

Activity-Based Costing and Management

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

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

LEARNING OBJECTIVE 1

Explain the strategic role of activity-based costing

Activity-based costing (ABC) is a method for determining accurate costs. While ABC is a relatively recent innovation in cost accounting, it is rapidly being adopted by companies across many 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 to have pizza. You each order an individual size pizza, and Al suggests that you all order 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 and as before, 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 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 plate was intended to be shared equally, it turns out that Al consumed most of it.

There are similar examples in manufacturing. Suppose you and Joe and Al are also product managers at a plant that manufactures furniture. Al is in charge of sofa manufacturing, Joe of dining room tables and chairs, and you are in charge of bedroom furniture. Each of your product lines has direct materials and labor costs that are traced directly to each of you. It is your responsibility to manage these direct costs. Also, there are indirect manufacturing costs (overhead) that cannot be traced to each product, including, the following activities: 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 ratio of units produced in a manager’s area to the total units produced for all managers? 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 usually 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 fairly 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 cost for you or Joe or Al 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—the materials handling, 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 USPS originated from the Postmaster General’s directive to develop a costing system that would help the USPS to become more competitive and to 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 use 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 strategic good choice for some firms. It is appropriate generally when direct costs are the major cost of the product or service and activities supporting the production of the product or service are relatively simple, low-cost, and homogenous across different product lines. This may be the case, for example, for a commodity manufacturer that has one or a few very homogeneous product lines—for example, a firm that manufactures paper products or a firm that produces certain 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 is often preferred: the volume-based approach will cause significant inaccuracies in the product costs—some products will be overcosted and others undercosted because the usage of activities is not in proportion to the volume of output.

Activity-Based Costing

LEARNING OBJECTIVE 2

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

An activity is a specific task or action of work done.

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

A resource consumption cost driver is an activity or characteristic that consumes resources.

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

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

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. Nevertheless, overhead costs are resources spent on a firm's activities to manufacture products, provide services, or facilitate manufacturing. A good costing system identifies costs with activities that consume resources and assign 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, we need to define several important terms: *activity*, *resource*, *cost driver*, *resource consumption cost driver*, and *activity consumption cost driver*.

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 set-up is an activity that may include several actions.

A **resource** is an economic element needed or consumed in performing activities. Salaries 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. 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 a measure of the amount of resources consumed by an activity. It is the cost driver for assigning a resource cost consumed by or related to an activity 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, size of factory buildings, and machine hours.

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 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 results of activities and activities use resources which incur 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.

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 or activity centers (activity cost pools) and calculates the cost of a unit of activity. The firm then assigns the cost of an activity to products or services by multiplying the cost of each activity by the amount of the activity consumed by each of the cost objects.

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

The Two-Stage Cost Assignment Procedure

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). Volume-based systems, in the first stage, charge factory overhead costs to a single plant cost pool or to 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 volume-based two-stage 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 always consume factory overhead resources in a cost pool in proportion to the volume-based measure or measures 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 especially when a substantial portion of factory overhead costs is not output-volume related and the firm manufactures a diverse mix of products with differences in volumes, sizes, or complexities.

Activity-based costing systems differ from volume-based costing systems by tracing uses of resources to activities and linking activity costs to products, services, or customers (see Exhibit 5.2). The firststage assigns factory overhead costs to activities or activity cost centers (activity cost pools) by using appropriate resource consumption cost drivers. The secondstage assigns the costs of activities or activity cost pools to cost objects using appropriate activity consumption cost drivers that measure the demands cost objects place on 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, activity-based costing 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 resource cost by the cost objects.

EXHIBIT 5.1 The Volume-Based Two-Stage Procedure

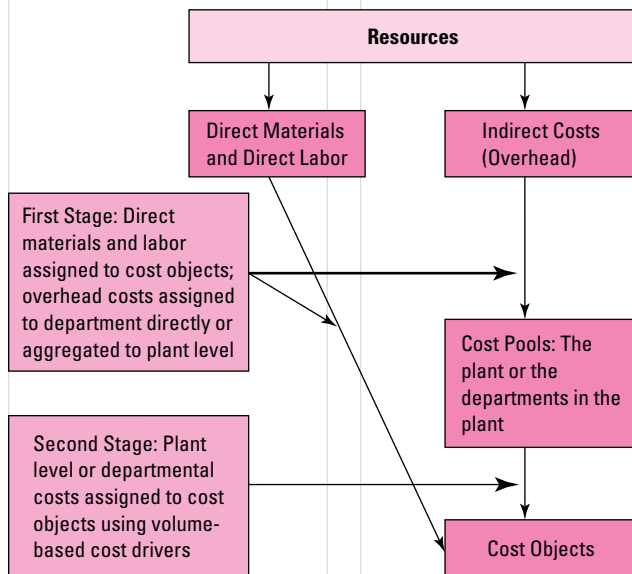
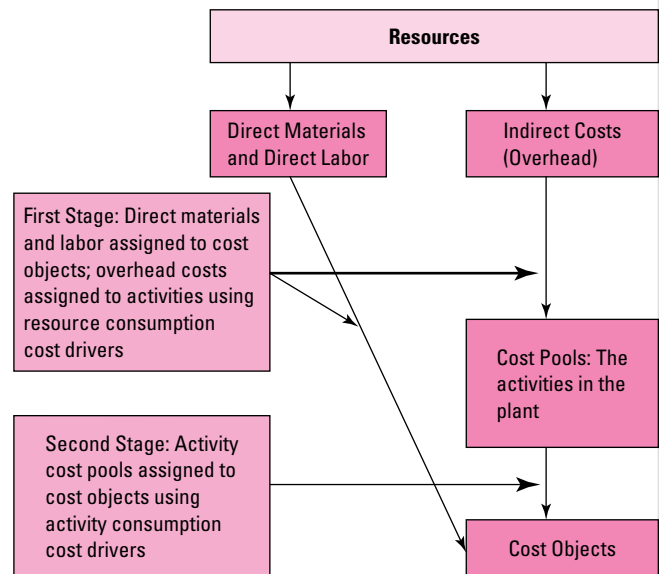


