CHAPTER FIVE

Activity-Based Costing and Customer Profitability Analysis

After studying this chapter, you should be able to . . .

- LO 5-1 Explain the strategic role of activity-based costing
- LO 5-2 Describe activity-based costing (ABC), the steps in developing an ABC system, and the benefits of an ABC system
- LO 5-3 Determine product costs under both the volume-based method and the activity-based method and contrast the two
- LO 5-4 Explain activity-based management (ABM)
- LO 5-5 Describe how ABC/M is used in manufacturing companies, service companies, and governmental organizations
- LO 5-6 Use an activity-based approach to analyze customer profitability
- LO 5-7 Identify key factors for successful ABC/M implementation

> Beware of little expenses. A small leak will sink a great ship.
>
> *Benjamin Franklin*

This chapter has a lot to do with implementing the spirit of Benjamin Franklin's observation—in cost management terms—that it really does matter how accurately you calculate a cost. Why? Having accurate costs is important for a variety of reasons: a company might find that it has a difficult time determining which of its products is most profitable. Alternatively, it finds its sales increasing but profits declining and cannot understand why. Perhaps the company keeps losing competitive bids for products and services and does not understand why. In many cases, accurate cost information is the answer to these questions. Improved understanding of the use of resources and the assignment of their related costs provides a competitive advantage. It helps a company or organization to develop and to execute its strategy by providing accurate information about the cost of its products and services, the cost of serving its customers, the cost of dealing with its suppliers, and the cost of supporting business processes within the company.

The Strategic Role of Activity-Based Costing

LO 5-1
Explain the strategic role of activity-based costing.

Activity-based costing (ABC) is a method for improving the accuracy of cost determination. While ABC is a relatively recent innovation in cost accounting, it has been adopted by companies in varying industries and within government and not-for-profit organizations. Here is a quick example of how it works, and why it is important. Suppose you and two friends (Joe and Al) have gone out for dinner. You each order a personal-size pizza, and Al suggests ordering a plate of appetizers for the table. You and Joe figure you will have

a bite or two of the appetizers, so you say OK. Dinner is great, but at the end Al is still hungry, so he orders another plate of appetizers, but this time, eats all of it. When it is time for the check, Al suggests the three of you split the cost of the meal equally. Is this fair? Perhaps Al should offer to pay more for the two appetizer plates. The individual pizzas are direct costs for each of you so that an equal share is fair, but while the appetizer plates were intended to be shared equally, it turns out that Al consumed most of them.

There are similar examples in manufacturing. Suppose you and Joe and Al are also product managers at a plant that manufactures furniture. There are three product lines. Al is in charge of sofa manufacturing, Joe of dining room tables and chairs, and you are in charge of bedroom furniture. The direct materials and labor costs are traced directly to each product line. Also, there are indirect manufacturing costs (overhead) that are associated with activities that cannot be traced to a single product, including: materials acquisition, materials storage and handling, product inspection, manufacturing supervision, job scheduling, equipment maintenance, and fabric cutting. What if the company decides to charge each of the three product managers a "fair share" of the total indirect cost using the proportion of units produced in a manager's area relative to the total units produced? This approach is described in Chapter 4 and is commonly referred to as *volume-based costing.* Note that whether the proportions used are based on units of product, direct labor-hours, or machine-hours, each of these is volume-based.

But if, as is often the case, the usage of these activities is not proportional to the number of units produced, then some managers will be overcharged and others undercharged under the volume-based approach. For example, suppose Al insists on more frequent inspections of his production; then he should be charged a higher proportion of overhead (inspection) than that based on units alone. Moreover, why should you pay any portion of fabric cutting if your bedroom furniture does not require fabric?

Another consideration is that the volume-based method provides little incentive for the manager to control indirect costs. Unfortunately, the only way you could reduce your share of the indirect costs is to reduce your units produced (or hope that Joe and/or Al increase production)—not much of an incentive. On reflection, the approach that charges indirect costs to product based on units produced does not provide very accurate product costs and certainly does not provide the appropriate incentives for managing the indirect costs. The solution is to use activity-based costing to charge these indirect costs to the products, using detailed information on the activities that make up the indirect costs—inspection, fabric cutting, and materials handling. This chapter shows how to do it.

A good example of one of many success stories for ABC is the application of ABC at the U.S. Postal Service (USPS). The ABC application at the USPS originated from the Postmaster General's directive to develop a costing system that would help the USPS become more competitive and serve as a basis for comparing performance among the various mail- processing facilities. The initial ABC system used 58 work activities and nine cost objects. The cost objects included handling of letters, flats, small parcels, large parcels, priority mail, express mail, registered mail, large mail containers, and small mail containers. In the initial application at a single mail-processing facility, there was a reduction of 13% in total cost as a result of the improved understanding of cost behavior in the facility. The USPS also used ABC to determine the cost differences in processing payments from customers who used cash, checks, or credit cards and from this analysis determined that the low-cost approach was to encourage the use of credit cards. The ABC-based analyses have helped the USPS to implement an effective, cost-competitive strategy.

Role of Volume-Based Costing

Volume-based costing can be a good strategic choice for some firms. It is generally appropriate when common costs are relatively small or when activities supporting the production of the product or service are relatively homogenous across different product lines. This may be the case, for example, for a firm that manufactures a limited range of paper products or a firm that produces a narrow range of agricultural products. Similarly, a professional

service firm (law firm, accounting firm) may not need ABC because labor costs for the professional staff are the largest cost of the firm, and labor is also easily traced to clients (the cost object). For firms other than these, the ABC approach may be preferred to avoid the distortions from overcosting or undercosting that may occur using a volume-based approach.

Activity-Based Costing

LO 5-2

Describe activity-based costing (ABC), the steps in developing an ABC system, and the benefits of an ABC system.

To develop a costing system we need to understand relationships among resources, activities, and products or services. Resources are spent on activities, and products or services are a result of activities. Many of the resources used in an operation can be traced to individual products or services and identified as direct materials or direct labor costs. Most overhead costs relate only indirectly to final products or services. A costing system identifies costs with activities that consume resources and assigns resource costs to cost objects such as products, services, or intermediate cost pools based on activities performed for the cost objects.

Resources, Activities, Resource Consumption Cost Drivers, and Activity Consumption Cost Drivers

Before discussing activity-based costing, several important terms must be understood: *activity, resource, cost driver, resource consumption cost driver,* and *activity consumption cost driver.*

An **activity** is some specific task or action of work done.

An **activity** is a specific task or action of work done. An activity can be a single action or an aggregation of several actions. For example, moving inventory from workstation A to workstation B is an activity that may require only one action. Production setup is an activity that may include several actions. Activities are often listed in what is called an *activity dictionary.* An illustration of key activities in a firm's internal supply chain is shown by the Supply Chain Council in what is called the SCOR® (Supply Chain Operations Reference) on the Council's website (**www.supply-chain.org/**).

A **resource** is an economic element needed or consumed in performing activities.

A **resource** is an economic element needed or consumed in performing activities. Labor and supplies, for example, are resources needed or used in performing manufacturing activities.

A **cost driver** is a factor that causes or relates to a change in the cost of an activity.

A **cost driver** is a factor that causes or relates to a change in the cost of an activity. Because cost drivers cause or relate to cost changes, measured or quantified amounts of cost drivers are excellent bases for assigning resource costs to activities and for assigning the cost of activities to cost objects.

A cost driver is either a *resource consumption cost driver* or an *activity consumption cost driver.* A **resource consumption cost driver** is some measure of the demand for resources by an activity. It is the basis for assigning resource costs to a particular activity or cost pool. Examples of resource consumption cost drivers are the number of items in a purchase or sales order, changes in product design, and square feet to occupied space.

A **resource consumption cost driver** is a measure of the amount of resources consumed by an activity.

An **activity consumption cost driver** measures how much of an activity a cost object uses.

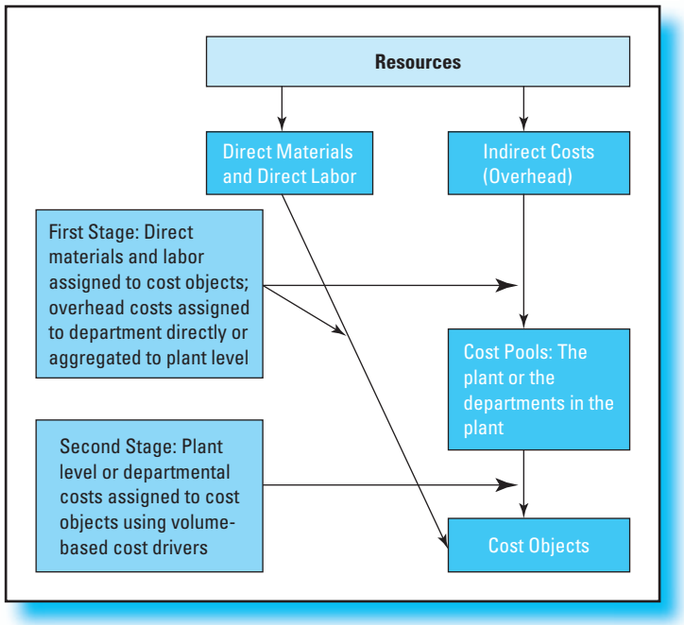
An **activity consumption cost driver** measures the amount of an activity performed for a cost object. It is used to assign activity cost pool costs to cost objects. Examples of activity consumption cost drivers are the number of machine-hours in the manufacturing of product X, or the number of batches used to manufacture product Y.

What Is Activity-Based Costing?

Activity-based costing (ABC) is a costing approach that assigns resource costs to cost objects based on activities performed for the cost objects.

Activity-based costing (ABC) is a costing approach that assigns resource costs to cost objects such as products, services, or customers based on activities performed for the cost objects. The premise of this costing approach is that a firm's products or services are the result of activities and activities require resources, which have costs. Costs of resources are assigned to activities based on the activities that use or consume resources (resource consumption drivers), and costs of activities are assigned to cost objects based on activities performed for the cost objects (activity consumption drivers). ABC recognizes the causal or direct relationships between resource costs, cost drivers, activities, and cost objects in assigning costs to activities and then to cost objects.

EXHIBIT 5.1
The Volume-Based Two-Stage Procedure



ABC assigns factory overhead costs to cost objects such as products or services by identifying the resources and activities as well as their costs and amounts needed to produce output. Using resource consumption cost drivers, a firm determines the resource costs consumed by activities, calculates the cost of a unit of activity, and then assigns the cost of an activity to cost objects by multiplying the cost of each activity by the amount of the activity consumed by each of the cost objects.

The Two-Stage Cost Assignment Procedure

A **two-stage cost assignment** assigns resource costs to activity cost pools and then to cost objects.

A **two-stage cost assignment** procedure assigns resource costs such as factory overhead costs to activity cost pools and then to cost objects to determine the amount of resource costs for each of the cost objects. Volume-based costing systems assign factory overhead costs first to plant or departmental cost pools and second to products or services (see Exhibit 5.1). In the first stage of volume-based costing the factory overhead costs are combined into a single plant cost pool or several departmental cost pools. This approach is convenient and simple, because many accounting systems in use today accumulate cost information by department, which is easily aggregated to the plant level. In the second stage, a volume-based rate (based on units produced or hours used in production) is then used to apply overhead to each of the cost objects. The volume-based approach is used in Chapter 4 in job costing. A strictly volume-based cost assignment procedure, however, is likely to distort product or service costs. This is true especially in the second stage where the volume-based costing system uses a cost driver such as direct labor-hours or output units to assign factory overhead costs. Because all products or services do not usually consume factory overhead resources in proportion to the volume-based measure the firm uses to assign factory overhead costs, a volume-based system often leads to inaccurate measures for the costs of support activities in its operations. This distortion becomes more serious when the firm manufactures a diverse mix of products with differences in volumes, sizes, or complexities and a substantial portion of the allocated costs are not related to output volume.

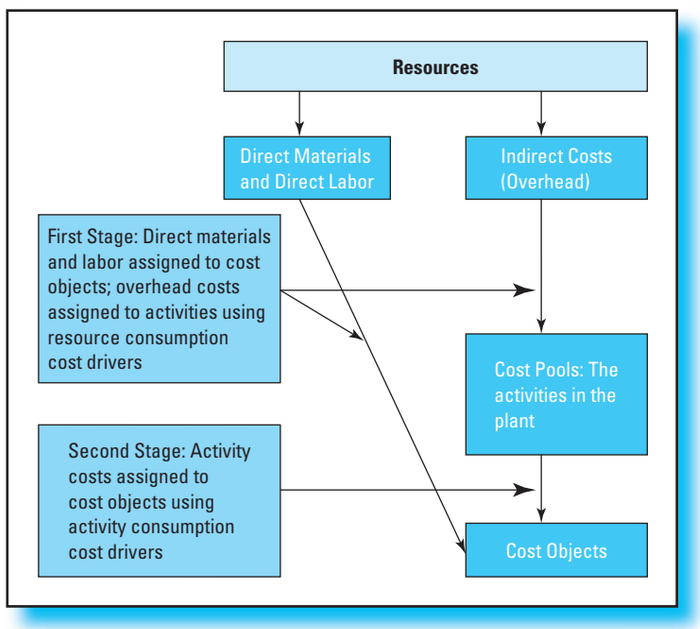
ABC systems differ from volume-based costing systems by linking uses of resources to activities and linking activity costs to products, services, or customers (see Exhibit 5.2). The first stage assigns factory overhead costs to activities by using appropriate resource consumption cost drivers. The second stage assigns the costs of activities to cost objects using appropriate activity consumption cost drivers that measure the demands cost objects

REAL-WORLD FOCUS Role of ABC Costing in Strategy Implementation at MCI

The telecommunications firm MCI was purchased by Verizon in 2005 for $8.4 billion, but prior to 2002 MCI was known as WorldCom. WorldCom is best remembered for the fraud that came to light in 2002 and brought the firm to bankruptcy; it emerged from bankruptcy as MCI. At this time MCI was struggling with the recovery from the bankruptcy and also the inadequate financial management systems that in part had a hand in the fraud and also caused the company in 2002 to have very little knowledge of its costs. In the WorldCom days, the company was revenue-driven and costs were given little attention. One of WorldCom's strategic blunders at that time was not to recognize that the telecommunications business had become commoditized, and cost leadership was a key to success. Mike Capellas, MCI's CEO after the bankruptcy, was a numbers guy and he insisted that financial managers get a solid understanding of the firm's costs. This new direction led to the adoption of activity-based costing and, most importantly, to a better understanding of the cost and profitability of the firm's different services and customer segments. The firm was profitable and growing when three years later it was purchased by Verizon.

Source: Thomas H. Davenport and Jeanne G. Harris, *Competing on Analytics* (Boston: Harvard Business School Press, 2007), pp. 64–66.

EXHIBIT 5.2
The Activity-Based Two-Stage Procedure



have for the activities. By using cost drivers in both the first and second stage cost assignments, activity-based costing systems provide more accurate measures of product or service costs for the cost of activities that are not proportional to the volume of outputs produced.

In summary, ABC systems differ from volume-based costing systems in two ways. First, the ABC system defines cost pools as activities rather than production plant or department cost centers. Second, the cost drivers that the ABC system uses to assign activity costs to cost objects are drivers based on an activity or activities performed for the cost object. The volume-based approach uses a volume-based cost driver that often bears little or no relationship to the consumption of resources by the cost objects.

Steps in Developing an Activity-Based Costing System

Developing an activity-based costing system entails three steps: (1) identifying resource costs and activities, (2) assigning resource costs to activities, and (3) assigning activity costs to cost objects. Steps 1 and 2 constitute stage 1 from Exhibit 5.2, and step 3 is equivalent to stage 2 from that exhibit.

Step 1: Identify Resource Costs and Activities

Most firms record resource costs in specific accounts in the accounting system. These accounts are often based upon the underlying function of the resources that are included, such as purchasing, marketing, and office supplies. The first step in the ABC process is to determine which of the resources in each of the accounts is consumed by the identified activities. The costs of the resources consumed for a particular activity may be only a small part of the costs in a particular account. For example, a single factory supplies account may include the cost of resources consumed by several different manufacturing operations. Also, the resources to perform an activity may come from several accounts. For example, order fulfillment might require resources from warehousing, shipping, and billing accounts.

An activity analysis identifies the work performed to carry out a firm's operations. It includes gathering data from existing documents and records, as well as collecting additional data using questionnaires, observations, or interviews of key personnel. Questions that ABC project team members typically ask employees or managers in gathering activity data include:

- What work or activities do you do?
- How much time do you spend performing these activities?
- What resources are required to perform these activities?
- What value does the activity have for the product, service, customer, or organization?

