been applied to output at a rate of 50% of direct labor costs. The following data pertain to Job 6.15.

Direct materials	\$2,500
Direct labor	\$3,500
Batches	2 batches
Number of parts	400 parts
Machine hours	600 machine hours

Required

1. Classify each of its three overhead activities as unit level, batch level, product level, or facility level.
2. What is the total cost of Job 6.15 if Success Systems applies overhead at 50% of direct labor cost?
3. What is the total cost of Job 6.15 if Success Systems uses activity-based costing?
4. Which approach to assigning overhead gives a better representation of the costs incurred to produce Job 6.15? Explain.

BEYOND THE NUMBERS

REPORTING IN ACTION

C1 A3



BTN 4-1 Refer to financial statements of **Best Buy** (BestBuy.com) and **Circuit City** (CircuitCity.com) to answer the following.

Required

1. Identify at least two activities at Best Buy and at Circuit City that cause costs to be incurred. Do you believe these companies should be concerned about controlling costs of the activities you identified? Explain.

2. Would you classify Best Buy and Circuit City as service, merchandising, or manufacturing companies? Explain.
3. Is activity-based costing useful for companies such as Best Buy and Circuit City? Explain.

BTN 4-2 **Best Buy** and **Circuit City** are competitors, and both sell products through their Websites and in retail stores. Compare these companies' income statements and answer the following.

Required

1. Which company has a higher ratio of costs to revenues? Show your analysis.
2. How might the use of activity-based costing help the less competitive company become *more* competitive?
3. Which company has more retail stores? What are the activities associated with opening a new retail store?

COMPARATIVE ANALYSIS

C4 A3



BTN 4-3 In conducting interviews and observing factory operations to implement an activity-based costing system, you determine that several activities are unnecessary or redundant. For example, warehouse personnel were inspecting purchased components as they were received at the loading dock. Later that day, the components were inspected again on the shop floor before being installed in the final product. Both of these activities caused costs to be incurred but were not adding value to the product. If you include this observation in your report, one or more employees who perform inspections will likely lose their jobs.

Required

1. As a plant employee, what is your responsibility to report your findings to superiors?
2. Should you attempt to determine if the redundancy is justified? Explain.
3. What is your responsibility to the employees whose jobs will likely be lost by your report?
4. What facts should you consider before making your decision to report or not?

ETHICS CHALLENGE

A3

BTN 4-4 The chief executive officer (CEO) of your company recently returned from a luncheon meeting where activity-based costing was presented and discussed. Though her background is not in accounting, she has worked for the company for 15 years and is thoroughly familiar with its operations. Her impression of the presentation about ABC was that it was just another way of dividing up total overhead cost and that the total would still be the same “no matter how you sliced it.”

Required

Write a memorandum to the CEO, no more than one page, explaining how ABC is different from traditional volume-based costing methods. Also, identify its advantages and disadvantages vis-à-vis traditional methods. Be sure it is written to be understandable to someone who is not an accountant.

COMMUNICATING IN PRACTICE

C1 C4

BTN 4-5 Accounting professionals that work for private companies often obtain the Certified Management Accountant (CMA) designation to indicate their proficiency in several business areas in addition to managerial accounting. The CMA examination is administered by the Institute of Management Accountants (IMA).

Required

Go to the IMA Website (IMAnet.org) and determine which parts of the CMA exam cover activity-based costing. A person planning to become a CMA should take what college course work?

TAKING IT TO THE NET

C1

TEAMWORK IN ACTION

C4 A3 P3

BTN 4-6 Observe the operations at your favorite fast-food restaurant.

Required

1. How many people does it take to fill a typical order of sandwich, beverage, and one side-order?
2. Describe the activities involved in its food service process.
3. What costs are related to each activity identified in requirement 2?

ENTREPRENEURIAL DECISION

C4 A3

BTN 4-7 Oregon Ice Cream Company has expanded its product offerings from basic chocolate and vanilla type flavors to nearly 100 flavors of ice creams, yogurts, and sorbets, and more than 500 different frozen dairy treats. Tom Gleason's managers for Oregon Ice Cream Company realize that financial success depends on cost control as well as revenue generation.