EXHIBIT 5.2 The Activity-Based Two-Stage Procedure



REAL-WORLD FOCUS

Traditional Costing System Distorted Product Costs at Xi'an Electronics in China

Xi'an Electronics produces special electronics with more than 250 products that have in excess of 600 specifications. Researchers collected data for 25 of the company's products during the last half of 1997 and grouped them into two product categories, high volume and low volume. They found that the unit conversion cost (direct labor and overhead) was 29.58 percent higher under traditional costing (using direct labor hours as the cost driver) than ABC (using 30 cost drivers)

for high-volume products and was 45.95 percent lower under traditional costing than ABC for low-volume products. Their findings show that traditional costing overestimates the costs of high-volume products and underestimates the costs of low-volume products.

Source: Pingxin Wang, Qinglu Jin, and Dagang Ke, "Activity-Based Costing and Its Application in Chinese Enterprises," *China Accounting and Finance Review*, March 2000, pp. 138–55.

The two-stage allocation procedure in an activity-based costing system identifies clearly the costs of activities of a firm. The assignment of activity costs to cost objects uses a measure or measures that represent the demands the cost objects make on activities of the firm. As a result, activity-based costing systems report more accurate product or service costs than traditional volume-based costing systems do.

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 one and two constitute stage 1 from Exhibits 5.1 and 5.2, and Step 3 is equivalent to stage 2 from these exhibits.

Step 1: Identify Resource Costs and Activities

The first step in designing an ABC system is to conduct an activity analysis to identify the resource costs and activities of the firm. Most firms record resource costs in specific accounts in the accounting system. Examples of these accounts include supplies, purchasing, materials handling, warehousing, office expenses, furniture and fixtures, buildings, equipment, utilities, and salaries and benefits. However, special effort most likely will be needed to determine appropriate resource costs for activity-based costing because generally several different resource costs may be recorded in a single account or the costs for an activity may be recorded in several accounts. For example, a firm may use a single factory supplies account for all supplies in its operations that include several manufacturing operations. Costs to complete a purchasing order may be spread over several accounts including accounts for warehousing, purchasing, and receiving.

Through activity analyses a firm identifies the work it performs to carry out its operations. Activity analyses include 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.

1. A **unit-level activity** is performed on each individual unit of product or service of the firm. Examples of unit-level activities include direct materials, direct labor-hours, inserting a

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

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

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

A **facility-level activity** supports the operation in general.

component, and inspecting every unit. A unit-level activity is volume-based. The required activity varies in proportion with the quantity of the cost object. The resource consumption driver and the activity consumption driver are most likely to be the same for unit level activities.

2. A **batch-level activity** is performed for each batch or group of units of products or services. A firm incurs a batch-level activity for each batch or group of units of products or services scheduled to be processed together, rather than for each individual unit of the cost object. A batch has more than one unit of a product or service. Examples of batch-level activities are setting up machines, placing purchase orders, scheduling production, conducting inspections by batch, handling materials, and expediting production.
3. A **product-level activity** supports the production of a specific product or service. Examples of product-sustaining activities include designing products, administering parts required for products, and engaging in engineering changes to modify products.
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 sustaining activities include providing security and safety, performing maintenance of general purpose machines, managing the plant, incurring factory property taxes and insurance and closing of the books each month. 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 always 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

Activity-based costing uses resource consumption cost drivers to assign resource costs to activities. Because activities drive the cost of resources used in operations, a firm should choose resource consumption cost drivers based on cause-and-effect relationships. Typical resource consumption 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.

Although a firm’s accounting system is a good starting point to find information about the cost of resources, most accounting systems report the costs of different resources, such as indirect labor, electricity, equipment, and supplies, but do not report the cost of activities performed. New accounting systems are needed to obtain and track resource costs for activities.

The cost of the resources can be assigned to activities by direct tracing or estimation. Direct tracing requires measuring the actual usage of resources by activities. 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.

Multiple resource consumption cost drivers often are needed to assign different resource costs to activity or activity center cost pools. Exhibit 5.4 illustrates resources and resources consumption drivers for factory overhead costs at AT&T’s New River Valley plant.

EXHIBIT 5.3
Activities and Activity Levels at Siemens Electric Motor Works

Activity	Activity Level
Direct materials	Unit
Direct labor-hours	Unit
Machine-hours	Unit
Number of production orders	Batch
Number of 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

Step 3: Assign Activity Costs to Cost Objects

The final step is to assign costs of activities or activity cost pools to cost objects based on the appropriate activity consumption cost drivers. Outputs are the cost objects for which firms or organizations perform activities. Typical outputs for a cost system are products and services; however, outputs also can include customers, projects, or business units. For example, the outputs 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.