With the help of industrial engineers and management accountants, the team also collects activity data by observing the work performed and making a list of all the activities involved.

Levels of Activities

To identify resource costs for various activities, a firm classifies all activities according to the way in which the activities consume resources.

A **unit-level activity** is performed for each unit of the cost object.

1. A **unit-level activity** is performed for each individual unit of product or service of the firm. Consider the activity of inserting a component. This activity is required for each unit produced, so the activity level varies in direct proportion to the quantity of the cost object produced. As a result, unit-level activities are said to be volume-based. The resource consumption driver and the activity consumption driver are likely to be the same for unit-level activities.

A **batch-level activity** is performed for each batch or group of products or services.

2. A **batch-level activity** is performed for each batch or group of units of products or services. Examples of batch-level activities are setting up machines, placing purchase orders, scheduling production, conducting inspections by batch, handling materials, and expediting production.

A **product-level activity** supports the production of a specific product or service.

3. A **product-level activity** supports the production of a specific product or service. Examples of product-level activities include designing products, purchasing parts required for products, and engaging in engineering changes to modify products.

A **facility-level activity** supports operations in general.

4. A **facility-level activity** supports operations in general. These activities are not caused by products or customer service needs and cannot be traced to individual units, batches, or products. Examples of facility-level activities include providing security for the plant, performing maintenance of general purpose machines, and incurring factory property taxes and insurance. Some firms refer to these activities as business or infrastructure-sustaining activities.

Note that a unit-level activity can always be traced to a batch (one of the units in the batch), and a batch-level activity can always be traced to a product (one batch of this particular product), and a product-level activity can usually be traced to a manufacturing facility; but, the reverse is not possible. Exhibit 5.3 illustrates activity-level classifications at Siemens Electric Motor Works.

Step 2: Assign Resource Costs to Activities

Activities drive the consumption of resources, so the next step is to use resource consumption drivers to assign resource costs to activities. A firm should choose resource consumption cost drivers based on cause-and-effect relationships. Typical resource consumption

EXHIBIT 5.3
Activities and Activity Levels at Siemens Electric Motor Works

Activity	Activity Level
Using direct materials	Unit
Using direct labor-hours	Unit
Using machine-hours	Unit
Starting production orders	Batch
Adding special components	Batch

EXHIBIT 5.4
Resource and Resource Consumption Cost Drivers at AT&T's New River Valley Plant

Resource	Resource Consumption Cost Driver
Personnel	Number of workers
Storeroom	Number of items picked for an order
Engineers	Time worked
Materials management	Time worked
Accounting	Time worked
Research and development	Number of new codes developed
Quality	Time worked
Utilities	Square-footage

cost drivers include the number of (1) labor-hours for labor intensive activities; (2) employees for payroll-related activities; (3) setups for batch-related activities; (4) moves for materials-handling activities; (5) machine-hours for machine repair and maintenance; and (6) square feet for general maintenance and cleaning activities.

Ideally, the cost of resources is directly traced or assigned to activities, which requires measuring the actual usage of resources by an activity. For example, power used to operate a machine can be traced directly to that machine's operation by reading the meter attached to the machine. When direct tracing is not available, department managers and supervisors need to estimate the amount or percentage of time (or effort) employees spend on each identified activity. Exhibit 5.4 illustrates resources and resource consumption drivers for factory overhead costs at AT&T's New River Valley plant.

Step 3: Assign Activity Costs to Cost Objects

The final step is to assign costs of activities to items of interest, generically called cost objects, based on the appropriate activity consumption cost drivers. The cost objects are the outputs resulting from the firm's activities, and typically are products or services; however, customers, projects, and even business units can be cost objects. For example, the cost objects of an insurance company may be individual insurance policies sold to customers, claims processed, types of policies offered, insurance agents, or divisions or subunits of the company.

Benefits of Activity-Based Costing

Since the 1980s an increasing number of firms have adopted an activity-based costing system. As previously noted, many firms found ABC reduced the distortions that resulted from using a volume-based system. ABC clearly shows the effect of differences in activities and changes in products or services on costs. Among the major benefits of activity-based costing that many firms have experienced from the improved information are:

1. **Better profitability measures.** ABC provides more accurate and informative product costs, leading to more accurate product and customer profitability measurements.
2. **Better decision making.** ABC provides more accurate measurements of activity-driving costs, helping managers to improve product and process value by making better product design decisions and better customer support decisions and fostering value-enhancement projects.
3. **Process improvement.** The ABC system provides the information to identify areas where process improvement is needed.

REAL-WORLD FOCUS Who Uses ABC and Why?

A 2005 survey of the members of BetterManagement.com found that improved product costing, better analysis of both product and customer profitability, and process improvement were the key goals of the ABC system. The 528 respondents were from a variety of industries: financial services, manufacturing, communications, and governmental units. The usage of ABC was comparable across industries, though the manufacturing and financial services industries placed more emphasis on product and customer profitability, while in the public sector the key emphasis was on product costing and process improvement.

A 2007 international survey of the 500 largest companies in Canada, France, Germany, Japan, Italy, the United Kingdom, and the United States showed that most of the 416 respondents found their ABC applications to be useful. However, there were large differences among the countries. France showed the most positive findings with 95% of the responses favorable to ABC, then Japan with 86%, the United States with 81%, Canada with 66%, the United Kingdom with 61%, and Italy with 60%, while in Germany only 43% of the responses were favorable. The authors of the survey attribute these differences to differences in implementation (a topic we take up at the end of the chapter). Also, the unfavorable response in Germany might be due to the common use in Germany of a different costing method which is comparable to resource consumption accounting (a topic also taken up at the end of the chapter).

Source: BetterManagement.com provides online resources for performance management (http://www.bettermanagement.com/). It is a wholly owned subsidiary of SAS Institute, Inc. Alnoor Bhimani, Maurice Gosselin, Mthuli Ncube, and Hiroshi Okano, "Activity-Based Costing: How Far Have We Come Internationally? *Cost Management*, May/June 2007, pp. 12–17.

4. **Improved planning.** Improved product costs lead to better estimates of costs for budgeting and planning.
5. **Cost of unused capacity.** Since many firms have seasonal and cyclical fluctuations in sales and production, there are times when plant capacity is supplied but not used. This can mean that costs are *incurred* at the batch-, product-, and facility-level activities but are *not used.* ABC systems provide better information to identify the cost of unused capacity and maintain a separate accounting for this cost. For example, if a plant manager decides to add capacity in expectation of future increases in sales and production, then the cost of that additional capacity should not be charged to current production but charged as a lump-sum in the plant's costs. Overall, the goal is to manage capacity levels to reduce the cost of underutilization of capacity and to price products and services properly.

Each of these benefits can contribute significantly to a company's competitiveness by helping the company make better decisions and implement its strategy.

A Comparison of Volume-Based and Activity-Based Costing

LO 5-3

Determine product costs under both the volume-based method and the activity-based method and contrast the two.

The following example contrasts the volume-based costing system using only direct labor-hours as the cost driver with an activity-based costing system that uses both volume-based and activity-based cost drivers. Since this illustration shows only step 3 of the ABC method, we also show an illustration (AIRCO Ltd) that includes all three steps of the ABC method in the section, "Real-World Activity-Based Costing/Management Applications," on page 145.

Haymarket BioTech Inc. (HBT) produces and sells two secure communications systems, AW(Anywhere) and SZ (SecureZone). AW uses satellite technology and allows customers to communicate anywhere on the earth. SZ uses similar technology but only allows communication between two parties that are within 10 miles of each other. HBT's customers are governmental and corporate customers for which these products are critical; the customers rely on HBT's ability to quickly adapt its products to threats from devices that would compromise the security of the products. SZ has been successful for nearly 10 years and has undergone a number of improvements in this time; sales are expected to continue to grow at 8–10% per year. AW, a more recent product, has also been successful, but demand has not been as strong and sales growth is expected to be 3–5% per year. Because of the higher profitability of the AW system (Exhibit 5.5), HBT is considering an extensive advertising campaign to boost sales of AW and is making plans for reallocating manufacturing facilities from SZ to AW to make this possible. HBT has the following operating data for the two products.

	AW	SZ
Production volume	5,000	20,000
Selling price	$400.00	$200.00
Unit direct materials and labor	$200.00	$80.00
Direct labor-hours	25,000	75,000
Direct labor-hours per unit	5	3.75

Volume-Based Costing

The volume-based costing system assigns factory overhead (FOH) based on direct labor-hours (DLH). The firm has total budgeted FOH of $2,000,000. Since the firm budgeted 100,000 direct labor-hours for the year, the FOH rate is $20 per direct labor-hour.

Total overhead		$2,000,000
Total DLH	25,000 + 75,000 =	100,000
Overhead rate per DLH		$ 20.00

Since the firm uses 25,000 direct labor-hours to manufacture 5,000 units of AW, the FOH assigned to AW is $500,000 in total and $100 per unit:

Total overhead assigned to AW	$20 × 25,000 =	$500,000
Number of units of AW		5,000
Factory overhead per unit of AW		$ 100.00

The FOH for SZ is $1,500,000 in total and $75 per unit since the firm spent 75,000 direct labor-hours to manufacture 20,000 units of SZ:

Total overhead assigned to SZ	$20 × 75,000 =	$1,500,000
Number of units of SZ		20,000
Factory overhead per unit of SZ		$ 75.00

Exhibit 5.5 shows a product profitability analysis using the firm's volume-based costing system.

Activity-Based Costing

To be able to assign activity costs to cost objects, HBT identified the following activities, budgeted costs, and activity consumption cost drivers:

Activity	Budgeted Cost	Activity Consumption Cost Driver
Engineering	$ 125,000	Engineering hours
Setups	300,000	Number of setups
Machine operation	1,500,000	Machine-hours
Packing	75,000	Number of packing orders
Total	$2,000,000	

EXHIBIT 5.5
Product Profitability Analysis under Volume-Based Costing

	AW	SZ
Unit selling price	$400	$200
Unit manufacturing cost:		
Direct materials and labor	$200	$80
Factory overhead	100	75
Cost per unit	300	155
Profit margin	$100	$ 45

HBT also gathered the following operating data pertaining to each of its products:

	AW	SZ	Total
Engineering hours	5,000	7,500	12,500
Number of setups	200	100	300
Machine hours	50,000	100,000	150,000
Number of packing orders	5,000	10,000	15,000

Using the above data, the cost driver rate for each activity consumption cost driver is calculated as follows:

(1) Activity Consumption Cost Driver	(2) Budgeted Cost	(3) Budgeted Activity Consumption	(4) = (2) ÷ (3) Activity Consumption Rate
Engineering hours	$ 125,000	12,500	$ 10 per hour
Number of setups	300,000	300	1,000 per setup
Machine hours	1,500,000	150,000	10 per hour
Number of packing orders	75,000	15,000	5 per order

Factory overhead costs are assigned to both products by these calculations:

***AW* (5,000 units)**

(1) Activity Consumption Cost Driver	(2) Activity Consumption Rate	(3) Activity Consumption	(4) = (2) × (3) Total Overhead	(5) Overhead per Unit
Engineering hours	$ 10	5,000	$ 50,000	$ 10
Number of setups	1,000	200	200,000	40
Machine hours	10	50,000	500,000	100
Number of packing orders	5	5,000	25,000	5
Overhead cost per unit			$775,000	$155

***SZ* (20,000 units)**

(1) Activity Consumption Cost Driver	(2) Activity Consumption Rate	(3) Activity Consumption	(4) = (2) × (3) Total Overhead	(5) Overhead per Unit
Engineering hours	$ 10	7,500	$ 75,000	$ 3.75
Number of setups	1,000	100	100,000	5.00
Machine hours	10	100,000	1,000,000	50.00
Number of packing orders	5	10,000	50,000	2.50
Overhead cost per unit			$1,225,000	$61.25

Exhibit 5.6 presents a product profitability analysis under the ABC system and Exhibit 5.7 compares product costs and profit margins under the two costing systems. The comparison shows that the volume-based product costing system significantly undercosts AW and overcosts SZ when considering the actual overhead consumption of the two products. This overcosting/undercosting is sometimes called *cross-subsidization.* Often the cross-subsidization is in the direction of undercosting the low-volume products (small batch size, as for AW) and overcosting the high-volume products (large batch size, as for SW) using the volume-based approach. The reason is that with ABC the batch-level costs are averaged over a larger number of units for high-volume products, thus bringing the costs of these products down, and vice-versa for the low-volume products.

EXHIBIT 5.6
Product Profitability Analysis under the ABC Costing System

	AW			SZ		
Unit selling price			$400			$200.00
Unit manufacturing cost						
Direct materials and labor		$200			$80.00	
Factory overhead:						
Engineering	$ 10			$ 3.75		
Setups	40			5.00		
Machine running	100			50.00		
Packing	5	155		2.50	61.25	
Cost per unit			355			141.25
Profit margin			$ 45			$ 58.75

EXHIBIT 5.7
Comparison of Alternative Costing Approaches

	AW	SZ
Unit overhead cost		
Volume-based	$100	$75.00
Activity-based	155	61.25
Difference	$ 55	$13.75
Profit margin		
Volume-based	$100	$45.00
Activity-based	45	58.75
Difference	$ 55	$13.75

For a short additional example, assume that product A is produced in a batch of 10 units, while product B is produced in a batch of 100 units, and that batch-level costs are $100 per batch. The ABC method would calculate the cost per unit of batch costs as $100 ÷ 10 = $10 per unit for the low-volume batch and $100 ÷ 100 = $1 per unit for the high-volume batch. In contrast, the volume-based method would calculate the cost of two batches and spread this equally to the 110 units produced; $200 ÷ 110 = $1.82 per unit. Using the volume-based method, the high-volume product is overcosted ($1.82 vs. $1) and the low-volume product is undercosted ($1.82 vs. $10). Distorted or inaccurate product costing can lead to inappropriate inventory valuations, unrealistic pricing, ineffective resource allocations, misplaced strategic focus, misidentified critical success factors, and lost competitive advantage.

The Five Steps of Strategic Decision Making for Haymarket BioTech Inc.

We can see how inaccurate costs under the volume-based method can affect HBT's success by considering the five steps of strategic decision making.

1. **Determine the strategic issues surrounding the problem.** HBT, the maker of AW and SZ, competes on product leadership (differentiation) as its customers rely on the ability of these products to provide secure communications. Because innovation is a key customer-buying criteria, HBT must take a long-term focus on developing innovations that meet expected future customer expectations and implement these innovations into successful, profitable products.
2. **Identify the alternative actions.** HBT is considering an advertising campaign and reallocation of manufacturing facilities to favor the AW product line.
3. **Obtain information and conduct analyses of the alternatives.** The information available to HBT under the volume-based cost system shows a unit margin of $100 for AW and $45 for SZ, while the ABC-based cost system shows unit margins for AW and SZ of $45 and $58.75, respectively. As the ABC system provides more comprehensive and accurate cost information, HBT should rely on the latter figures, which show that on a unit basis the SZ product is more profitable.
4. **Based on strategy and analysis, choose and implement the desired alternative.** Considering the ABC cost information and the higher margins for SZ relative to AW, the plans to

promote AW and reallocate manufacturing facilities from SZ to AW are not consistent with HBT's long-term growth and profitability. The firm's best advantage for future growth and profitability would be to put resources behind SZ rather than AW.

5. **Provide an ongoing evaluation of the effectiveness of implementation in Step 4.** HBT should continue to review the ABC-based costs and profit margins of existing and new products, together with long-term projections of sales and customer expectations for these products, to choose the products with the best advantage for long-term growth and profitability.

Calculating the Cost of Capacity in ABC

The ABC application illustrated above uses activity-consumption rates based on total budgeted activity costs and budgeted activity consumption. Since budgets are plans, budgeted activity costs are the planned level of spending, and budgeted activity consumption is based on planned usage. The ABC costs assigned to cost objects are, therefore, based on planned levels of spending and usage of capacity. What if we want to know the cost of maintaining idle or excess capacity for planning capacity utilization? Perhaps the unused capacity can be used by other business units in the firm to expand their operations, or alternatively, the excess capacity can be sold or leased. Information on excess capacity allows the firm to manage and reduce these costs when appropriate.