Required

1. If Oregon Ice Cream Company wanted to expand its product line to include yogurt smoothies, what activities would it need to perform that are not required for its current product lines?
2. Related to part 1, should the additional overhead costs related to new product lines be shared by existing product lines? Explain your reasoning.

HITTING THE ROAD

C4 A3 P3

BTN 4-8 Visit and observe the processes of three different fast-food restaurants—these visits can be done as individuals or as teams. The objective of activity based costing is to accurately assign costs to products and to improve operational efficiency.

Required

1. Individuals (or teams) can be assigned to each of three different fast-food establishments. Make a list of the activities required to process an order of a sandwich, beverage, and one side-order at each restaurant. Record the time required for each process, from placing the order to receiving the completed order.
2. What activities do the three establishments have in common? What activities are different across the establishments?
3. Is the number of activities related to the time required to process an order? Is the number of activities related to the price charged to customers? Explain both.
4. Make recommendations for improving the processes you observe. Would your recommendations increase or decrease the cost of operations?

GLOBAL DECISION

C4 A3




BTN 4-9 Visit the Websites and review the financial statements for **DSG international** (DSGiplc.com), **Best Buy** (BestBuy.com), and **Circuit City** (CircuitCity.com). Each of these companies is a retailer of electronics with extensive online markets.

Required

1. In what country(ies) are DSG's Electricals division stores located?
2. In what country(ies) are the retail stores for Best Buy and Circuit City located?
3. How would customer service activities be different for DSG than for Best Buy or Circuit City? How would these differences affect their costs?

ANSWERS TO MULTIPLE CHOICE QUIZ

1. b; Under traditional costing methods, overhead costs are allocated to products on the basis of some measure of volume such as direct labor hours or machine hours. This results in much of the overhead cost being allocated to high-volume products. In contrast, under activity-based costing, some overhead costs are allocated on the basis of batch level or product level activities. This change in allocation bases results in shifting overhead costs from high-volume products to low-volume products.
2. d; Generally, an activity-based costing system is more difficult to implement and maintain than a traditional costing system (thus statement A is false). Instead of eliminating waste by allocating costs to products that waste resources, activity-based management is a management approach that focuses on managing activities as a means of eliminating waste and reducing delays and defects (thus statement B is false). Instead of using a single allocation base (such as direct labor hours), activity-based costing uses a number of allocation bases for assigning costs to products (thus statement C is false). Statement D is true.
3. d; Batch level activities are activities that are performed each time a batch of goods is handled or processed, regardless of how many units are in a batch. Further, the amount of resources consumed depends on the number of batches rather than on the number of units in the batch. Worker recreational facilities relate to the organization as a whole rather than to specific batches and, as such, are not considered to be batch level. On the other hand, purchase order processing, setting up equipment, and the clerical activities described are activities that are performed each time a batch of goods is handled or processed, and, as such, are batch level activities.

4. c;

	(A) Activity Rate (Budgeted overhead cost ÷ Budgeted activity)	(B) Actual Activity	(A × B) Overhead Cost Applied to Production
Activity 1 . . .	$(\$80,000 \div 1,000) = \80.00	800	\$ 64,000
Activity 2 . . .	$(\$58,400 \div 1,500) = \38.93^*	500	19,465
Activity 3 . . .	$(\$360,000 \div 6,000) = \60.00	5,400	<u>324,000</u>
Total overhead cost per unit for Product B			<u>\$407,465</u>
Divided by number of units produced			<u>÷ 31,652</u>
Overhead cost per unit of Product B			<u>\$ 12.87</u>

* rounded

5. d; The activity rate for Activity 3 is determined as follows:

$$\begin{array}{rclcl} \text{Budgeted cost} & \div & \text{Budgeted activity} & = & \text{Activity rate} \\ \$14,000 & \div & 700 & = & \$20 \end{array}$$