Firms use activity consumption cost drivers to assign activity costs to cost objects. Activity cost drivers should explain why the cost of a cost object goes up or down. Typical activity consumption cost drivers are purchase orders, receiving reports, inspection reports or hours, parts stored, payments, direct labor-hours, machine-hours, and setups and manufacturing cycle time. Careful analyses should be conducted in determining proper activity consumption cost drivers. For example, at the Hewlett-Packard (HP)'s Surface Mount Center in Boise, the ABC system has been fully operational since the early 1990s. This facility manufactures about 50 electronic circuit boards for internal HP customers. The center's accounting, production, and engineering staffs jointly conducted an intense analysis of the production process and cost behavior patterns to select cost drivers. This combination of accounting and engineering analysis helped management choose cost drivers.

Benefits and Limitations of Activity-Based Costing

Since the 1980s an increasing number of firms have adopted the activity-based costing system. These firms adopt ABC because of the benefits it offers.

Benefits

Initially, many firms adopt activity-based costing to reduce distortions in product costs often found in their volume-based costing systems. Volume-based costing systems, generate product or service costs bearing little or no relationship to activities and resources consumed in operations. 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 are:

1. **Better profitability measures.** ABC provides more accurate and informative product costs, leading to more accurate product and customer profitability measurements and to better-informed strategic decisions about pricing, product lines, and market segments.
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, 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.

A 2001 survey of 166 users of ABC costing reported that most adopters used ABC to improve product costing, to assist in cost reduction, and to better assess the profitability of its products and customers. Other common uses were for process improvement, cost estimation, pricing, and performance measurement. Many of the surveyed firms are in the manufacturing industry, and ABC was critical in finding competition responses to industry price competition, identifying unprofitable products, and identifying unprofitable customers.

The survey also reported a significant diversity among these firms in the number of activities, cost objects, and cost drivers. While some firms had several thousand activities in their ABC system, the majority had between 25 and 250. Also, while some firms had several thousand cost objects, most had fewer than 100. The most common number of resource and activity cost drivers was occasionally over 100 but for most firms was between 6 and 10.

A 2005 survey of the members of BetterManagement.com validated these results. Drawn from 528 responses from the financial services industry, manufacturing, and communications and public service sectors, the survey 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 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.

Source: Dan Swenson and Douglas Barney, "ABC/M: Which Companies Have Success?" *The Journal of Corporate Accounting and Finance*, March/April 2001, pp. 35–44.

BetterManagement.com provides online resources for performance management (<http://www.bettermanagement.com/>). It is a wholly owned subsidiary of SAS Institute, Inc.

4. **Cost estimation.** Improved product costs lead to better estimates of job costs for pricing decisions, 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 unused. This can mean that costs are *incurred* at the batch-, product-, and facility-level activities but are *not used*. Capacity is supplied but not used in production ABC systems provide better information to identify the cost of unused capacity and maintain a separate accounting for this cost. For example, if a particular customer's order requires the addition of a certain type of capacity in the plant, then the customer can be charged for that additional capacity. Alternatively, 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.

Limitations

Although activity-based costing provides better product or service costs than volume based systems, managers should be aware of its limitations:

1. **Allocations.** Not all costs have appropriate or unambiguous activity or resource consumption cost drivers. Some costs require allocations to departments and products based on arbitrary volume measures because finding the activity that causes the cost is impractical. Examples are facility-sustaining costs such as the costs of the information system, factory manager's salary, factory insurance, and property taxes for the factory.
2. **Omission of costs.** Product or service costs identified by an ABC system are likely to not include all costs associated with the product or service. Product or service costs typically do not include costs for such activities as marketing, advertising, research and development, and product engineering even though some of these costs can be traced to individual products or services. Product costs do not include these costs because generally accepted accounting principles (GAAP) for financial reporting require them to be treated as period costs.
3. **Expense and time.** An ABC system is not cost free and is time-consuming to develop and implement. For firms or organizations that have been using a traditional volume-based costing system, installing a new ABC system is likely to be very expensive. Furthermore, like most innovative management or accounting systems, ABC usually requires a year or longer for successful development and implementation.

A Comparison of Volume-Based and Activity-Based Costing

LEARNING OBJECTIVE 3

Determine product costs under both the volume-based and the activity-based methods, and contrast the two

The following example contrasts Steps 2 and 3 of the volume-based costing system using direct labor-hours as the cost driver with an activity-based costing system that uses both volume-based and activity-based cost drivers.

Haymarket BioTech, Inc. (HBT) produces and sells two secure communication systems, AW (Anywhere) and SZ (SecureZone). AW uses satellite technology and allows parties whose DNA is implanted in the device to communicate anywhere on the earth. SZ uses similar technology except it allows communication between two parties who are within 10 miles of each other. 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 that the firm uses assigns factory overhead (OH) based on direct labor-hours (DLH). The firm has a total budgeted overhead of \$2,000,000. Since the firm budgeted 100,000 direct labor hours for the year, the overhead rate per direct labor hour 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 factory overhead assigned to AW is \$500,000 in total and \$100 per unit:

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

The factory overhead 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 OH assigned to SZ	$\$20 \times 75,000 =$	\$1,500,000
Number of units of SZ		20,000
Factory overhead per unit of SZ		\$ 75.00

In Exhibit 5.5 we show a product profitability analysis using the firm's volume based costing system.