A straightforward adaptation of the ABC method provides the desired additional information—the cost of capacity. For example, suppose for simplicity that of the four activities for HBT we consider only the engineering activity. Engineering cost for HBT is budgeted at $125,000 as currently shown, but suppose that instead of a budgeted activity consumption of 12,500 hours, HBT were to use the practical capacity of the engineering staff, which is 15,625 hours. Practical capacity is the capacity available with the current resources of people, equipment, and facilities—the reasonable level of output if the resource is fully utilized. Using practical capacity, the activity consumption rate would be $8 per engineering hour (= $125,000 ÷ 15,625). If only 12,500 hours were used, as shown in the example, then the overhead cost charged to AW and SZ would be reduced because of the lower rate ($8 instead of the original rate of $10). AW overhead would be reduced by $10,000 (5,000 hours × $2) and SZ overhead would be reduced by $15,000 (7,500 hours × $2). The total reduction for the two products, $25,000 (= $10,000 + $15,000) is the cost of unused capacity. The cost of unused capacity can also be calculated directly by taking the hours of unused capacity—3,125 hours (15,625 − 12,500)—and multiplying by the $8 activity consumption rate for engineering.

Determining the cost of capacity is a strategically important feature of ABC because it helps managers plan the short- and longer-term use of the available operating resources. Also, the cost of capacity plays a central role in two methods that extend the basic ABC model; these are resource consumption accounting and time-driven activity-based costing. Both methods are explained at the end of the chapter.[1]

Activity-Based Management

LO 5-4
Explain activity-based management (ABM).

Benefits of activity-based costing systems are not limited to improved assignment of product costs. The information from the ABC system can also help management increase both the value customers receive and the profits to the firm through the use of activity-based management.

[1] Generally accepted accounting principles (FASB ASC 330-10-30) for "Inventory Costs" requires the costs associated with an abnormally low production level to be treated as a period cost and not assigned to product. The authoritative accounting literature notes that some variation in production level from period to period is expected and that these variances should not affect the accounting for inventory, but when in the accountant's judgment the amount of expense is for an abnormally low production level, then the amount should be separated from inventory costs, as we have done in the above example, and charged against current income.

REAL-WORLD FOCUS Process Analysis Reaps Benefits

When finding themselves in financially dire straits, hospital managers, like managers from other industries, often yield to their first impulse: lay off staff. At one level, this solution makes sense. However, management may benefit from taking a step back and examining their processes. A thorough examination of how things work from beginning to end can help identify inefficiencies that exist in end-to-end processes and result in staggering savings and improvements to their bottom line.

Many inefficiencies in a process come from handoffs from one department to another, but these handoffs are often not analyzed, meaning the opportunities for improvement are missed. In one example, a hospital found such inefficiency through an analysis of its admitting process. The underlying problem was simply that the admitting department lacked a fax machine, and this was revealed by simply walking through the admitting process from end to end. The observation showed that in order to receive the eight or nine admitting orders that came from physicians each day, staff would take an elevator up several floors, pull the orders from the fax machine in the nursing unit, and then go back downstairs to preregister patients. This was a massive inefficiency that was easily remedied.

Source: John Ortiz, "Cutting Hospital Costs without Cutting Staff," *Healthcare Financial Management* 65, no. 10 (Oct. 2011), pp. 46–48.

EXHIBIT 5.8
The Role of ABC/M Tools

Critical Questions	ABC/M Tools
What do we do?	Activity analysis
How much does it cost?	Activity-based costing
How well do we do it?	Performance measurement, including the balanced scorecard
How can we do it better?	Benchmarking, total quality management, business process improvement, and business intelligence

What Is Activity-Based Management?

Activity-based management (ABM) manages resources and activities to improve the value of products or services to customers and increase the firm's competitiveness and profitability. ABM draws on ABC as its major source of information and focuses on the efficiency and effectiveness of key business processes and activities. Using ABM, management can identify ways to improve operations, reduce costs, or increase value to customers, all of which can enhance the firm's competitiveness.

ABM applications can be classified into two categories: operational ABM and strategic ABM. Operational ABM enhances operational efficiency and asset utilization and lowers costs; its focuses are on doing things right and performing activities more efficiently. Operational ABM applications use management techniques such as activity analysis, business process improvement, total quality management, and performance measurement.

Strategic ABM focuses on choosing appropriate activities for the operation, eliminating nonessential activities, and selecting the most profitable customers. Strategic ABM applications use management techniques such as process design, customer profitability analysis, and value-chain analysis, all of which can alter the demand for activities and increase profitability through improved activity efficiency.

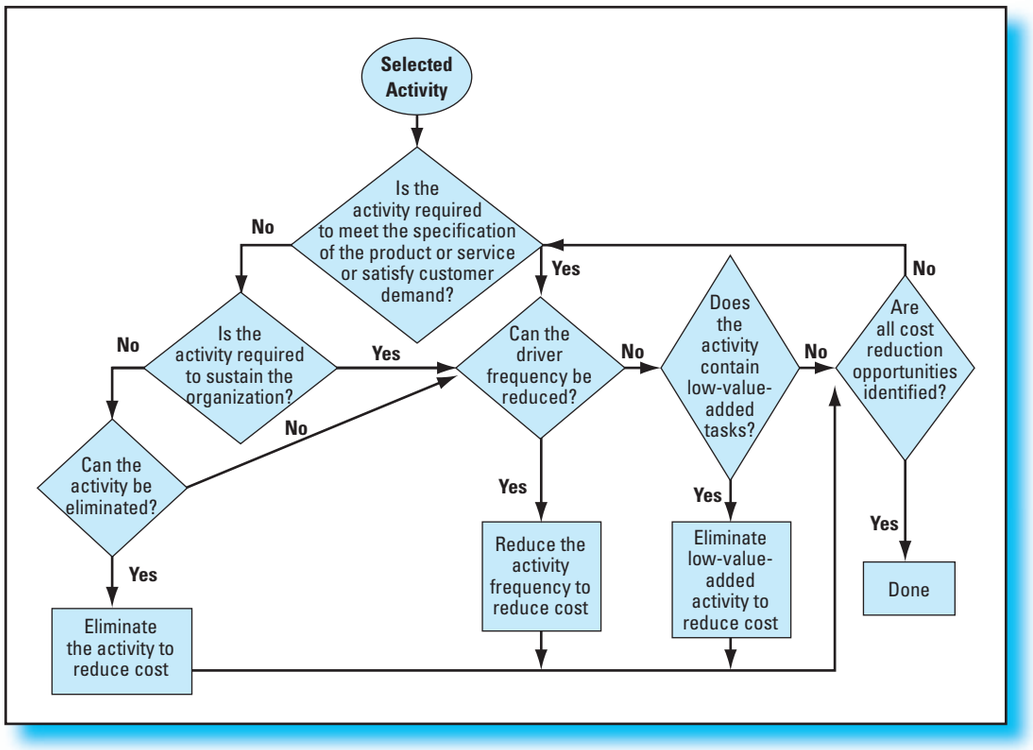
Exhibit 5.8 illustrates questions that strategic and operational ABC/ABM (ABC/M) can help to answer and the tools that are used. Some of the key tools of ABC/M are activity analysis, activity-based costing, performance measurement (covered in Chapters 18 and 19), and several contemporary management techniques explained in Chapter 1: benchmarking, total quality management, business process improvement, and others. Another technique, value-added analysis, is explained here.

Activity Analysis

To be competitive a firm must assess each of its activities based on its need by the product or customer, its efficiency, and its value content. Ideally, a firm performs an activity for one of the following reasons:

- It is required to meet the specification of the product or service or satisfy customer demand.

EXHIBIT 5.9 **Example of an Activity Analysis**



- It is required to sustain the organization.
- It is deemed beneficial to the firm.

Examples of activities required to sustain the organization are providing plant security and compliance with government regulations. Although these activities have no direct effect on the product or service or customer satisfaction, they cannot be eliminated. Examples of discretionary activities deemed beneficial to the firm include a holiday party and free coffee. Exhibit 5.9 depicts an activity analysis. Some activities, however, may not adequately meet any of the above criteria, making them candidates for elimination.

Value-Added Analysis

Eliminating activities that add little or no value to customers reduces resource consumption and allows the firm to focus on activities that increase customer satisfaction. Knowing the values of activities allows employees to see how work really serves customers and which activities may have little value to the ultimate customers and should be eliminated or reduced.

A **high-value-added activity** increases the value of the product or service to the customers.

A **high-value-added activity** increases significantly the value of the product or service to the customers. Removal of a high-value-added activity decreases perceptively the value of the product or service to the customer. Inserting a flange into a part, pouring molten metal into a mold, and preparing a field for planting are examples of high-value-added activities, as are designing, processing, and delivering products and services. Exhibit 5.10 illustrates high-value-added activities of a television news broadcasting firm. The exhibit also includes examples of low-value-added activities.

A **low-value-added activity** consumes time, resources, or space, but adds little to satisfying customer needs.

A **low-value-added activity** consumes time, resources, or space, but adds little in satisfying customer needs. If eliminated, customer value or satisfaction decreases imperceptively or remains unchanged. Moving parts between processes, waiting time, repairing, and rework are examples of low-value-added activities.

EXHIBIT 5.10
Television News Broadcasting Firm's High-Value-Added and Low-Value-Added Activities

A *high-value-added activity* is one that, if eliminated, would affect the accuracy and effectiveness of the newscast and decrease total viewers as well as ratings for that time slot.

1. Activities that augment accuracy
   - Verification of story sources and acquired information.
2. Activities that augment effectiveness
   - Efficient electronic journalism to ensure effective taped segments.
   - Newscast story order planned so that viewers can follow from one story to the next.
   - Field crew time used to access the best footage possible.
   - Meaningful news story writing.
   - Contents of the newscast planned so that viewers get the best possible package of stories.

A *low-value-added activity* is one that, if eliminated, would not affect the accuracy and effectiveness of the newscast. The activity contributes nothing to the quest for viewer retention and improved ratings.

- Developing stories not used in a newscast.
- Assigning more than one person to develop each facet of the same news story.
- Newscast not completed on time because of one or more inefficient processes.
- Too many employees on a particular shift or project.

EXHIBIT 5.11
A Classification of High-Value-Added and Low-Value-Added Activities

Activity	High-Value-Added	Low-Value-Added
Designing product	X	
Setting up		X
Waiting		X
Moving		X
Processing	X	
Reworking		X
Repairing		X
Storing		X
Inspecting		X
Delivering product	X	

Reduction or elimination of low-value-added activities reduces cost. *Low-value-added activities* are those that:

- Can be eliminated without affecting the form, fit, or function of the product or service.
- Begin with prefix "re" (such as rework or returned goods).
- Result in waste and add little or no value to the product or service.
- Are duplicated in another department or add unnecessary steps to the business process.
- Produce an unnecessary or unwanted output.

Additional examples of high- and low-value-adding activities are shown in Exhibit 5.11.

Real-World Activity-Based Costing/Management Applications

LO 5-5
Describe how ABC/M is used in manufacturing companies, service companies, and governmental organizations.

Activity-based costing/management (ABC/M) applications are quite common and this section provides an application example in manufacturing and within government.

ABC/M Application in Manufacturing: Industrial Air Conditioner Units

AIRCO Ltd (**www.airco.co.za**) of Johannesburg and Cape Town, South Africa, is a manufacturer of industrial air conditioning units. The units range in size and power from 5 to 20 tons.[2] Each unit has more than 200 parts, including holding tanks, electronic controllers,

[2] Heather Nachtmann and Mohammad Hani Al-Rifai, "An Application of Activity-Based Costing in the Air Conditioner Manufacturing Industry," *The Engineering Economist* 49 (2001), pp. 221–236. Used with permission. For simplicity, for the remainder of the chapter we will refer to resource consumption cost drivers as resource cost drivers and we will refer to activity consumption cost drivers as activity cost drivers.

EXHIBIT 5.12
AIRCO Overhead Cost Resources

Overhead Resource	Cost
Indirect labor	$2,786,900
Computer and software	731,405
Product transportation	319,800
Energy	170,600
Facility and vehicle rent	165,870
Business and training travel	66,000
Miscellaneous	65,480
Maintenance	60,000
Depreciation	48,200
Advertising	40,000
Office and utilities	4,355
	$4,458,610

metal sheets, cooling coils, wires, and insulation material. Almost 90% of manufacturing workers are hourly workers, and the company operates two shifts. The organization of the manufacturing process is conventional, with separate departments for purchasing, engineering, job scheduling, materials handling, shipping, accounting, and human resources. AIRCO developed an ABC system to assist in the analysis of product profitability. Its first step was to identify the resource cost pools that make up total overhead of $4,458,610 at the plant (Exhibit 5.12). The resource costs are from the firm's accounting system, which collects resources costs in the 11 categories noted in the exhibit.

The next step is to identify production activities and to use resource consumption cost drivers to assign the resource costs to the activity cost pools, which are shown in column 1 of Exhibit 5.13. The activity cost pools are machines; data record maintenance; materials handling; production changeover (setup); scheduling and production preparation; materials receiving and handling; product shipment; and customer service. The assignment of resources to activities typically uses resource cost drivers. Instead of using cost drivers, AIRCO determined the estimated contribution of each resource to each activity based on managers' and employees' experience. For example, the resource, maintenance costs of $60,000, was assigned entirely to the activity, machines. To illustrate, the cost of the machine activity was determined from the resources as follows (other activities were obtained in a similar way):

$$
\begin{aligned}
\text{Machine activity cost} &= 20\% \text{ of the computer and software costs} \\
&\quad + 100\% \text{ of energy costs} + 15\% \text{ of miscellaneous expense} \\
&\quad + 100\% \text{ of maintenance expense} + 100\% \text{ of depreciation expense} \\
&\quad + 12\% \text{ of office and utilities expense} \\
&= (.2 \times \$731{,}405) + \$170{,}600 + (.15 \times \$65{,}480) + \$60{,}000 \\
&\quad + \$48{,}200 + (.12 \times \$4{,}355) \\
&= \$435{,}425
\end{aligned}
$$

The machine activity cost and the cost of other activities is shown in column 2 of Exhibit 5.13. The use of estimated percentages in place of other types of resource consumption cost drivers is a practical and convenient approach that is often used in implementing ABC costing.

The next step in ABC is to identify activity cost drivers, to identify the total amounts for these cost drivers, and then to determine the ABC-based application rate. This is shown in Exhibit 5.13, columns 3, 4, and 5, respectively. Thus, the cost of machine time is assigned to each of the products based on machine-hours used by that product times the rate of $5.89 per machine-hour ($5.89 = $435,425 ÷ 73,872). This same process is done for the other activities. The determination of ABC cost and profitability analysis for AIRCO's key product lines is the final step and is shown in Exhibit 5.14. Note that this analysis shows that the 5-ton, 6-ton, and 12.5-ton products are not profitable.