EXHIBIT 5.5

Product Profitability Analysis under Volume-Based Costing

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

Activity-Based Costing

In using an activity-based costing, HBT has 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 running	1,500,000	Machine-hours
Packing	75,000	Number of packing orders
Total	<u>\$2,000,000</u>	

HBT also has 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 gathered data, the cost driver rate for each activity consumption cost driver is calculated as follows:

(1) Activity Consumption Cost Driver	(2) Cost	(3) Activity Consumption	(4) = (2)/(3) Activity Rate
Engineering hours	\$ 125,000	12,500	\$ 10
Number of setups	300,000	300	1,000
Machine-hours	1,500,000	150,000	10
Number of packing orders	75,000	15,000	5

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

AW (5,000 units)				
(1) Activity Consumption Cost Driver	(2) Activity Rate	(3) Activities	(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			<u>\$775,000</u>	<u>\$155</u>

SZ (20,000 units)				
(1) Activity Consumption Cost Driver	(2) Activity Rate	(3) Activities	(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			<u>\$1,225,000</u>	<u>\$61.25</u>

EXHIBIT 5.6
Product Profitability Analysis
under the ABC Costing System

	AW		SZ	
Unit selling price		\$400		\$200.00
Unit product 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		<u>355</u>		<u>141.25</u>
Unit margin		<u>\$ 45</u>		<u>\$ 58.75</u>

EXHIBIT 5.7
Comparison of Alternative
Costing Approaches

	AW	SZ
Unit overhead cost		
Volume-based	\$100	\$75.00
Activity-based	<u>155</u>	<u>61.25</u>
Difference	\$ 55	\$13.75
Unit margin		
Volume-based	\$100	\$45.00
Activity-based	<u>45</u>	<u>58.75</u>
Difference	\$ 55	\$13.75

Exhibit 5.6 presents a product profitability analysis under the activity-based costing system and Exhibit 5.7 compares product costs and profit margins under the two costing systems.

Remember that one major limitation of a volume-based costing system is that it tends to undercost complex low-volume products and overcost high-volume products. The activity-based costing system presents a more accurate measurement of product costs by tracing overhead consumption. The preceding comparison shows that the volume-based product costing system significantly undercosts AW (a low-volume product) and overcosts SZ (a high-volume product) when considering the actual overhead consumptions of the two products. This is sometimes called *cross-subsidization*, that is, the cost accounting subsidizes some products at the expense of others. 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.

Activity-Based Management

LEARNING OBJECTIVE 4

Explain activity-based management (ABM)

Benefits of activity-based costing systems are not limited to improving product costings. After having an activity-based costing system in place, management often discovers that information from a well-designed ABC system helps to increase both the value customers received and the profits to the firm, especially for firms that embrace activity-based management.

What Is Activity-Based Management?

Activity-Based Management (ABM) manages 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 pinpoint avenues for improving operations, reducing costs, or increasing values to customers. By identifying resources spent on customers, products, and activities, ABM improves management's focus on the firm's critical success factors and enhances its competitive advantage.

ABM applications can be classified into two categories: operational ABM and strategic ABM. Operational ABM enhances operation efficiency and asset utilization and lowers costs; its focuses are on doing things right and performing activities more efficiently. Operational

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
How can we do it better?	Benchmarking, total quality management, business process improvement, reengineering, and value-added analysis

ABM applications use management techniques such as activity management, business process reengineering, total quality management, and performance measurement.

Strategic ABM attempts to alter the demand for activities and increase profitability through improved activity efficiency. 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.

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 17 and 18), and several contemporary management techniques explained in Chapter 1: benchmarking, total quality management, business process improvement, and reengineering. Another technique, value-added analysis, is explained here. We take a look now at activity analysis and value-added analysis.

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. 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.
- 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.

Value-Added Analyses

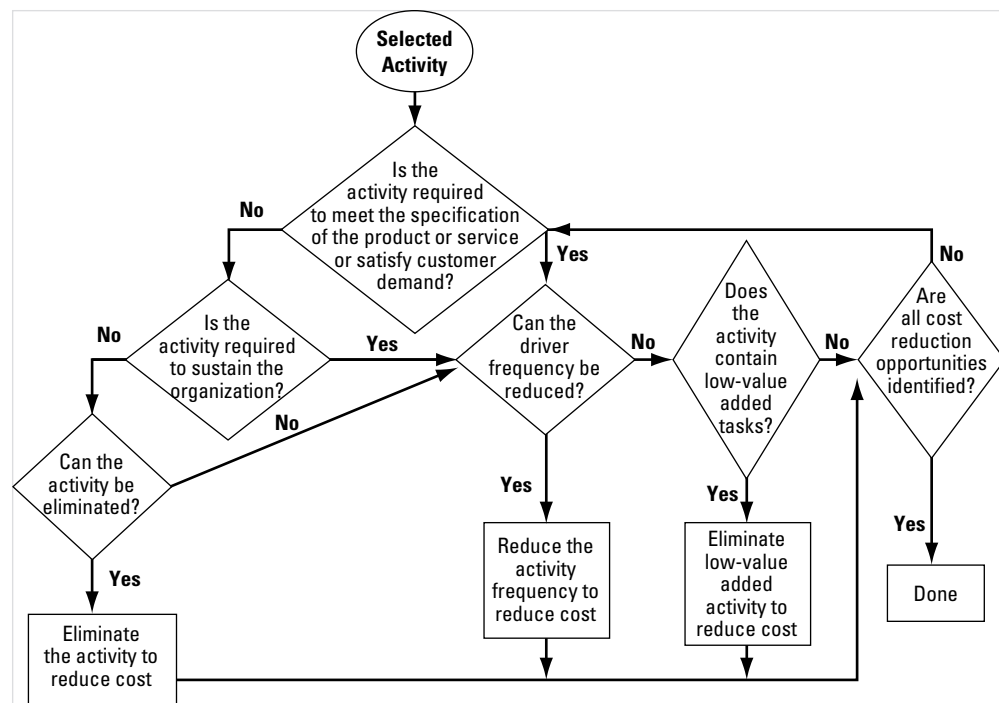
Eliminating activities that add little or no value to customers reduces resource consumption and allows the firm to focus on activities that increase customer satisfaction. Knowing the values of activities allows employees to see how work really serves customers and which activities may have little value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