EXHIBIT 5.13 AIRCO Resource Consumption Cost Pools Assigned to Activities, Activity Cost Drivers, and Activity-Based Rates

(1) Activity Cost Pool	(2) Budgeted Activity Cost	(3) Activity Cost Driver	(4) Budgeted Activity	(5) = (2) ÷ (4) Activity-Based Application Rate
Machines	$ 435,425	Number of machine-hours	73,872	$ 5.89 per hour
Data record maintenance	132,596	Number of products lines	14	9,471 per line
Materials handling	1,560,027	Number of products	16,872	92.46 per product
Production changeover (setup)	723,337	Setup time (hours)	72	10,046 per hour
Scheduling and production preparation	24,876	Number of production runs	2,788	8.92 per run
Materials receiving and handling	877,106	Number of receipts	2,859	307 per receipt
Product shipment	561,013	Distance (miles)	13,784,015	.041 per mile
Customer service	144,230	Number of customer contacts	2,533	56.94 per contact
Total	$4,458,610			

EXHIBIT 5.14 AIRCO: Overhead Allocation and Product Profitability under ABC Costing

	5-ton	6-ton	7.5-ton	10-ton	12.5-ton	15-ton	20-ton
Direct labor	$ 342.20	$ 342.20	$ 342.20	$ 410.64	$ 410.64	$ 410.64	$ 410.64
Direct material	665.00	665.00	665.00	1,957.00	1,957.00	2,510.00	2,510.00
Overhead (ABC-based)	174.63	404.27	160.26	172.62	1,029.52	343.95	309.90
Total manufacturing cost	$ 1,181.83	$1,411.47	$1,167.46	$2,540.26	$3,397.16	$3,264.59	$3,230.54
Selling price	1,000.00	1,300.00	1,750.00	2,560.00	3,200.00	4,572.00	5,450.00
Product margin	$ (181.83)	$ (111.47)	$ 582.54	$ 19.74	$ (197.16)	$1,307.41	$2,219.46

The ABC analysis can be compared to the volume-based approach that AIRCO used prior to ABC, in which overhead costs were assigned to products based on a rate of $12.02 per direct labor-hour. The results of the volume-based approach are shown in Exhibit 5.15 and a comparison of those results to the ABC results is shown in Exhibit 5.16. Note that the ABC and volume-based methods show significantly different results for some of the products, particularly the 6-ton and 12.5-ton models. While the detailed calculations of the ABC costs for these products are not shown, the company reports that the 12.5-ton model required significantly more raw materials receipts (the cost driver for materials receiving and handling) than other products, and it also required more setup time and customer service contacts. Thus, the ABC costs for the 12.5-ton model are significantly higher than for volume-based costs. Similarly, the 6-ton product has higher costs under

EXHIBIT 5.15 AIRCO: Overhead Allocation and Product Profitability under Volume-Based Costing

	5-ton	6-ton	7.5-ton	10-ton	12.5-ton	15-ton	20-ton
Direct labor	$ 342.20	$ 342.20	$ 342.20	$ 410.64	$ 410.64	$ 410.64	$ 410.64
Direct material	665.00	665.00	665.00	1,957.00	1,957.00	2,510.00	2,510.00
Overhead (volume-based)	240.41	240.41	240.41	288.49	288.49	288.49	288.49
Total product cost	$1,247.61	$1,247.61	$1,247.61	$2,656.13	$2,656.13	$3,209.13	$3,209.13
Selling price	1,000.00	1,300.00	1,750.00	2,560.00	3,200.00	4,572.00	5,450.00
Product margin	$ (247.61)	$ 52.39	$ 502.39	$ (96.13)	$ 543.87	$1,362.87	$2,240.87

REAL-WORLD FOCUS

The Cost of Complexity and the Role of ABC: Lego, Nike, and GM

In three companies (Nike, General Motors, and the Lego Group), the strong influence of the design staff created a proliferation of products that created additional complexity and costs without improving profits.

Nike, a leader in the sports apparel industry, discovered in 2006 that it had 30 different styles of the basic T-shirt. The company knew, however, that 95% of the company's apparel sales came from 40% of its apparel products. Over several months a design team was assigned to bring this to one design that would be available in a variety of colors and fabrics. This was part of a companywide effort to reduce complexity. The goal was to reduce costs and improve overall profitability.

The same could be said for GM and the Lego Group. GM found that car models that sold less than 2,000 units (such as the Saturn Astra and the Pontiac G8) were unprofitable. Even if the vehicle shared most parts with other vehicles, there were incremental costs of engineering, sales, brochures, owner manuals, and the like. So GM as well as Ford and Chrysler are simplifying their model lineups. In the Lego Group, the concern arose when sales were increasing but profits were falling. This is a common sign of a company that could use ABC costing, to identify those products that might have sales growth but are unprofitable. Lego found that it, like GM and Nike, had become a design-driven company, and there was a proliferation of products. The solution for Lego was to place more emphasis on costs and to reduce the number of products and color variety; this was accomplished in part by requiring closer coordination between operations and design.

The cost of complexity as illustrated in the above examples is a key reason that ABC costing can play a strategic role for these firms—it provides a way to accurately determine the cost of product variety and other operating complexities, so the firm can identify the most profitable products and operations.

Source: Kaj Grichnik and Conrad Winkler, *Make or Break: How Manufacturers Can Leap from Decline to Revitalization* (New York: McGraw-Hill, 2008), pp. 52–56; Stephanie Kang, "Nike Gets Back to Basics, Reinventing the T-Shirt," *The Wall Street Journal,* April 2, 2007, p. B1; Sharon Terlep and Neal E. Boudette, "Unpopular Models Slow Down GM," *The Wall Street Journal,* September 9, 2008, p. B1.

EXHIBIT 5.16
AIRCO: Comparison of Product Profit Margins under Volume-Based and ABC Costing

	ABC Product Margin	Volume-Based Product Margin	Difference
5-ton	$ (181.83)	$ (247.61)	$ 65.78
6-ton	(111.47)	52.39	(163.86)
7.5-ton	582.54	502.39	80.15
10-ton	19.74	(96.13)	115.87
12.5-ton	(197.16)	543.87	(741.03)
15-ton	1,307.41	1,362.87	(55.46)
20-ton	2,219.46	2,240.87	(21.41)

ABC because of its relatively high use of setup time and customer service contact. The ABC information provides the company a useful basis for becoming more competitive, for example, by reconsidering the pricing of certain products and looking for ways to increase efficiency in the use of its activities.

ABC/M Applications in Government

ABC/M is used widely in government, as illustrated by the U.S. Postal Service example that introduced this chapter (see page 132). Another example is the U.S. Patent and Trademark Office (PTO), which uses ABC to better understand its cost structure. The PTO is not taxpayer supported; rather, it relies on user fees, and the volume of applications has been rising, making the determination of accurate costs and the setting of appropriate user fees for its different services critical. The ABC model at the PTO used 29 activities and the cost objects included utility patents, design patents, plant patents, reissues, reexaminations, trademarks, and appeals. One finding of the ABC implementation was that the cost of trademark processing was higher than expected.[3]

There are many other examples because the U.S. federal government encourages the use of ABC within its various units. In 1990, three officials responsible for federal financial reporting established the Federal Accounting Standards Advisory Board (FASAB) as a federal advisory committee (**www.fasab.gov**). The officials were the Secretary of the

[3] For additional examples: Gary Cokins, *Activity-Based Cost Management in Government,* Management Concepts, Inc., 2001.

Treasury, the Director of the Office of Management and Budget, and the Comptroller General of the United States. They created FASAB to develop accounting standards and principles for the U.S. government. *FASAB Standard Number 4,* "Managerial Cost Accounting Concepts and Standards for the Federal Government, " explains the advantages of ABC for use in governmental units.

Customer Profitability Analysis

> The customer is the most important part of the assembly line.
>
> *W. Edwards Deming*

ABC/M is best known for its application in computing product costs, but firms also find it useful in determining the cost of serving customers and as a basis for evaluating the profitability of a specific customer or group of customers. Why is this important? Most managers agree that 80% of their profits come from the top 20% of their customers, and most important, the bottom 20% of their customers are unprofitable! For example, to better compete with Walmart, Best Buy works hard to attract profitable customers (it calls them *angels*) and equally hard to discourage the unprofitable customers (the *devils*)—those that are price shopping and looking for discounts and promotions and comparing prices to Walmart. Best Buy studies demographic and sales data for each store location to identify angels and devils. Similarly, the large food distributor, CONCO, studies its customer base (mostly restaurants) to identify profitable and unprofitable customers. CONCO found that certain food products and smaller customers tended to be unprofitable.[4]

Customer profitability analysis identifies customer service activities, cost drivers, and the profitability of individual customers or customer group.

Customer profitability analysis identifies customer service activities and cost drivers and determines the profitability of each customer or customer group. Here, customer service includes all activities to complete the sale and satisfy the customer, including advertising, sales calls, delivery, billing, collections, service calls, inquiries, and other forms of customer service. Customer profitability analysis allows managers to:

- Identify most profitable customers.
- Manage each customer's costs-to-serve.
- Introduce profitable new products and services.
- Discontinue unprofitable products, services, or customers.
- Shift a customer's purchase mix toward higher-margin products and service lines.
- Offer discounts to gain more volume with low costs-to-serve customers.
- Choose types of after-sale services to provide.

A good understanding of the profitability of a firm's current and potential customers can help firms improve overall profits and become more competitive. This begins with an analysis of the cost to serve the customer.

Customer Cost Analysis

LO 5-6

Use an activity-based approach to analyze customer profitability.

Not all customers require similar activities either before or after the sale. Examples of customer-specific activities include:

- Order processing costs.
- Billing, collection, and payment processing costs.
- Accounts receivable and carrying costs.
- Customer service costs.
- Selling and marketing costs.

[4] Stephen Schulist, "Using ABC to Manage and Improve at CONCO Foods," *The Journal of Corporate Accounting & Finance,* March/April 2004, pp. 29–34; Gary McWilliams, "Analyzing Customers, Best Buy Decides Not All Are Welcome," *The Wall Street Journal,* November 8, 2004, p. 1; Jaclyne Badal, "A Reality Check for the Sales Staff," *The Wall Street Journal,* October 16, 2006, p. B3.

REAL-WORLD FOCUS Customer Loyalty May Not Yield Customer Desirability

Loyal customers are not necessarily desirable customers. The common practice of trying to retain customers by discounting or providing a loyalty program may no longer be an affordable way to do business. In fact, the customer that needs such incentives may be what Kumar and Rajan call "barnacles." It does not necessarily mean the customers should be abandoned, just that the level of resources dedicated to supporting these customers may need to be altered. However, a weak economy is causing some businesses to, in fact, stop servicing customers. Customers that continue to ask for more discounts or concessions and extend out their payments put tremendous pressure on businesses. Tying up resources to support unprofitable customers hurts the company's ability to take advantage of other, more profitable opportunities. Websmith Group, LLC is an example. The owner decided to eliminate 5% of the group's clients; they were taking up 20% of the resources. By redeploying the resulting freed-up resources, the group's revenues were on track to rise over 10% from the prior year. The bottom line is that maybe a company will reach a point where it makes no sense to continue to service customers on which money with every transaction.

Sources: V. Kumar and Bharath Rajan, "Nurturing the Right Customers," *Strategic Finance,* September 2009, pp. 27–33; and Raymund Flandez, "It Just Isn't Working? Some File for Customer Divorce," *The Wall Street Journal,* November 10, 2009, p. B7.

Customer cost analysis identifies activities and cost drivers related to servicing customers.

Customer cost analysis is the process of identifying the activities and cost drivers related to servicing customers. Traditionally these costs are hidden in the customer support, marketing, and sales function. ABC/M can help managers to understand their costs to serve customers.

Different activities often have different cost drivers. Based on the activities and cost drivers involved in services performed to acquire and complete a transaction, customer costs can be classified into the following categories:

- *Customer unit-level cost*—resources consumed for each unit sold to a customer. Examples include sales commissions based on the number of units sold or sales dollars, shipping cost when the freight charge is based on the number of units shipped, and cost of restocking each returned unit.
- *Customer batch-level cost*—resources consumed for each sales transaction. Examples include order-processing costs, invoicing costs, and recording of sales returns or allowances every time a return or allowance is granted.
- *Customer-sustaining cost*—resources consumed to service a customer regardless of the number of units or batches sold. Examples are salespersons' travel costs to visit customers, monthly statement processing costs, and collection costs for late payments.
- *Distribution-channel cost*—resources consumed in each distribution channel the firm uses to service customers. Examples are operating costs of regional warehouses that serve major customers and centralized distribution centers that serve small retail outlets.
- *Sales-sustaining cost*—resources consumed to sustain sales and service activities that cannot be traced to an individual unit, batch, customer, or distribution channel. Examples are general corporate expenditures for sales activities, and the salary, fringe benefits, and bonus of the general sales manager.

Exhibit 5.17 shows customer-related activities, cost drivers and their rates, and the cost category of each of the activities of Winsome Office Supply. These activities are based on the results of a careful study of the firm's selling, administrative, and general expenditures, as well as customer transactions for the last three years. Exhibit 5.18 shows the detailed customer-related activities that Winsome experienced for the sales to the firm's three major customers GereCo., HomeServ Inc., and Advance Tek.

Both customer activity costs, cost categories, and their cost drivers illustrated in Exhibit 5.17 and the detailed customer-related activities reported in Exhibit 5.18 provide the basis for analyzing customer costs. Exhibit 5.19 shows customer cost analyses for Winsome's three customers.

As illustrated in Exhibits 5.18 and 5.19, while these three customers purchased about equal amounts from Winsome, the costs to serve these customers ranged from $1,555 to $20,395. The costs to service these customers differ because they do not place similar demands on the service-related resources of the firm.

EXHIBIT 5.17
Customer-Related Activity, Cost Driver, Cost Rate, and Cost Category: Winsome Office Supply

Activity	Cost Driver and Rate	Cost Category
Order taking	$30 per order	Customer batch-level
Order processing	$20 per order,	Customer batch-level
	and $1 per item	Customer unit-level
Delivery	$100 per trip, and	Customer batch-level
	$1 per mile	Customer batch-level
Expedited order taking, processing, and delivery	$800 per order	Customer batch-level
Customer visit	$200 per visit	Customer-sustaining
Monthly billing:		
First statement	$5 per statement	Customer-sustaining
Subsequent reminder	$25 per notice	Customer-sustaining
Sales returns	$100 per occurrence	Customer batch-level
Restocking	$5 per item returned	Customer unit-level

EXHIBIT 5.18
Customer-Related Activity for Selected Customers: Winsome Office Supply

	GereCo.	HomeServ Inc.	Advance Tek
Net sales	$463,917	$477,600	$472,576
Number of orders and deliveries	2	20	80
Average number of items per order	400	38	8
Delivery miles	10	15	20
Number of expedited orders	0	0	5
Number of visits by salesperson	1	2	5
Sales returns			
Number of requests	2	1	10
Average units per return	3	4	2
Billing reminder	0	0	2

EXHIBIT 5.19
Customer Cost Analysis: Winsome Office Supply

	GereCo.	HomeServ Inc.	Advance Tek
Customer unit-level cost			
Order processing	$400 \times 2 \times \$1 = \$800$	$38 \times 20 \times \$1 = \$760$	$8 \times 80 \times \$1 = \$640$
Restocking	$2 \times 3 \times \$5 = 30$	$1 \times 4 \times \$5 = 20$	$10 \times 2 \times \$5 = 100$
Customer batch-level cost			
Order taking	$2 \times \$30 = 60$	$20 \times \$30 = 600$	$80 \times \$30 = 2{,}400$
Order processing	$2 \times \$20 = 40$	$20 \times \$20 = 400$	$80 \times \$20 = 1{,}600$
Delivery			
Trips	$2 \times \$100 = 200$	$20 \times \$100 = 2{,}000$	$80 \times \$100 = 8{,}000$
Miles	$10 \times 2 \times \$1 = 20$	$15 \times 20 \times \$1 = 300$	$20 \times 80 \times \$1 = 1{,}600$
Expedited orders	—	—	$\$800 \times 5 = 4{,}000$
Sales returns	$2 \times \$100 = 200$	$1 \times \$100 = 100$	$10 \times \$100 = 1{,}000$
Customer-sustaining costs			
Sales visits	$1 \times \$200 = 200$	$2 \times \$200 = 400$	$5 \times \$200 = 1{,}000$
Monthly billings	$1 \times \$5 = 5$	$1 \times \$5 = 5$	$1 \times \$5 = 5$
Subsequent reminders	—	—	$2 \times \$25 = 50$
Sales-sustaining costs	—	—	—
Total	$1,555	$4,585	$20,395

Customer Profitability Analysis

Customer profitability analysis combines customer revenues and customer cost analyses to assess customer profitability and helps identify actions to improve customer profitability. Exhibit 5.20 illustrates customer profitability analysis for Winsome.

The reasons that GereCo. is not as profitable as HomeServ relate to sales activities. Winsome granted GereCo. much more favorable sales terms than the terms granted to HomeServ. GereCo. also had a high amount of sales returns and allowances; it returned twice as often as HomeServ did.

Cost Management in Action

How to Validate Your Customer Profitability Strategy: Data or Expertise?

Harrah's Casinos, the Royal Bank of Canada, and Capital One have a special ability to understand customer profitability. In recent years, these companies have used their customer profitability strategy effectively to improve revenues and profits. Some would say their success has been due to hard work, or to good judgment, or just dumb luck. Perhaps you are a customer of one of these companies; how do you think they have been successful?

(Refer to Comments on Cost Management in Action at the end of the chapter.)