A **high-value-added activity** increases 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. Installing software to protect a computer from spam is a high-value-added activity to customers annoyed by bombardments of unwanted e-mail. Designing, processing, and delivering products and services are high-value-added activities.

Exhibit 5.10 illustrates high-value-added and low-value-added activities of a television news broadcasting firm. For a television news broadcasting company a high-value-added activity is one that, if eliminated, would affect the accuracy and effectiveness of the newscast and decrease viewer satisfaction and ratings for that time slot. An activity that shortens delivery from three to two days is a high-value-added activity. Activities that verify story sources

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

EXHIBIT 5.9
Example of an Activity
Analysis



to ensure the story's accuracy are high-value-added activities. Activities to plan newscasts so that viewers can follow transitions from one story to the next are high-value-added activities. *High-value-added* activities are those:

- That are necessary or required to meet customer requirements or expectations.
- That enhance purchased materials or components of a product.
- That contribute to customer satisfaction.
- That are critical steps in a business process.
- That are performed to resolve or eliminate quality problems.
- That are performed upon request of a satisfied customer.
- That you would do more of, if time permitted.

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.

1. Activities that generate excess
 - Developing stories not used in a newscast.
 - Assigning more than one person to develop each facet of the same news story.
2. Activities that augment delay (downtime)
 - 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	

A **low-value-added activity** consumes time, resources, or space, but adds little or does not contribute 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. A low-value-added activity for a television news broadcasting company is one that, if eliminated, would have little or no effect on the accuracy and effectiveness of the newscast; the activity contributes little or nothing to the quest for viewer retention and improved ratings. Activities such as developing stories not used in a newscast or correcting prior stories are examples of low-value-added activities for a television broadcasting company. In fact, many would consider these activities as non-value-added. Inventory, transportation, waiting, and correction are examples of low-value-added activities. Other high- and low-value-added activities are illustrated in Exhibit 5.11.

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 performed due to inefficiencies or errors in the process stream.
- Are duplicated in another department or add unnecessary steps to the business process.
- Are performed to monitor quality problems.
- Are performed due to a request of an unhappy or dissatisfied customer.
- Produce an unnecessary or unwanted output.
- If given the option, you would prefer to do less of.

Activity-Based Costing/Management (ABC/M) Applications

LEARNING OBJECTIVE 5

Describe how ABC/M is used in manufacturing companies, service companies, and governmental organizations

ABC/M applications are now common in most industries. This section illustrates some example applications in the manufacturing and service industries and within government.

ABC/M Application in Manufacturing: Industrial Air Conditioner Units

AIRCO is a manufacturer of industrial air conditioning units. The units range in size and power from 5 to 20 tons.¹ Each unit has more than 200 parts, including holding tanks, electronic controllers, 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

¹ Heather Nachtmann, and Mohammad Hani Al-Rifai, “An Application of Activity-Based Costing in the Air Conditioner Manufacturing Industry,” *The Engineering Economist*, 2004, 49, pp 221–236.

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
	<u>\$4,458,610</u>

of \$4,458,605 at the plant (Exhibit 5.12). The resource costs (indirect labor, computer and software, etc.) are from the firm's accounting system, which collects resource costs in these 11 categories.

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. The activity cost pools are machines; data record maintenance; material handling; product changeover (setup); scheduling and production preparation; materials receiving and handling; product shipment; and customer service (Exhibit 5.13, column 1). The assignment of resources to activities typically uses resource consumption 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, \$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):

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

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

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

(1) Activity Cost Pool	(2) Activity Cost	(3) Activity Cost Driver	(4) Activity Cost Driver: Total	(5) = (2)/(4) Activity-Based Application Rate
Machines	\$ 435,425	Number of machine hours	73,872	\$ 5.89
Data record maintenance	132,596	Number of products lines	14	9,471
Materials handling	1,560,027	Number of products	16,872	92.46
Production changeover (setup)	723,337	Setup time (hours)	72	10,046
Scheduling and production preparation	24,876	Number of production runs	2,788	8.92
Material receiving and handling	877,106	Number of receipts	2,859	306
Product shipment	561,013	Distance (miles)	13,784,015	.041
Customer service	144,230	Number of customer contacts	2,533	56.94
Total	<u>\$4,458,610</u>			

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 product cost	<u>\$1,181.83</u>	<u>\$1,411.47</u>	<u>\$1,167.46</u>	<u>\$2,540.26</u>	<u>\$3,397.16</u>	<u>\$3,264.59</u>	<u>\$3,230.54</u>
Selling price	<u>1,000.00</u>	<u>1,300.00</u>	<u>1,750.00</u>	<u>2,560.00</u>	<u>3,200.00</u>	<u>4,572.00</u>	<u>5,450.00</u>
Product margin	\$ (181.83)	\$ (111.47)	\$ 582.54	\$ 19.74	\$ (197.16)	\$1,307.41	\$2,219.46

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 consumption 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 is done in the same manner 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.