EXHIBIT 5.20
Customer Profitability Analysis: Winsome Office Supply

	GereCo.	HomeServ Inc.	Advance Tek
Total sales	$500,000	$480,000	$540,000
Less: Sales discounts	25,000	—	27,000
Net invoice amount	$475,000	$480,000	$513,000
Less: Sales returns and allowances	4,750	2,400	30,780
Less: Cash discounts	6,333	—	9,644
Net sales	$463,917	$477,600	$472,576
Cost of goods sold	408,620	384,720	432,014
Gross margin	$ 55,297	$ 92,880	$ 40,562
Customer costs			
Order processing	$ 800	$ 760	$ 640
Restocking	30	20	100
Order taking	60	600	2,400
Order processing	40	400	1,600
Delivery			
Trips	200	2,000	8,000
Miles	20	300	1,600
Expedited orders	—	—	4,000
Sales returns	200	100	1,000
Sales visits	200	400	1,000
Monthly billings	5	5	5
Subsequent reminders	—	—	50
Total customer costs	$ 1,555	$ 4,585	$ 20,395
Net customer profit	$ 53,742	$ 88,295	$ 20,167

Although Advance Tek had the highest total sales, it generated the lowest profit of the three customers. Winsome should be concerned about Advance Tek's high returns and its frequency of orders and number of expedited orders. Winsome needs to look into the reasons for these high levels of activity, as it may potentially lose this customer. Late payments also add to the cost to serve Advance Tek; they might indicate Advance Tek's dissatisfaction with Winsome's sales and services or weakness of Advance Tek's financial condition.

Customer profitability analysis provides valuable information to the assessment of customer value. In addition, firms must weigh other relevant factors before determining the action appropriate for each customer. The following are among these relevant factors:

- Growth potential of the customer, the customer's industry, and its cross-selling potential.
- Possible reactions of the customer to changes in sales terms or services.
- Importance of having the firm as a customer for future sales references, especially when the customer could play a pivotal role in bringing in additional business.

Customer Lifetime Value

Exhibit 5.20 shows how to determine the profitability of a customer at a given point in time. Many companies now see the importance of looking at the long-term value of the customer, the expected contribution to profit during the full period the company retains

REAL-WORLD FOCUS Customer Metrics and Their Impact on Financial Performance

Sunil Gupta and Valerie Zeithaml have summarized the research that has examined the relationship between a variety of customer metrics and profitability. They integrated this large amount of knowledge into the following generalizations which they argue are supported by the research. These generalizations are important because they help us to understand the role of customer lifetime value (CLV).

1. Improvement in customer satisfaction has a significant and positive impact on firms' financial performance—shown by many studies
2. The link between customer satisfaction and profitability is asymmetric and nonlinear—an increase in satisfaction has less of a positive effect on profitability than the negative effect of declines in satisfaction; increases in satisfaction have a greater than linear effect on profits.
3. The strength of the satisfaction-profitability link varies across industries as well as across firms within an industry
4. There is a strong positive relationship between customer satisfaction and customer retention.
5. While customer satisfaction and service quality are strongly correlated with behavioral intentions, behavioral intentions imperfectly predict actual (buying) behavior.
6. The relationship between observable and unobservable metrics is nonlinear—as the relationship between satisfaction and profitability is nonlinear, so is the relationship between satisfaction and repurchase intention (an unobservable).
7. Marketing decisions based on observable customer metrics, such as CLV, improve a firm's financial performance.
8. Customer retention is one of the key drivers of CLV and firm profitability.

Source: Sunil Gupta and Valerie Zeithaml, "Customer Metrics and Their Impact on Financial Performance," *Marketing Science,* November–December 2006, pp. 718–739.

Customer lifetime value (CLV) is the net present value of estimated future profits from the customer.

the customer. This concept is called **customer lifetime value (CLV),** and it is calculated as the net present value of estimated future profits from the customer for a specified time, which may be three to five years. Present value is used because the profits from the customer are expected to occur over a number of years. To provide a more comprehensive and strategically relevant measure of the value of the customer, CLV takes into account the company's expectations about the future potential growth in profits for a customer. The following example illustrates the calculation of CLV. Assume MidTown Medical Clinic purchases medical supplies from Johnson Medical Supply Company. Johnson calculates the CLV of the medical clinic by projecting profits from the clinic. Suppose the forecast is for $20,000 profit per year for the next three years. Further, suppose Johnson uses a discount rate of 6% (the relevant discount factor is 2.673 from the present value Table 2 at the end of Chapter 12 on page 498), then

$$\text{CLV} = \$53{,}460 = \$20{,}000 \times 2.673$$

CLV can be used to measure the value of a customer or group of customers and to determine how marketing and support services should be allocated to these customers to improve the firm's overall profitability. Since there is a significant level of judgment involved in estimating the variables in the calculation, it is also important to compare different calculations of CLV made with different assumptions about profit forecasts and discount rates.

Implementation Issues and Extensions

If you want to make enemies, try to change something.

Woodrow Wilson

LO 5-7

Identify key factors for successful ABC/M implementation.

A successful ABC/M implementation requires close cooperation among management accountants, engineers, and manufacturing and operating managers. They need to act as a team in identifying activities, cost drivers, and requisite information, both financial and nonfinancial.

Following are processes found in many successful implementations of ABC/M:

Implementation Process	Why This Leads to Success
Involve management and employees in creating an ABC system	Allows them to become familiar with ABC/M. They could then be more willing to implement the system because they feel included and share in ownership of the new system.
Use ABC/M on a job that will succeed	Shows how and why the process works. Successfully completing one job enables individuals to see the benefits of ABC/M more clearly.
Keep the initial ABC/M design simple	Avoids overwhelming users and holds costs down; also reduces implementation time.

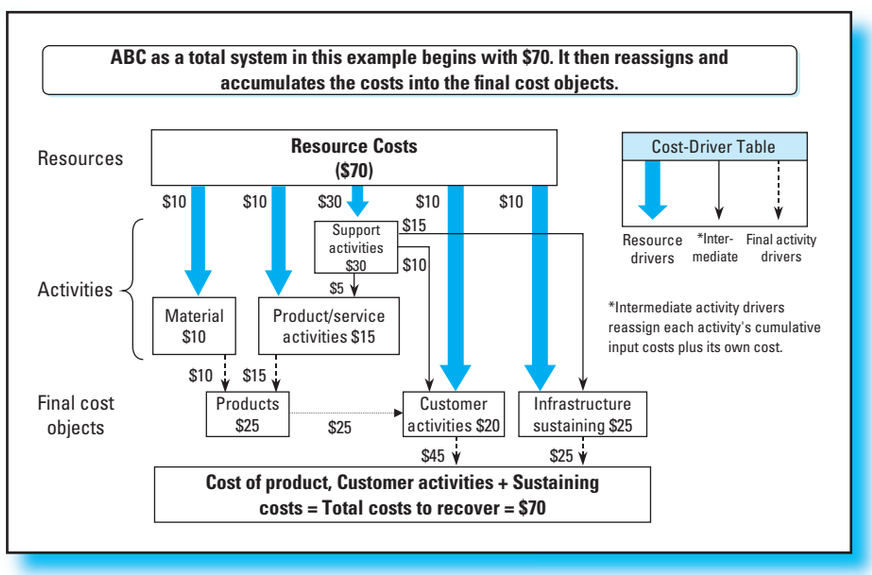
Extensions of the ABC model are becoming more common. We discuss three of these below: multistage ABC, resource consumption accounting (RCA), and time-driven activity-based costing (TDABC). All three respond directly to the inherent complexity of resource and activity cost assignments in actual applications, noted as one of the implementation issues above. The latter two take a resource-focused approach to ABC.

Multistage Activity-Based Costing

In practice, you may find some activities are intermediate cost objects for other activities while others are assigned directly to cost objects. To capture and calculate accurately the costs for this situation, some firms use multistage activity-based costing rather than two-stage ABC described earlier in the chapter. In **multistage ABC,** resource costs are assigned to certain activities which in turn are assigned to other activities before being assigned to the final cost objects. Exhibit 5.21 illustrates such a case. The activity labeled "support activities" provides service to other activities later in the value chain—product/service activities, customer activities, and infrastructure-sustaining activities. The exhibit illustrates how a total of $70 of resource costs are assigned in multistage ABC costing. After multistage allocations, $25 is assigned to products, $20 is assigned to customer-related activities, and $25 is assigned to infrastructure-related costs (computer equipment and software, buildings, and other equipment, etc.).

In **multistage ABC,** resource costs are assigned to certain activities which in turn are assigned to other activities before being assigned to the final cost objects.

EXHIBIT 5.21
Multistage Activity Cost Flows



Resource Consumption Accounting (RCA)

Resource consumption accounting (RCA) is a comprehensive and fully integrated management accounting approach that provides managers with decision support information based on an operational view of the organization.

Resource consumption accounting (RCA) is relatively new to the field of cost management and is an integration of principle from the German costing system Grenzplankostenrechnung (GPK) and ABC. On the RCA Institute website (**www.rcainstitute.org**), RCA is formally defined as "a dynamic, fully integrated, principle-based, and comprehensive management accounting approach that provides managers with decision support information for enterprise optimization."[5] Like ABC, RCA uses an activity/process view but integrates marginal costs and a detailed resource consumption analysis to generate information for decision support. Another notable feature of RCA is that depreciation expense is based on an estimated replacement cost for the asset rather than historical acquisition cost.

RCA's emphasis is on being able to attribute costs, both fixed and proportional, to cost objects for decision support, and there are three foundational concepts for RCA:

- The view of resources—resources are the suppliers of capacity, meaning that capacity is a function of the resources available.
- The quantity-based model—an operational view of the organization based on the concept that there is a causal relationship that can be expressed in terms of input and output units.
- Cost behavior—the characteristics of the cost are inherent to the underlying resource and the consumption of those resources by value-creating operations.

The RCA approach relies heavily on the concept of an attributable cost, which is a concept of attaching costs to a cost object only when causality exists. This concept helps ensure that decisions are not made on the basis of arbitrary allocations. Understanding and modeling causality allows for the modeling of cost behavior based on responsiveness, which is the level of correlation between a particular output quantity and the input quantity needed to produce the output.

RCA offers tremendous potential benefits, but like any system, management must decide if the benefits exceed the cost of implementation. Additionally, the collection, storage, and processing of the underlying data for an effective RCA implementation requires its own use of resources, which could be quite extensive. For large organizations, this may mean an enterprise resource planning (ERP) system needs to be in place. However, medium and smaller sized organizations are not out of luck. There is an open source application for RCA available called ROSA, making RCA possible for those organizations that have less sophisticated cost management systems.

Time-Driven Activity-Based Costing (TDABC)

Time-driven activity-based costing (TDABC) assigns resource costs directly to cost objects using the cost per time unit of supplying the resource, rather than first assigning costs to activities and then from activities to cost objects.

Another resource-centric approach to the implementation of large ABC costing systems is based on the idea that the common element in the utilization of activities is the unit of time. ABC traces and reassigns resource expenses to the activities that consume them and then further reassigns them proportionately to the final cost objects based on the quantity of each activity's cost driver. When a substantial amount of the cost of a company's activities are in a highly repetitive process, the cost assignment can be based on the average time required for each activity. **Time-driven activity-based costing (TDABC)** assigns resource costs directly to cost objects using the cost per time unit of supplying the resource, rather than first assigning costs to activities and then from activities to cost objects.[6]

TDABC provides a direct way to measure unused capacity. To illustrate, assume there is a credit card processing facility and one of its activities is validation of mailing addresses. Traditional ABC would first pool the costs associated with the various activities of the facility and then select cost drivers to come up with costs per activity. The cost of activities associated with validating mailing addresses would be assigned to the cost object "mailing list validation" and that pool of costs would be divided by the number of

[5] In RCA, resource cost pools are called cost centers. Useful references for RCA include Kip Krumwiede and Augustin Suessmair, "Getting Down to Specifics on RCA," *Strategic Finance* (June 2007); and the Resource Consumption Accounting Institute website **www.rcainstitute.org**.

[6] Robert S. Kaplan and Steven R. Anderson, *Time-Driven Activity-Based Costing* (Boston: Harvard Business School Press, 2007).

validations to determine a cost per validation. Assume there were 10,000 validations for the year and the ABC rate was $10 per validation.

In contrast, TDABC considers the standard time for each validation, which we assume is 17 minutes. TDABC computes the cost per minute of the resources performing the work activity. In this example we assume that two clerical workers, each paid $45,000 annually, work only on validations. TDABC calculates the total cost as $45,000 × 2 employees = $90,000; then TDABC calculates the total time available for the activity. Assuming each employee has 30 productive hours per week and actually works 50 weeks per year, the time available is 2 employees × 50 weeks × 30 hours per week × 60 minutes per hour = 180,000 minutes. The TDABC rate is $90,000 ÷ 180,000 minutes = $0.50 per minute. The cost of a validation can now be estimated to be 17 minutes × $0.50 per minute = $8.50 per validation.

TDABC can then calculate the unused capacity cost by determining the activity cost and netting it from the total expense. In this example the TDABC activity cost is calculated as $85,000 (i.e., 17 minutes × 10,000 validations × $.50 per validation). This means that $5,000 (or 10,000 minutes at $.50 per minute) unused capacity is potentially available to be used for other work.

TDABC can be expanded to include complexities in the activity, in what is called a time equation. For example, we assume the time to validate an address is significantly increased for an international address—each requires an additional 22 minutes. Then the time equation can be determined as follows:

Time to validate address = 17 minutes + 22 minutes (if it is an international address)

The determination of the cost per minute is done in the same manner, but with the addition of the expected time for international addresses.

A difference between TDABC and ABC is that TDABC is capacity-sensitive and computes a standard activity cost using standard rates, meaning activity driver rates remain constant. In contrast, ABC might not include capacity, as in the HBT and AIRCO Ltd cases presented earlier. ABC computes the activity cost each period as actual and therefore the final cost object's unit cost fluctuates each period. TDABC requires an upfront investment to measure activity times and to continuously maintain them.

Note that traditional ABC may use amount of time for an activity. For example, setup time might be used rather than number of setups. Of course, it will be necessary to determine budgeted time for the activity and the actual time for each setup. Note however, that this approach to ABC is still different from TDABC; TDABC uses the time to drive costs directly from resources to cost objects—there is no assignment of resource costs to activities and then from activities to cost objects.

The following is an example illustrating the use of time as a driver. Consider that the three activities—machine setup, inspection, and packaging—require an average of 80 minutes, 15 minutes, and 20 minutes, respectively. Under ABC the activity consumption cost drivers for these activities are based on the total activity cost divided by the number of minutes available for that activity. For example, if the total cost of setup is $50,000, and there is a capacity of 1,250 minutes of setup time, then the activity rate is $50,000 ÷ 1,250 = $40 per minute. This approach can improve the ABC application since actual time is used to assign costs. For example, if setup time for a special customer order requires an additional 15 minutes, the assigned setup cost would be based on $40 per minute times the total time of 95 minutes: 95 minutes × $40 = $3,800.

A disadvantage of TDABC is its reliance on the accuracy of the time estimates; also, the effort to determine these time estimates could be very time-consuming and costly. Some activities are not time-driven and should not be included in a comprehensive TDABC; for example, in a chemical company, the cost of the setup and cleanup activities involves significant materials costs, apart from the cost of the time involved. However, these materials costs could be included in a modified TDABC where pounds of materials could be used rather than minutes of setup or cleanup; this is then a combination of time- and pounds-driven ABC. Finally, because of its distinction of resources and activities, traditional ABC can in some cases provide a better framework for identifying opportunities for cost savings, while TDABC can provide a better framework for identifying unused capacity.

Summary

Many companies have replaced their volume-based costing systems with activity-based costing systems for more accurate product costing and better decision making.

Volume-based costing systems use a volume-based overhead rate, either a single rate for the entire plant or departmental rates. These volume-based overhead rates typically use measures such as direct labor-hours, machine-hours, or direct labor costs for all products or services, even if the firm has diverse products, manufacturing processes, and volumes. For firms with more than one product or process, these overhead rates often generate inaccurate and significantly distorted product costs.

Activity-based costing systems recognize that products and services consume indirect costs in a manner that follows the usage of activities rather than the volume of output. ABC costing improves on costing accuracy because it identifies the detail-level activities which cause the consumption of resources; ABC costing assigns these activity-based costs to the products or services using activity-consumption cost drivers, rather than volume-based cost drivers.

Activity-based management manages resource costs and activities to improve the value of products or services to the customer by reducing product cost and/or increasing value-adding activities.

Customer profitability analysis and customer lifetime value are methods, enabled by activity-based costing, which provide important tools for determining the profitability of product lines, customer groups, or individual customers.

Multistage ABC, resource consumption accounting (RCA), and time-driven ABC (TDABC) are new tools which have been developed in recognition of the complexity of cost relationships in many organizations.