The ABC analysis can be compared to the volume-based approach that AIRCO used prior to ABC. The volume-based overhead costs were assigned to products based on a rate of \$12.02 per direct labor hour. The results are shown in Exhibit 5.15. 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 is not shown, the company reports that the 12.5-ton model required significantly more raw materials receipts (the cost driver for material 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 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 Application in the Service Industry: A Retirement and Assisted Living Community

The following is based on an actual 70-unit retirement and assisted living community, which we will call Bellhaven Homes, Inc.² Bellhaven has three levels of resident care: care-free

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	<u>\$1,247.61</u>	<u>\$1,247.61</u>	<u>\$1,247.61</u>	<u>\$2,656.13</u>	<u>\$2,656.13</u>	<u>\$3,209.13</u>	<u>\$3,209.13</u>
Selling price	<u>1,000.00</u>	<u>1,300.00</u>	<u>1,750.00</u>	<u>2,560.00</u>	<u>3,200.00</u>	<u>4,572.00</u>	<u>5,450.00</u>
Product margin	\$ (247.61)	\$ 52.39	\$ 502.39	\$ (96.13)	\$ 543.87	\$1,362.87	\$2,240.87

² Sidney J. Baxendale, Mahesh Gupta, and P. S. Raju, "Profit Enhancement Using an ABC Model," *Management Accounting Quarterly*, Winter 2005, pp. 11–21.

REAL-WORLD FOCUS

Distorted Medicare Reimbursement with Inappropriate Cost Drivers

Hospitals must complete a Medicare cost report each year to be eligible for government reimbursement for services rendered to Medicare patients. Government uses this cost information to set amounts for various Medicare reimbursement parameters. Hospitals often use the same cost information as the basis for determining the charges for privately insured patients. For inpatient care costs, Medicare requires that all operating costs pertaining to patient care be allocated to patients based only on the number of days a patient spends in the hospital (patient-days). Thus, Medicare cost reporting does not explicitly consider the possibility of multiple cost drivers.

Huang and Kirby noted at least two cost drivers for patient care costs: (1) the number of patient-days and (2) the number of patients admitted. Patient-day costs include costs of meals, laundry, and basic nursing care. Admission costs include costs for taking patients' history upon admission, preparing patients for surgery, intensive care immediately following surgery, preparing rooms for new patients, and handling medical coding and billing. The first cost driver, the number of patient-days, is a unit-level cost driver while the second cost driver is likely a batch-level cost driver.

Using publicly available data, Huang and Kirby compared the results of current Medicare reimbursement procedures that use a

single volume-based, unit-level cost driver (patient-days), with the results that would be obtained if Medicare reimbursements were based on two cost drivers: a unit-level cost driver (patient-days) and a batch-level cost driver (number of admissions). Their study results suggest that Medicare is potentially overcharged by between \$66 million and \$1.98 billion per year for hospital patient care! The main reason is that Medicare patients tend to be older and have a much longer average length of hospitalization than private insurance patients do. Because Medicare reimbursements consider only patient-days, Medicare is charged for a disproportionately large share of admitted patients.

Moreover, Medicare reimbursement for a given medical procedure is based on a formula developed by the Health Care Financing Administration (HCFA) which relies on physician time and the complexity of the procedure. Since some of the costs of any given procedure may not be related to physician time and/or the complexity rating, the Medicare formula will not always accurately reflect incurred costs.

Source: Yuchang Huang and Alison L. Kirby, "Distorted Medicare Reimbursements: The Effect of Cost Accounting Choices," *Journal of Management Accounting Research*, Fall 1994, pp. 128–43.

living, semi-assisted living, assisted living, and short-term care. Each is offered in a studio or one bedroom floor plan, except care-free living, which is also offered in a two-bedroom floor plan. These nine different care-level/floor-plan combinations are priced differently and are regarded as the cost objects at Bellhaven. There are currently 56 residents at Bellhaven, spread across the nine cost objects. The services at Bellhaven include resident care, housekeeping, maintenance of grounds and facility, food service, resident activities, and transportation. Each of these six services are the activities used by Bellhaven in developing an ABC model to determine the cost and profitability of each of its nine cost objects. The cost drivers for each activity are the number of hours worked by employees in each of these activities. The ABC application rates are then determined from the hours available in each of the service units, and the ABC costs for each cost object are calculated. Exhibit 5.16 illustrates the per resident costs within each of the nine cost objects. The ABC analysis provides Bellhaven useful information for pricing its services and for identifying activities where costs can be reduced and/or value added.

A special feature of the Bellhaven analysis is the calculation of the cost of unused capacity. Since Bellhaven maintains staff sufficient to cover all 70 units in the facility, it is important to track the costs of underutilization. Bellhaven has room for 14 more residents. This means that the application rates are based on 70-unit capacity and not actual usage, as is sometimes the case in ABC. When rates are based on capacity, management is able to determine the additional information about the cost of unused capacity.