Key Terms

activity, *133*
activity-based costing (ABC), *133*
activity consumption cost driver, *133*
batch-level activity, *136*
cost driver, *133*
customer cost analysis, *150*
customer lifetime value (CLV), *153*
customer profitability analysis, *149*
facility-level activity, *136*
high-value-added activity, *144*
low-value-added activity, *144*
multistage ABC, *154*
product-level activity, *136*
resource, *133*
resource consumption accounting (RCA), *155*
resource consumption cost driver, *133*
time-driven activity-based costing (TDABC), *155*
two-stage cost assignment, *134*
unit-level activity, *136*

Comments on Cost Management in Action

Admittedly, the answer to this question requires some guesswork. However, it has been proven time after time that data win over perceived expertise, experience, or unaided judgment. Each of these companies uses business analytics, a key form of business intelligence. Business analytics involves the use of computer-based models, statistical analysis, or simulations to test hypotheses about what drives customer loyalty and profitability.

Harrah's is a company that uses a model to predict when a customer is about to change to another casino. At Harrah's, the model predicts when customers are reaching their threshold of "too much" gambling losses; a "luck ambassador" is sent to encourage them to take a break and have a free meal, on Harrah's. Its model is based on extensive data obtained about customers. Harrah's system is based on information from a loyalty program, a program in which customers use a swipeable card whenever they use the firm's services and receive "rewards," while the company receives vital data about the customers. Capital One uses the same approach to determine the best ways to recruit and retain credit card customers. And the Royal Bank of Canada uses customer data extensively, in combination with ABC costing, to assess customer profitability for each of its banking customers.

Sources: Thomas H. Davenport and Jeanne G. Harris, *Competing on Analytics* (Boston: Harvard Business School Press, 2007); and Ian Ayres, *Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart* (New York: Bantam, 2007).

Self-Study Problem

(For solution, please turn to the end of the chapter.)

Volume-Based Costing versus ABC

Carter Company manufactures two products, Deluxe and Regular, and uses a traditional two-stage cost allocation system. The first stage assigns all factory overhead costs to two production departments, A and B, based on machine-hours. The second stage uses direct labor-hours to allocate overhead to individual products.

For 2013, the firm budgeted $1,000,000 total factory overhead cost for these operations.

	Production Department A	Production Department B
Machine-hours	4,000	16,000
Direct labor-hours	20,000	10,000

The following information relates to the firm's operations for the month of January:

	Deluxe	Regular
Units produced and sold	200	800
Unit cost of direct materials	$100	$50
Hourly direct labor wage rate	$25	$20
Direct labor-hours in Department A per unit	2	2
Direct labor-hours in Department B per unit	1	1

Carter Company is considering implementing an activity-based costing system. Its management accountant has collected the following information for activity cost analysis for 2013.

Activity	Budgeted Overhead	Cost Driver	Budgeted Quantity	Driver Consumption	
				Deluxe	Regular
Material movement	$ 7,000	Number of production runs	350	15	20
Machine setups	400,000	Number of setups	500	25	50
Inspections	588,000	Number of units	19,600	200	800
Shipment	5,000	Number of shipments	250	50	100
	$1,000,000				

Required

1. Calculate the unit cost for each of the two products under the existing volume-based costing system.
2. Calculate the overhead per unit of the cost driver under the proposed ABC system.
3. Calculate the unit cost for each of the two products if the proposed ABC system is adopted.

Please visit ***http://www.mhhe.com/blocher6e*** *to access a narrated, animated tutorial for solving this problem.*

Questions

5-1 "Undercosting a product increases the profit from the product and benefits the firm." Do you agree? Why?

5-2 Firms sell products with high costs at high prices. High selling prices increase revenues and profits. Why then should managers worry about product overcosting?

5-3 Explain why a costing system that uses a volume-based rate is likely to produce distorted product costs.

5-4 What is activity-based costing, and how can it improve an organization's costing system?

5-5 Describe general levels of cost hierarchy in activity-based costing systems.

5-6 What is the second-stage procedure in assigning costs to products when using an activity-based costing system?

5-7 What type of company needs an activity-based costing system?

5-8 What are unit-level activities? Give two examples of unit-level activities.

5-9 What are batch-level activities? Give two examples of batch-level activities.

5-10 What are product-level activities? Give two examples of product-level activities.

5-11 What are facility-level activities? Give two examples of facility-level activities.

5-12 Why do product-costing systems using a single, volume-based cost driver tend to overcost high-volume products? Will there be any undesirable strategic effects from such product cost distortion?

5-13 What is activity-based management?

5-14 How can activity-based costing and management be used in service organizations?

5-15 Identify opportunities afforded by performing a customer profitability analysis.

Brief Exercises

5-16 Tasty Beverage Co. produces soft drinks, specializing in fruit drinks. Tasty produces 5,000 cans of product per batch. Setup cost for each batch is $50 and each drink costs $0.10 to produce. What is the total cost per batch? How much would it cost to fill an order for 100,000 cans?

5-17 Montross Lumber processes wood to be shipped to construction companies. In order to keep its products uniform, Montross conducts inspections on 20% of the boards produced. Inspections cost the company $10 per hour and it takes one minute to inspect each board. How much would it cost to fill an order for 30,000 boards?

5-18 Orange Inc. grows cabbage. Each package shipped contains 20 vegetables. It costs Orange $5 to put together each package and $0.10 to clean and process each vegetable. How much more does it cost to produce an order for 60 heads of cabbage than an order of 50 heads?

5-19 Williams Performance Co. manufactures sports cars. After making a sale, the salesperson sends the car to be detailed before the customer takes it home. Detailing the car takes 30 minutes at a cost of $15 per hour for direct labor and $5 per car for materials. If the average salesperson sells five cars per day, what is the average cost per five-day week for detailing cars?

5-20 Stackhouse Computing produces high performance desktop computers. Labor cost data shows that the company spent $1,000,000 for 5,000 computers produced, and each computer requires two technician hours and five hours of direct labor. Direct labor is paid $10 per hour by the company. What is the cost of one technician hour?

5-21 Haywood Printing is processing a job with the following activity rates:

Activity	Cost Driver	Driver Rate
Direct labor	Number of hours	$8
Copying	Number of copies	$0.05

If this job requires five hours for the 1,000 copies, what is the activity-based cost of the job?

5-22 Locke Data Processing reported expenses of $5 million for indirect labor, of which $3 million was for data analysis and $2 million was for data entry. Locke recorded 30,000 hours of data analysis and 100,000 hours of data entry. What are the activity-based rates for each area of direct labor?

5-23 The materials handling charge for ABC Corp. is $.50 per pound of finished product. What is the materials handling charge for a job that produced 10,000 units at a weight of 6 pounds per unit?

Exercises

[LO 5-1]

5-24 **Role of Activity-Based Costing in Implementing Strategy** Laurent Products is a manufacturer of plastic packaging products with plants located throughout Europe and customers worldwide. During the past 10 years Laurent Products has successfully developed a line of packaging materials and a unique bagging system that present an important opportunity to increase the productivity of checkout counters in grocery stores. The plastic bags manufactured by Laurent are produced in several sizes and different plastic film colors and may have attractive multicolor printed designs on one or both sides to meet the specification of a particular grocery store. The advantages provided by the Laurent bagging system include the lower cost of bags and labor at the checkout counter as well as improved customer service. The system has contributed to a significant growth in Laurent's sales in recent years.

Laurent's success in the grocery chain market has attracted an increasing number of competitors into the market. While the company had been very successful in bringing out a series of new product types with innovative labor-saving features for the grocery stores, the competitors have eventually been able to develop quite similar products. The result has been increased competition with a substantial reduction in Laurent's prices.

As a result of the increased competition in the grocery chain market, Laurent is planning to begin to focus on the small independent grocery stores that purchase bags from large wholesale distributors. The potential sales for this wholesaler segment is about the same size as the grocery chain market but includes a much larger number of independent store customers.

Investments in manufacturing equipment in recent years have been to support two principal objectives: to increase capacity and to reduce costs. The cost reduction initiatives principally

concerned material costs and reduced processing times. Over the years Laurent has chosen to invest in machines that are similar to existing equipment in order to capitalize on the fact that the process is relatively simple and that products can, with relatively few exceptions, be processed on any machine in the plant. The only major restriction is the number of colors that a machine can accommodate on a single pass. Future investment proposals now being considered are based on this rationale.

Required What are the key strategic issues facing Laurent, and how can ABC costing assist in resolving these issues?

[LO 5-2, 5-3] 5-25 **Activity-Based Costing in the Fashion Apparel Industry** Fleet Street Inc., a manufacturer of high-fashion clothing for women, is located in South London. Its product line consists of trousers (45%), skirts (35%) , dresses (15%), and other (5%). Fleet Street Inc. has been using a volume-based rate to assign overhead to each product; the rate it uses is £2.25 per unit produced. The results for the trousers line, using the volume-based approach are as follows:

Number of units produced	10,000
Price (all figures in £)	20.525
Total revenue	205,250
Direct materials	33,750
Direct labor	112,500
Overhead (volume-based)	22,500
Total product cost	168,750
Nonmanufacturing expenses	31,500
Total cost	200,250
Profit margin for trousers	5,000

Recently, it has conducted a further analysis of the trousers line of product, using ABC. In the study, eight activities were identified, and direct labor was assigned to the activities. The total conversion cost (labor and overhead) for the eight activities, after allocation to the trousers line, is as follows:

Pattern cutting	£22,000
Grading	19,000
Lay planning	18,500
Sewing	21,000
Finishing	14,300
Inspection	6,500
Boxing up	3,500
Storage	7,000

Required Determine the profit margin for trousers using ABC and comment on the difference in comparison to the volume-based calculations. Is Fleet Street more likely to use ABC as a U.K. company than a similar company in France or the United States (refer to real-world focus boxes in the chapter)?

[LO 5-3] 5-26 **Activity Levels and Cost Drivers** Steve's Slop Shop, a small hamburger shop, has identified the resources used in its operations (assume each customer's order is a batch for this example):

a. Bread
b. Hourly help
c. Store rent
d. Ground beef
e. Catsup
f. Advertising for Triple-Burger special
g. Salary for the store managers
h. Utilities
i. $1-off-coupon for each order
j. Bags for each order

Required

1. Classify its costs as unit-level, batch-level, product-level, or facility-level costs.
2. Suggest a proper driver for each of the above items.

[LO 5-3] 5-27 **Activity Levels and Cost Drivers** Shroeder Machine Shop has the following activities:

a. Machine operation
b. Machine setup
c. Production scheduling
d. Materials receiving
e. Research and development
f. Machine maintenance
g. Product design
h. Parts administration
i. Final inspection
j. Materials handling

Required

1. Classify each of the activities as a unit-level, batch-level, product-level, or facility-level activity.
2. Identify a proper cost driver for each activity in requirement 1.

[LO 5-3] 5-28 **Activity-Based Costing** Hakara Company has been using direct labor costs as the basis for assigning overhead to its products. Under this allocation system product A has been assigned overhead of $46.88 per unit while product B has been assigned $15.63 per unit. Management feels that an ABC system will provide a more accurate allocation of the overhead costs and has collected the following cost pool and cost driver information:

Cost Pools	Activity Costs	Cost Driver	Driver Consumption
Machine setup	$360,000	Setup hours	4,000
Materials handling	100,000	Pounds of materials	20,000
Electric power	40,000	Kilowatt-hours	40,000

The following cost information pertains to the production of two of its products, A and B:

	A	B
Number of units produced	4,000	20,000
Direct materials cost	$42,000	$54,000
Direct labor cost	$24,000	$40,000
Number of setup hours	200	240
Pounds of materials used	1,000	3,000
Kilowatt-hours	2,000	4,000

Required

1. Use activity-based costing to determine a unit cost for each product.
2. Comment on management's belief that the ABC system will generate an overhead allocation that is more accurate than the volume-based system currently in use.

[LO 5-3] 5-29 **ABC and Job-Costing Working with Unknowns** North Company designs and manufactures machines that facilitate DNA sequencing. Depending on the intended purpose of each machine and its functions, each machine is likely to be unique. The job-order costing system in its Norfolk plant has five activity cost pools, in addition to direct materials and direct labor. Job TPY–2306 requires 1,000 printed-circuit boards. The cost per board that passes the final inspection is $240. On average, only 50% of the completed units pass the final inspection. The prime costs per completed board are direct materials $25 and direct labor $5. Information pertaining to manufacturing overhead for printed-circuit boards follows:

Activity Cost Pool	Cost Driver	Activity Driver Rate	Unit of Cost Driver per Board	Factory Overhead per Board
Axial insertion	Number of axial insertions	$0.20	$ 30	**$ A?**
Hardware insertion	Number of hardware insertions	2.00	**B?**	37.00
Hand load	Boothroyd time	**C?**	5	35.50
Masking	Number of points masked	0.12	100	**D?**
Final test	Test time	**E?**	10	6.00

Required Fill in the unknowns identified as A through E.

[LO 5-4] 5-30 **High-Value-Added and Low-Value-Added Activities** The Lindex General Hospital has determined the activities of a nurse including the following:

a. Report for duty and review patient charts
b. Visit each patient and take her/his temperature
c. Update patients' records
d. Coordinate lab and radiology works
e. Wait for the attending physician to arrive
f. Accompany attending physician
g. Explain treatments to patients
h. Call kitchen to have the wrong meal tray replaced
i. Perform CPR

Required Classify each item as a high-value-added or a low-value-added activity.

[LO 5-5] 5-31 **Applications of ABC in Government** Activity-based costing is used widely within the U.S. government. One example is the Department of Agriculture's Animal and Plant Health Inspection Service (APHIS). APHIS helps to protect U.S. agriculture from exotic pests and diseases, to minimize wildlife/agriculture conflicts, and to protect the welfare of animals used for research or sold wholesale for pets. APHIS performs its services for a variety of users, some of whom pay a user fee. ABC was adopted to provide an accurate basis for determining these fees, and also for analysis of the effectiveness and efficiency of its programs in meeting the service's overall goals. The National Institute of Health and the U.S. Mint also use ABC/M to achieve their missions effectively and efficiently.

Required

1. Identify an example or two of a governmental entity that you think could benefit from the application of activity-based costing, and explain why.
2. Identify some of the resources, activities, and cost drivers you would expect to see in this application.

[LO 5-1, 5-3, 5-5] 5-32 **Product-Line Profitability; ABC** Supermart Food Stores (SFS) has experienced net operating losses in its frozen food products line in the last few periods. Management believes that the store can improve its profitability if SFS discontinues frozen foods. The operating results from the most recent period are:

	Frozen Food	Baked Goods	Fresh Produce
Sales	$120,000	$91,000	$158,175
Cost of goods sold	105,000	67,000	110,000

SFS estimates that store support expenses, in total, are approximately 20% of revenues.

The controller says that not every sales dollar requires or uses the same amount of store support activities. A preliminary analysis reveals store support activities for these three product lines are:

Activity (cost driver)	Frozen Food	Baked Goods	Fresh Produce
Order processing (number of purchase orders)	10	45	100
Receiving (number of deliveries)	12	55	120
Shelf-stocking (number of hours per delivery)	2	0.5	4
Customer support (total units sold)	30,000	40,000	86,000

The controller estimates activity-cost rates for each activity as follows:

Order processing	$ 80 per purchase order
Receiving	110 per delivery
Shelf-stocking	15.25 per hour
Customer support	0.21 per item

Required

1. Prepare a product-line profitability report for SFS under the current costing system.
2. Prepare a product-line profitability report for SFS using the ABC information the controller provides.

3. What new insights does the ABC system in requirement 2 provide to SFS managers?
4. It is not clear what measure of activity was used to determine the activity-cost rates above. Comment on the impact of using the expected driver consumption versus the practical capacity of the driver when computing the activity-cost rates.

[LO 5-1, 5-3, 5-5] 5-33 **Product Line Profitability Analysis** Studemeir Paint & Floors (SPF) has experienced net operating losses in its Other Flooring Products line during the last few periods. SPF's management team thinks that the store will improve its profitability if it discontinues the Other Flooring Products line. The operating results from the most recent period are:

	Paint & Paint Supplies	Carpet	Other Flooring Products
Sales	$295,000	$214,900	$167,900
Cost of goods sold	165,000	150,000	135,250

SPF estimates that store support expenses are approximately 24% of revenues.

Harish Rana, SPF's controller, states that not every sales dollar requires or uses the same amount of store support activities. He conducts a preliminary investigation and his results and analysis are as follows:

Activity (cost driver)	Paint & Paint Supplies	Carpet	Other Flooring Products
Order processing (number of purchase orders)	425	150	100
Receiving (number of deliveries)	50	120	60
Customer support (hours required per sale)	0.50	8.0	0.75

Harish estimates activity-cost rates for each activity as follows:

Order processing	$140 per purchase order
Receiving	180 per delivery
Customer support	18 per hour

Required

1. Prepare a product-line profitability report for SPF under the current costing system.
2. Prepare a product-line profitability report for SPF using the ABC information the controller provides.
3. What new insights does the ABC system in requirement 2 provide to SPF managers?