ABC/M Applications in Government

ABC/M is used widely in government. The U.S. Postal Service example that introduced this chapter is one good example. Another example is the U.S. Patent and Trademark Office (PTO) which uses ABC to better understand its cost structure. As the volume of patent requests has increased substantially, and since the PTO is not taxpayer supported but relies on user fees, the determination of accurate costs and the setting of appropriate user fees for its different services is 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

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

EXHIBIT 5.16 ABC Costing at Bellhaven Retirement and Assisted Living Community

	Care-Free Living		Semi-Assisted Living		Assisted Living		Short-Term Care		Total Activity Cost Assigned	Cost of Excess Capacity	Total Activity Cost Incurred
	Studio	One Bed	Two Bed	Studio	One Bed	Studio	One Bed	Studio			
Resident Care	\$ 166	\$ 166	\$ 166	\$ 332	\$ 554	\$ 332	\$ 332	\$ 332	\$ 14,114	\$ 2,454	\$ 16,568
Housekeeping	17	18	23	17	23	17	18	17	1,047	1,773	2,820
Maintenance	16	16	16	16	16	16	16	16	896	2,019	2,915
Food Service	84	84	84	85	86	85	85	85	4,731	4,476	9,207
Resident Activities	16	16	16	12	3	12	12	12	758	1,826	2,584
Transportation	8	8	8	8	8	8	8	8	448	631	1,079
	\$ 307	\$ 308	\$ 313	\$ 470	\$ 691	\$ 471	\$ 471	\$ 471	\$ 21,994	\$ 13,179	\$ 35,173

Other examples include the Internal Revenue Service (IRS), which uses ABC/M to calculate the costs of processing each of its different types of tax returns, and the U.S. Army, which uses ABC in the management of the delivery of medical care and the maintenance of military equipment, among other applications.

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 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 United States 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

How is customer service doing? Bezos isn’t interested in a qualitative answer. He wants to know average customer contacts per hour, average time per contact, the breakdown of e-mail versus telephone, and the total cost to the company of each.

Interview with Jeff Bezos, CEO of Amazon.com Fortune, May 26, 2003, p. 64.

ABC/M is best known for its application in computing product costs, but many firms find that it is also very useful in determining the cost of serving customers and as a basis for evaluating the profitability of a specific customer or of a selected 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 Wal-Mart, 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 Wal-Mart. This strategy involves improved service and fewer discount/promotion offers. 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 and cost drivers and determines profitability of each customer or group of customers. 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 to a lower level.
- Establish a surcharge for or repricing expensive costs-to-serve activities.
- Reduce services for high cost-to-serve customers.
- Introduce new products and services.
- Discontinue products, services, or customers.
- Improve the process of customer service.
- Shift the customer’s purchase mix toward higher-margin products and service lines.
- Offer discounts to gain more volume with low costs-to-serve customers.
- Select customer mix—What types of customer should we market to? What types should we not market to?
- Choose types of after-sale services to provide.

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.

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

LEARNING OBJECTIVE 6

Use an activity-based approach to analyze customer profitability

Customer cost analysis identifies activities and cost drivers to service customers.

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

Customer Cost Analysis

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

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

Customer cost analysis identifies activities and cost drivers to service customers before and after sales, not including product costs. Traditionally these costs are hidden in the customer support, marketing, and sales function. ABC/M can help managers to grasp activities and 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 of the returned units.
- *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 salary, fringe benefits, and bonus of the general sales manager.

Exhibit 5.17 reports 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 reports 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 reports customer cost analyses for Winsome's three customers.

As illustrated in Exhibit 5.18 and 19, the costs to service customers often differ because they do not require the same amount of services. These three customers purchased approximately equal amounts from Winsome. The costs to serve these customers, however, ranged from \$1,555 to \$10,795.

EXHIBIT 5.17
Customer-Related Activity,
Cost Driver, Cost Rate, and
Cost Category

Activity	Cost Driver and Rate	Cost Category
Order taking	\$30 per order	Customer batch-level
Order processing	\$20 per order, and \$1 per item	Customer batch-level Customer unit-level
Delivery	\$100 per trip, and \$1 per mile	Customer batch-level Customer batch-level
Expedited order taking, processing, and delivery (additional costs)	\$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
Sales office		
Salaries and fringe benefits	\$100,000 per month	Sales sustaining
Office expenses	\$50,000 per month	Sales sustaining

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	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

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	$2 \times \$100 = 200$	$20 \times \$100 = 2,000$	
Miles	$10 \times 2 \times \$1 = 20$	$15 \times 20 \times \$1 = 300$	
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	0	0	0
Total	<u>\$1,555</u>	<u>\$4,585</u>	<u>\$10,795</u>

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 customer profitability analysis shows that HomeServ is the most profitable among Winsome’s three major customers, even though HomeServ had the lowest amount of

Cost Management in Action

CUSTOMER PROFITABILITY: IS IT BETTER FOR WEB CUSTOMERS?

An important part of customer profitability is the cost to acquire a new customer. Bain and Company, a consulting firm, estimated that the cost of obtaining a new customer in the consumer electronics industry needs more than four years of business from each new customer to break even,

but more than half of the new customers will defect before the four-year breakeven point. The numbers are similar for the apparel industry. Many firms are now trying to acquire new customers through the Web. What would be the effect of the Web acquisition on profitability?

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	—
Miles	20	300	—
Expedited orders	—	—	4,000
Sales returns	200	100	1,000
Sales visits	200	400	1,000
Monthly billings	5	5	5
Subsequent reminders	0	0	50
Total customer costs	\$ 1,555	\$ 4,585	\$ 10,795
Net customer profit	\$ 53,742	\$ 88,295	\$ 29,767

purchases from Winsome. The analysis also shows that although Advance Tek made the highest total purchases of the three, it yields the lowest net customer profit.