[LO 5-6] 5-34 **Customer Profitability Analysis; Luxury Hotel Industry** The luxury hotel chain Ritz-Carlton introduced a system called "Mystique" that collects information about its customers from employees and staff at the hotel. The information is used to personalize the services provided to each guest. For example, a bottle of the guest's favorite type of wine would be placed in the room without the guest having to request it. Similarly, the type of fruit a guest prefers will be waiting in the room on arrival. The information is available throughout the Ritz system so that when the guest checks into any Ritz-Carlton hotel, the special treatment is available. Other hotel chains such as Marriott, Hilton, and Hyatt have similar programs

Required

1. How do these information-gathering programs help the hotels become more competitive? What is the strategic role of these programs?
2. Do you see a role for activity-based accounting for these firms, as it relates to their information gathering and customer service?
3. What ethical issues, if any, do you see in the information-gathering systems?

[LO 5-6] 5-35 **Customer Profitability Analysis** Colleen Company has gathered the following data pertaining to activities it performed for two of its major customers.

	Jerry Inc.	Kate Co.
Number of orders	5	30
Units per order	1,000	200
Sales returns:		
Number of returns	2	5
Total units returned	40	175
Number of sales calls	12	4

Colleen sells its products at $200 per unit. The firm's gross margin ratio is 25%. Both Jerry and Kate pay their accounts promptly and no accounts receivable is over 30 days. After a careful analysis using a business intelligence software on the operating data for the past 30 months the firm has determined the following activity costs:

Activity	Cost Driver and Rate
Sales calls	$ 1,000 per visit
Order processing	300 per order
Deliveries	500 per order
Sales returns	100 per return and $5 per unit returned
Sales salary	100,000 per month

Required

1. Classify activity costs into cost categories (unit, batch, etc.) and compute the total cost for Colleen Company to service Jerry Inc. and Kate Co.
2. Compare the profitability of these two customers.

[LO 5-6] 5-36 **Customer Profitability Analysis** Garner Industries manufactures precision tools. The firm uses an activity-based costing system. CEO Deb Garner is very proud of the accuracy of the system in determining product costs. She noticed that since the installment of the ABC system 10 years earlier the firm had become much more competitive in all aspects of the business and earned an increasing amount of profits every year.

In the last two years the firm sold 1 million units to 4,100 customers each year. The manufacturing cost is $600 per unit. In addition, Garner has determined that the order-filling cost is $100.50 per unit. The $784.56 selling price per unit includes 12% markup to cover administrative costs and profits.

The order-filling cost per unit is determined based on the firm's costs for order-filling activities. Order-filling capacity can be added in blocks of 60 orders. Each block costs $60,000. In addition, the firm incurs $1,500 order-filling costs per order.

Garner serves two types of customers designated as PC (Preferred Customer) and SC (Small Customer). Each of the 100 PCs buys, on average, 5,000 units in two orders. The firm also sells 500,000 units to 4,000 SCs. On average each SC buys 125 units in 10 orders. Ed Cheap, a buyer for one PC, complains about the high price he is paying. Cheap claims that he has been offered a price of $700 per unit and threatens to take his business elsewhere. Garner does not give in because the $700 price Cheap demands is below cost. Besides, she has recently raised the price to SC to $800 per unit and experienced no decline in orders.

Required

1. Demonstrate how Garner arrives at the $100.50 order-filling cost per unit.
2. What would be the amount of loss (profit) per unit if Garner sells to Cheap at $700 per unit?
3. What is the amount of loss (profit) per unit at the $800 selling price per unit for units sold to SC?

[LO 5-7] 5-37 **Tools for Successful ABC/M Implementation** The Consortium for Advanced Management, International (CAM-I) and the American Productivity and Quality Center (APQC) collaborated in the survey of 166 manufacturing and service firms to assess the implementation of ABC/M in these firms. Sixty-eight percent of the respondents were in manufacturing and 25% in service companies. The results showed that the majority of senior managers reported "very successful" implementations of the ABC/M system, while department managers were somewhat evenly split between "very successful" and "moderately successful." Line personnel tended to vote "moderately successful." So, the higher the level in the organization, the more perceived benefit of the ABC/M system.

Interviews with selected respondents and further data analysis showed that the three most common characteristics of successful systems were (1) a high level of top-management support and commitment, (2) technical competence of the implementation team, and (3) effective change management, that is, companies driven by competitive pressures to strive to better understand their internal capabilities and external competition. Some of the responding companies made strategic changes, including changes in the supply chain and changes in target customers. These results are similar to those reported in prior studies of ABC/M implementation.

Required In addition to the three characteristics of successful ABC/M implementation noted above, list two or three other guidelines or tips for ABC/M implementation.

Problems

[LO 5-1, 5-3] 5-38 **Activity-Based Costing; Value-Chain Analysis** Hoover Company uses activity-based costing and provides this information:

Manufacturing Activity	Cost Driver	Overhead Rate
Materials handling	Number of parts	$ 0.50
Machinery	Number of machine-hours	51.00
Assembly	Number of parts	2.85
Inspection	Number of finished units	30.00

Hoover has just completed 80 units of a component for a customer. Each unit required 105 parts and 3 machine-hours. The prime cost is $1,250 per finished unit. All other manufacturing costs are classified as manufacturing overhead.

Required

1. Compute the total manufacturing costs and the unit costs of the 80 units just completed using ABC costing.
2. In addition to the manufacturing costs, the firm has determined that the total cost of upstream activities including research and development and product design is $180 per unit. The total cost of downstream activities, such as distribution, marketing, and customer service is $250 per unit. Compute the full product cost per unit, including upstream, manufacturing, and downstream activities. What are the strategic implications of this new cost result?
3. Explain to Hoover Company the usefulness of calculating the total value-chain cost and of knowing costs of different value-creating activities.

[LO 5-1, 5-3] 5-39 **Resource and Activity-Based Cost Drivers** EyeGuard Equipment Inc. (EEI) manufactures protective eyewear for use in commercial and home applications. The product is also used by hunters, home woodworking hobbyists, and in other applications. The firm has two main product lines—the highest-quality product is called Safe-T, and a low-cost, value version is called Safe-V. Information on the factory conversion costs for EEI is as follows:

	Factory Costs
Salaries	$ 850,000
Supplies	150,000
Factory expense	550,000
	$1,550,000

EEI uses ABC costing to determine the unit costs of its products. The firm uses resource consumption cost drivers based on rough estimates of the amount that each activity consumes, as shown below. EEI has four activities: job setup, assembly, inspecting and finishing, and packaging.

	Setup	Assembly	Inspect & Finishing	Packaging	
Salaries	15%	55%	20%	10%	100%
Supplies	20	60	20		100
Factory expense		80	20		100

The activity cost drivers for the two products are summarized below.

Activities	Activity Driver
Setup	Batch
Assembly	Units
Inspect and finishing	Hours
Packaging	Hours

	Safe-V	Safe-T
Batches	250	600
Units	60,000	72,000
Finishing hours, per unit	0.2	0.3
Packaging hours, per unit	0.1	0.15
Materials per unit	$ 3.50	$ 6.00

Required

1. Determine the amount of the cost pool for each of the four activities.
2. Determine the activity-based rates for assigning factory costs to the two products.
3. Determine the activity-based unit cost for each of the products.
4. What is the strategic role of the information obtained in requirement 3?
5. The quantities of resource consumption cost drivers used were based on rough estimates. Under what conditions would you recommend that more accurate cost driver data be collected?

[LO 5-1, 5-3, 5-6] 5-40 **Activity-Based Costing; Customer Group Cost Analysis** Lenngton Furniture, Inc. (LFI) manufactures bedroom furniture in sets (a set includes a dresser, two queen-size beds, and one bedside table) for use in motels and hotels. LFI has three customer groups, which it calls the value, quality, and luxury groups. The value products are targeted to low-price motels that are looking for simple furniture, while the luxury furniture is targeted to the very best hotels. The value line is attractive to a variety of hotels and motels that appreciate the combination of quality and value. Currently there has been a small increase in the low-cost and value lines, and an appreciable increase in demand in the luxury line, reflecting cyclical changes in the marketplace. Luxury hotels are now in more demand for business travel, while a few years ago, the value segment was the most popular for business travelers. LFI wants to be able to respond to the increased demand with increased production but worries about the increased production cost and about price setting as its mix of customers and production change. LFI has used a volume-based rate based on direct labor-hours for some time. Direct labor cost is $12 per hour.

	Budgeted Cost	Cost Driver
Materials handling	$ 349,600	Number of parts
Product scheduling	160,000	Number of production orders
Setup labor	216,000	Number of setups
Automated machinery	1,750,000	Machine-hours
Finishing	619,500	Direct labor-hours
Pack and ship	290,400	Number of orders shipped
	$3,385,500	
General, selling, and adm. costs	$5,000,000	

The budgeted production data for the three product lines follows.

Product Lines	Value	Quality	Luxury
Units produced	15,000	5,000	500
Price	$650	$900	$1,200
Direct materials cost per unit	$80	$50	$110
Number of parts per unit	30	50	120
Direct labor-hours per unit	4	5	7
Machine-hours per unit	3	7	15
Production orders	50	70	200
Production setups	20	50	50
Orders shipped	1,000	2,000	300
Number of inspections	2	6	14

Required (Round all rates to two decimal places)

1. Determine the cost per set and the total production cost of each of the three customer groups using activity-based costing.
2. Determine the production cost for each of the three customer groups using LFI's current volume-based approach.
3. The activity usage data given in the problem reflects current usage of the various cost drivers to manufacture the firm's product lines. Suppose you are given the following information regarding the firm's practical capacity for each of these activities, as follows:

Cost Driver	Practical Capacity
Number of parts	990,000
Number of production orders	800
Number of setups	200
Machine-hours	100,000
Direct labor-hours	123,900
Number of orders shipped	5,000

Comment on how you would use this additional information for costing the firm's products and assisting in strategic planning.

4. Compare the two approaches and discuss the strategic and competitive issues of using each of the two methods.

[LO 5-1, 5-3, 5-4] 5-41 **Volume-Based Costing versus ABC** West Chemical Company produces three products. The operating results of 2013 are:

Product	Sales Quantity	Target Price	Actual Price	Difference
A	1,000	$279.00	$280.00	$ 1.00
B	5,000	294.00	250.00	<44.00>
C	500	199.50	300.00	$100.50

The firm sets the target price of each product at 150% of the product's total manufacturing cost. Recognizing that the firm was able to sell Product C at a much higher price than the target price of the product and lost money on Product B, Tom Watson, CEO, wants to promote Product C much more aggressively and phase out Product B. He believes that the information suggests that Product C has the greatest potential among the firm's three products since the actual selling price of Product C was almost 50% higher than the target price while the firm was forced to sell Product B at a price below the target price.

Both the budgeted and actual factory overheads for 2013 are $493,000. The actual units sold for each product also are the same as the budgeted units. The firm uses direct labor dollars to assign manufacturing overhead costs. The direct materials and direct labor costs per unit for each product are:

	Product A	Product B	Product C
Direct materials	$50.00	$114.40	$65.00
Direct labor	20.00	12.00	10.00
Total prime cost	$70.00	$126.40	$75.00

The controller noticed that not all products consumed factory overhead similarly. Upon further investigations, she identified the following usage of factory overhead during 2013:

	Product A	Product B	Product C	Total Overhead
Number of setups	2	5	3	$ 8,000
Weight of direct materials (pounds)	400	250	350	100,000
Waste and hazardous disposals	25	45	30	250,000
Quality inspections	30	35	35	75,000
Utilities (machine-hours)	2,000	7,000	1,000	60,000
Total				$493,000

Required

1. Determine the manufacturing cost per unit for each of the products using the volume-based method.
2. What is the least profitable and the most profitable product under both the current and the ABC costing systems?

3. What is the new target price for each product based on 150% of the new costs under the ABC system? Compare this price with the actual selling price.
4. Comment on the result from a competitive and strategic perspective. As a manager of West Chemical, describe what actions you would take based on the information provided by the activity-based unit costs.

[LO 5-2, 5-3] 5-42 **Activity-Based Costing** Miami Valley Architects Inc. provides a wide range of engineering and architectural consulting services through its three branch offices in Columbus, Cincinnati, and Dayton, Ohio. The company allocates resources and bonuses to the three branches based on the net income of the period. The results of the firm's performance for the year 2013 follows ($ in thousands):

	Columbus	Cincinnati	Dayton	Total
Sales	$1,500	$1,419	$1,067	$3,986
Less: Direct labor	382	317	317	1,016
Direct materials	281	421	185	887
Overhead	710	589	589	1,888
Net income	$ 127	$ 92	$ (24)	$ 195

Miami Valley accumulates overhead items in one overhead pool and allocates it to the branches based on direct labor dollars. For 2013, this predetermined overhead rate was $1.859 for every direct labor dollar incurred by an office. The overhead pool includes rent, depreciation, and taxes, regardless of which office incurred the expense. Some branch managers complain that the overhead allocation method forces them to absorb a portion of the overhead incurred by the other offices.

Management is concerned with the 2013 operating results. During a review of overhead expenses, management noticed that many overhead items were clearly not correlated to the movement in direct labor dollars as previously assumed. Management decided that applying overhead based on activity-based costing and direct tracing wherever possible should provide a more accurate picture of the profitability of each branch.

An analysis of the overhead revealed that the following dollars for rent, utilities, depreciation, and taxes could be traced directly to the office that incurred the overhead ($ in thousands):

	Columbus	Cincinnati	Dayton	Total
Direct overhead	$180	$270	$177	$627

Activity pools and their corresponding cost drivers were determined from the accounting records and staff surveys as follows:

General administration	$ 409,000
Project costing	48,000
Accounts payable/receiving	139,000
Accounts receivable	47,000
Payroll/Mail sort and delivery	30,000
Personnel recruiting	38,000
Employee insurance processing	14,000
Proposals	139,000
Sales meetings/Sales aids	202,000
Shipping	24,000
Ordering	48,000
Duplicating costs	46,000
Blueprinting	77,000
	$1,261,000

	Volume of Cost Drivers by Location		
Cost Driver	Columbus	Cincinnati	Dayton
Direct labor cost	$ 382,413	$ 317,086	$317,188
Timesheet entries	6,000	3,800	3,500
Vendor invoices	1,020	850	400
Client invoices	588	444	96
Employees	23	26	18

New hires	8	4	7
Insurance claims filed	230	260	180
Proposals	200	250	60
Contracted sales	1,824,439	1,399,617	571,208
Projects shipped	99	124	30
Purchase orders	135	110	80
Copies duplicated	162,500	146,250	65,000
Blueprints	39,000	31,200	16,000

Required (Round all answers to thousands)

1. What overhead costs should be assigned to each branch based on ABC concepts?
2. What is the contribution of each branch before subtracting the results obtained in requirement 1?
3. What is the profitability of each branch office using ABC?
4. Evaluate the concerns of management regarding the volume-based cost technique currently used.

[LO 5-2, 5-4] 5-43 **Volume-Based Costing versus ABC** Coffee Bean Inc. (CBI) processes and distributes a variety of coffee. CBI buys coffee beans from around the world and roasts, blends, and packages them for resale. Currently the firm offers 15 coffees to gourmet shops in one-pound bags. The major cost is direct materials; however, a substantial amount of factory overhead is incurred in the predominantly automated roasting and packing process. The company uses relatively little direct labor.

Some of the coffees are very popular and sell in large volumes; a few of the newer brands have very low volumes. CBI prices its coffee at full product cost, including allocated overhead, plus a markup of 30%. If its prices for certain coffees are significantly higher than the market, CBI lowers its prices. The company competes primarily on the quality of its products, but customers are price conscious as well.

Data for the 2013 budget include factory overhead of $3,000,000, which has been allocated by its current costing system on the basis of each product's direct labor cost. The budgeted direct labor cost for 2013 totals $600,000. The firm budgeted $6,000,000 for purchases and use of direct materials (mostly coffee beans).

The budgeted direct costs for one-pound bags of two of the company's products are as follows:

	Mona Loa	Malaysian
Direct materials	$4.20	$3.20
Direct labor	0.30	0.30

CBI's controller, Mona Clin, believes that its current product costing system could be providing misleading cost information. She has developed this analysis of the 2013 budgeted factory overhead costs:

Activity	Cost Driver	Budgeted Activity	Budgeted Cost
Purchasing	Purchase orders	1,158	$ 579,000
Materials handling	Setups	1,800	720,000
Quality control	Batches	720	144,000
Roasting	Roasting-hours	96,100	961,000
Blending	Blending-hours	33,600	336,000
Packaging	Packaging-hours	26,000	260,000
Total factory overhead cost			$3,000,000

Data regarding the 2010 production of two of its lines, Mona Loa and Malaysian, follow. There is no beginning or ending direct materials inventory for either of these coffees.

	Mona Loa	Malaysian
Budgeted sales	100,000 pounds	2,000 pounds
Batch size	10,000 pounds	500 pounds
Setups	3 per batch	3 per batch
Purchase order size	25,000 pounds	500 pounds
Roasting time	1 hour per 100 pounds	1 hour per 100 pounds
Blending time	0.5 hour per 100 pounds	0.5 hour per 100 pounds
Packaging time	0.1 hour per 100 pounds	0.1 hour per 100 pounds

Required

1. Using Coffee Bean Inc.'s current product costing system,
   a. Determine the company's predetermined overhead rate using direct labor cost as the single cost driver.
   b. Determine the full product costs and selling prices of one pound of Mona Loa coffee and one pound of Malaysian coffee.
2. Using an activity-based costing approach, develop a new product cost for one pound of Mona Loa coffee and one pound of Malaysian coffee. Allocate all overhead costs to the 100,000 pounds of Mona Loa and the 2,000 pounds of Malaysian. Compare the results with those in requirement 1.
3. What are the implications of the activity-based costing system with respect to CBI's pricing and product mix strategies? How does ABC add to CBI's competitive advantage?

(CMA Adapted)

[LO 5-2, 5-3, 5-4]

5-44 **Cost of Capacity (Continuation of Problem 5-43)** Use the same information as above for Coffee Bean Inc. (CBI) except assume now that Mona Loa and Malaysian are the only two products at CBI. Also, now include the following additional information about the practical capacity Coffee Bean has in each of its activities. For example, currently Coffee Bean has total practical capacity for processing 1,400 purchase orders, 2,400 setups, etc. These are the levels of activity work that are sustainable.

Activity	Practical Capacity
Purchasing	1,400
Materials handling	2,400
Quality control	1,200
Roasting	100,000
Blending	36,000
Packaging	30,000

Required

1. Determine the activity rates based on practical capacity and the cost of unused capacity for each activity.
2. Explain the strategic role of the information you have developed in part (1) above.
3. Assume the same information used in parts (1) and (2) above, but now assume also that the cost in the purchasing activity consists entirely of the cost of 8 employees; the cost in materials handling consists entirely of the cost of 20 employees; the cost of quality control consists entirely of the cost of 4 employees; the cost of roasting and blending consists entirely of the costs of machines—10 roasting machines and 10 blending machines; and the cost of packaging consists entirely of the cost of 3 employees. Based on this additional information, what can you now advise management about the utilization of capacity?

[LO 5-2, 5-7]

5-45 **Ethics; Cost System Selection** Aero Dynamics manufactures airplane parts and engines for a variety of military and civilian aircraft. The company is the sole provider of rocket engines for the U.S. military that it sells for full cost plus a 5% markup.

Aero Dynamics's current cost system is a direct labor-hour-based overhead allocation system. Recently, the company conducted a pilot study on the feasibility of using an activity-based costing system. The study shows that the new ABC system, while more accurate and timely, will result in the assignment of lower costs to the rocket engines and higher costs to the company's other products. Apparently, the current direct labor-based costing system overcosts the rocket engines and undercosts the other products. On hearing of this, top management has decided to scrap the plans to adopt the ABC system because its rocket engine business with the military is significant and the reduced cost would lower the price and, thus, the profit for this part of Aero Dynamics's business.

Required As the management accountant participating in this ABC pilot study project, what is your responsibility when you learn that top management has decided to cancel the plans for the ABC system? Can you ignore your professional ethics code in this case? What would you do?

[LO 5-3, 5-7]

5-46 **Time-Driven Activity-Based Costing (TDABC) in a Call Center** Marketing Specialists Inc. (MSI) provides a range of services to its retail clients—customer service for inquiries, order taking, credit checking for new customers, and a variety of related services. Auto Supermarket (AS) is a large auto dealer that provides financing for the autos and trucks that it sells. AS has approached MIS to

manage the inquiries that come in regarding these loans. AS is not satisfied with the performance of the call center it currently uses for handling inquiries on these loans and is considering a change to MSI. MSI has been asked to estimate the cost of providing the service for the coming year.

There are two types of loans at AS, one for autos and SUVs and another for light trucks. The loans for auto and truck buyers typically have different types of customers and loan terms, so the nature and volume of the inquiries are expected to differ. MSI would use its own call center to handle the AS engagement. The MSI call center's annual costs are as follows:

Call center costs	
Salaries	$4,223,555
Utilities	2,387,446
Leasing of facilities	1,983,063
Other expenses	801,036
	$9,395,100

MSI's call center is staffed 12 hours per day with 60 call staff always available. Each staff has a paid 10-minute break for each hour worked, and an unpaid 1-hour break for a lunch/dinner during their 12-hour shift. Thus, the call center has 12,045,000 minutes (11 hrs. × 50 min. × 60 staff × 365 days) available for calls during the year.

AS and MSI work together to estimate the number of calls and time required for each call, based on AS's prior experience with its current call center.

Inquiries	Total Calls Answered	Average Number of Minutes/Call	Total Time (minutes)
Inquire re: rates and terms			
Autos	96,000	5	480,000
Trucks	32,000	7	224,000
Inquire re: loan application status			
Autos	37,500	6	225,000
Trucks	6,750	11	74,250
Inquire re: payment status			
Autos	39,000	3	117,000
Trucks	12,000	4	48,000
Inquire re: other matters			
Autos	29,000	11	319,000
Trucks	8,500	15	127,500
			1,614,750

Required

1. Determine the amount that MSI should propose to charge AS for the coming year using TDABC, assuming MSI desired a profit of 25% of incurred cost.
2. Suppose that AS wants the proposal broken down by type of loan (auto, truck). What would the proposal look like now?

[LO 5-3, 5-4, 5-7] 5-47 **TDABC (Continuation of Problem 5-46)** Suppose that in addition to the call center engagement outlined above, AS also provides the following annual service to 10 other clients:

	Total Calls Answered	Average Number of Minutes/Call
Platinum Regional Bank	234,000	6.0
Healthwise Software Inc.	66,788	5.0
Johnson Manufacturing	122,665	4.0
Lesco Online Shopping	233,756	6.0
Babcock Insurance Service	55,455	5.5
Garcia Electric Supply and Service	38,956	3.4
Gilbert's Online Garden Supplies	145,902	4.0
Financial Planning Services Inc.	68,993	11.0
Porter's Camera and Optical	198,440	6.0
Jordan Auto World Inc	965,887	3.0

Required

1. What is the unused capacity at MSI, **not** assuming that AS becomes a customer? What are the implications for the operating and marketing strategies at AS?
2. Assume that AS comes back to MSI with a revised proposal. The revised proposal includes call center activity as described in Problem 5-46, but in addition, AS wants MSI to provide error-checking services for those who apply for loans at AS. MSI would use some of the call center staff, after appropriate training, to complete the processing of the credit checks. AS expects the following service to be needed:

Processing Credit Checks	Requests	Min./request
Auto	45,600	10
Truck	12,500	18

What would be the unused capacity with the revised proposal? What would be the cost of the unused capacity?

[LO 5-3, 5-5, 5-7] 5-48 **Personnel Planning; TDABC** Recent competitive pressures have caused National Insurance Company to examine policies regarding personnel planning. As a start, the company has decided to experiment with and develop a time-driven ABC model for its claims processing center.

A study of this support center indicates the following three primary activities: remote processing of customer claims, 0.5 hour; onsite processing of customer claims, 1.0 hour; and, updating/maintaining customer records, 0.2 hour. Onsite processing is required for larger claims, while remote processing is done for smaller claims. (For onsite processing, assume—for simplicity—that the claims processors use their own automobiles.) All claims will require that the customers' records be updated.

The claims processing center currently employs three full-time employees. Total annual cost of the center (salaries, depreciation, utilities, etc.) is estimated at $255,000. The net amount of available personnel time per year for this department is approximately 5,000 hours.

Required

1. Why are service organizations, such as the present example, particularly well-suited to apply activity-based costing for cost and resource planning purposes?
2. What estimates are needed to implement a time-driven activity-based costing (TDABC) model? In this regard, what is the budgeted resource cost rate for the present example?
3. Assume that the budgeted number of offsite (i.e., remote) claims is 1,900 for the year. What is the budgeted claims-processing support cost to serve this subset of customers? (Show calculation.)
4. Assume that the budgeted number of onsite (i.e., large) claims for the coming year is 2,900. What is the budgeted claims-processing support cost for this subset of customers? (Show calculation.)
5. Assume now that the customer mix reflected above in requirements 2 and 3 were to change as follows: number of remote cases, 2,700; number of onsite claims, 2,000. How much labor processing time would be needed to service this revised level of service demand? What support cost would be budgeted for each class of customer?
6. In response to the projected shift in customer mix reflected above in requirement 5, why might the company not experience an immediate financial improvement? Put another way, will National's resource spending necessarily decrease in response to the shift in customer demand?
7. Finally, why do most proponents of ABC (both traditional and time-driven) recommend the use of practical capacity when calculating cost rates for planning purposes?

[LO 5-6] 5-49 **Research Assignment; Assessing Customer Lifetime Value** How important to profitability are customer referrals? What customers feel about your company (and you) and what they are prepared to tell others about you can be just as important as what your customers do themselves. The authors of the following article hypothesize overall customer value, what they call *customer lifetime value,* as consisting of two components: the amount a customer brings in from purchases and the value of referrals. See V. Kumar, J. A. Petersen, and R. P. Leone, "How Valuable Is Word of Mouth?" *Harvard Business Review,* October 2007, pp. 139–146, prior to answering the following questions.

Required

1. What is the primary managerial question or issue that the authors of this article are addressing?
2. Define the terms *customer lifetime value (CLV)* and *customer referral value (CRV).* Which of these values do the authors believe is more important for financial success? Why?

3. Which of the two components of value, CLV or CRV, is the more difficult to estimate? Why?
4. Explain the *customer value matrix* developed by the authors and presented on page 144 of their article. Of what strategic importance is this matrix?
5. In what way can the management accountant aid in the estimation of CLV and CRV (and, by extension, the creation of the customer value matrix)?

[LO 5-1, 5-2, 5-3, 5-5]

5-50 **Volume-Based Costing versus ABC** ADA Pharmaceutical Company produces three drugs—Diomycin, Homycin, and Addolin—belonging to the analgesic (pain-killer) family of medication. Since its inception four years ago, ADA has used a direct labor-hour-based system to assign manufacturing overhead costs to products.

Eme Weissman, the president of ADA Pharmaceutical, has just read about activity-based costing in a trade journal. With some curiosity and interest, she asked her financial controller, Takedo Simon, to examine differences in product costs between the firm's current costing and activity-based costing systems.

ADA has the following budget information for the year:

	Diomycin	Homycin	Addolin
Cost of direct materials	$ 205,000	$265,000	$258,000
Cost of direct labor	250,000	234,000	263,000
Number of direct labor-hours	7,200	6,800	2,000
Number of capsules	1,000,000	500,000	300,000

ADA has identified the following activities as cost drivers and has allocated them to total overhead cost of $200,000 as follows:

Activity	Cost Driver	Budgeted Overhead Cost	Budgeted Cost Driver Volume
Machine setup	Setup hours	$ 16,000	1,600
Plant management	Workers	36,000	1,200
Supervision of direct labor	Direct labor-hours	46,000	1,150
Quality inspection	Inspection-hours	50,400	1,050
Expediting orders	Customers served	51,600	645
Total overhead		$200,000	

Takedo selected the cost drivers with the following justifications:

SETUP HOURS: The cost driver of setup hours is used because the same product takes about the same amount of setup time regardless of size of batch. For different products, however, the setup time varies.

NUMBER OF WORKERS: Plant management includes plant maintenance and corresponding managerial duties that make production possible. This activity depends on the number of workers. The more workers involved, the higher the cost.

SUPERVISION OF DIRECT LABOR: Supervisors spend their time supervising production. The amount of time they spend on each product is proportional to the direct labor-hours worked.

QUALITY INSPECTION: Inspection involves testing a number of units in a batch. The time varies for different products but is the same for all similar products.

NUMBER OF CUSTOMERS SERVED: The need to expedite production increases as the number of customers served by the company increases. Thus, the number of customers served by ADA is a good measure of expediting production orders.

Takedo gathered the following information about the cost driver volume for each product:

	Diomycin	Homycin	Addolin
Machine setups	200	600	800
Plant management	200	400	600
Supervision of direct labor	200	300	650
Quality inspection	150	200	700
Expediting production orders	45	100	500

Required

1. Use the firm's current costing system to calculate the unit cost of each product.
2. Use the activity-based cost system to calculate the unit cost of each product.
3. The two cost systems provide different results; give several reasons for this. Why might these differences be strategically important to ADA Pharmaceutical? How does ABC add to ADA's competitive advantage?
4. How and why may firms in the pharmaceutical industry use ABC? What is the strategic advantage?

[LO 5-1, 5-7]

5-51 **Research Assignment; Environmental Costing** Environmental sustainability is not only a potential competitive advantage to an organization, but might also be a regulatory requirement. The creation of business processes to support environmental sustainability requires the expenditure of resources and management is faced with evaluating the costs and benefits of such efforts. See the article, "An Activity Based Management Methodology for Evaluating Business Processes for Environmental Sustainability," by Joseph Sarkis, Laura Meade, and Adrien Presley, *Business Process Management Journal* 12, no. 6 (2006), pp. 751–766, for some advice on how managers can deal with these issues. Read the article and then answer the following questions.

Required

1. What is the purpose of environmental cost accounting and why is it important?
2. What are some of the obvious and what are some of the "hidden" environmental costs?
3. The authors reference a categorization developed by the EPA, which classifies costs based on the ease of measurement. Difficulty of measurement does not relieve management of the responsibility to adequately evaluate the costs of a proposed course of action (or inaction). How might the concepts of ABC and ABM be applied to help managers evaluate environmental costs?

Solution to Self-Study Problem

Volume-Based Costing versus ABC

1. Volume-based costing system

Stage 1 Allocation: Machine Hours

Total overhead allocated to Department A

$1,000,000 × (4,000 ÷ 20,000) = $200,000

Total overhead allocated to Department B

$1,000,000 × (16,000 ÷ 20,000) = $800,000

Stage 2 Allocation: Labor Hours

	Per Unit Cost	
	Deluxe	**Regular**
Overhead allocated to		
Department A		
($200,000 ÷ 20,000) × 2 =	$ 20	
($200,000 ÷ 20,000) × 2 =		$ 20
Department B		
($800,000 ÷ 10,000) × 1 =	80	
($800,000 ÷ 10,000) × 1 =		80
Total	$100	$100

Product cost per unit

	Deluxe	**Regular**
Direct materials	$100	$ 50
Direct labor		
$25 × (2 + 1) =	75	
$20 × (2 + 1) =		60
Factory overhead	100	100
Unit cost	$275	$210

2. Budgeted overhead rates for cost drivers:

Cost Driver	Budgeted Overhead	Budgeted Cost Driver Quantity	Budgeted Overhead Rate
Number of production runs	$ 7,000	350	$ 20 per run
Number of setups	400,000	500	800 per setup
Number of units	588,000	19,600	30 per unit
Number of shipments	5,000	250	20 per shipment
	$1,000,000		

3. ABC system

	Deluxe	Regular
Overhead allocated to		
Material movement		
$20 × 15 =	$ 300	
$20 × 20 =		$ 400
Machine setups		
$800 × 25 =	20,000	
$800 × 50 =		40,000
Inspections		
$30 × 200 =	6,000	
$30 × 800 =		24,000
Shipment		
$20 × 50 =	1,000	
$20 × 100 =		2,000
Total	$27,300	$66,400
Unit overhead cost	$136.50	$ 83
Product cost per unit		
Direct materials	$100	$ 50
Direct labor	75	60
Factory overhead	136.50	83
Unit cost	$311.50	$ 193

Note that the volume-based costing system overcosts the high-volume regular product and undercosts the low-volume deluxe product.

Please visit **http://www.mhhe.com/blocher6e** *to access a narrated, animated tutorial for solving this problem.*