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.

Discounts and sales returns are contributing factors for the low profitability of Advance Tek. 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 expediting orders. The high returns could be a result of the customer's dissatisfaction with Winsome's products. Winsome needs to look into the reason for the high returns before losing the customer to competition. Late payments also add cost to serve Advance Tek; they might indicate Advance Tek's dissatisfaction with Winsome's sales and services or tightness of Advance Tek's financial condition.

Customer Value Assessment

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.

REAL-WORLD FOCUS

ABC/M: Which Companies Have Success?

The Consortium for Advanced Manufacturing International (CAM-I) and the American Productivity and Quality Center (APQC) recently 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 respondents were in the organization, the more they perceived benefits from use 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.

Source: Dan Swenson and Douglas Barney, “ABC/M: Which Companies Have Success?” *The Journal of Corporate Accounting & Finance*, March/April 2001, pp. 35–44. See also, Douglas T. Hicks, “Good Decisions Require Good Models: Developing Activity-Based Solutions that Work for Decision Makers,” *Cost Management*, March/April 2005, pp. 32–40, and Michael D. Shields and Michael A. McEwen, “Implementing Activity-Based Costing Systems Successfully,” *Cost Management*, Winter, 1996, pp. 15–22.

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

- 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.

Some companies quantify the concept of customer value in what is called **customer lifetime value (CLV)**. CLV is the net present value of all estimated future profits from the customer. For example, assume Johnson Instruments Inc, a customer of Hughes Chemical Company, is expected to produce profits for Hughes of \$20,000 per year for the next three years. If Hughes uses a discount rate of 6%, then the CLV for Johnson is $2.673 \times \$20,000 = \$53,460$. The PV factor, 2.673, is obtained from Table 2 of the Present Value Tables at the end of the text. CLV is a useful means to examine the relative value of Hughes’s customers.

Implementation Issues

LEARNING OBJECTIVE 7

Identify key factors for successful ABC/M implementation.

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

Woodrow Wilson

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.

Understanding the production process and identifying cost drivers require careful efforts. Efforts to redesign cost systems usually are rewarded when organizations have high product diversity, various cost drivers, multiple distribution channels, and heterogeneous batch sizes.

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

Implementing Strategy

Involve management and employees in creating an ABC system

Maintain a parallel system

Use ABC/M on a job that will succeed

Justification

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.

Allows individuals to adapt gradually to the ABC/M system. Abruptly changing cost systems can confuse and frustrate management and employees.

Shows how and why the process works. Successfully completing one job enables individuals to see the benefits of ABC/M more clearly.

(Continued)

Keep the initial ABC/M design simple	Avoids overwhelming users and holds costs down; also reduces implementation time.
Create desired incentives	Reassures employees that they will be properly evaluated in accordance with their performance.
Educate Managers and employees	Uses seminars to educate managers and employees about ABC/M to enable them to understand the concept and appreciate the benefits. Management becomes aware of the activities that drive the business.

Two important issues to consider in ABC/M implementation have to do with the relatively high complexity of these systems in practical applications: multiple-stage activity-based costing and time-driven activity-based costing.

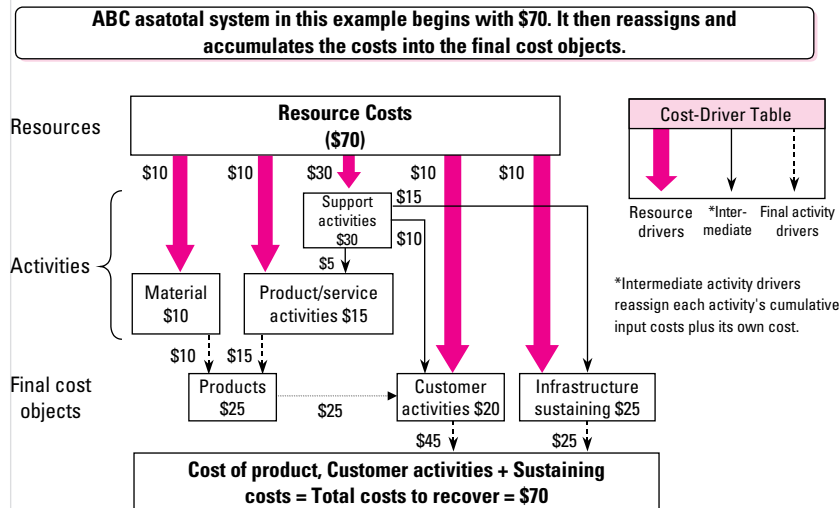
Multiple-Stage Activity-Based Costing

In practice, because of the complexity of the firm’s operations, some activities are cost objects for other activities. To implement this complexity, some firms will use multiple-stage activity-based costing, in which resource costs are assigned to certain activities, which are in turn assigned to other activities before being assigned to the final cost objects—the firm’s products or services. 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 information sustaining activities. The exhibit illustrates how a total of \$70 of resource costs are assigned in multiple-stage ABC.

Time-Driven Activity-Based Costing

A recent attempt to simplify some of the complexity of large ABC systems is based on the idea that the common element in the utilization of activities is the unit of time.⁵ For example, the three activities—machine setup, inspection, and packaging—might require 80 minutes, 15 minutes, and 20 minutes, respectively. 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 simplify the ABC application, since the management accountant can add additional complexity to an activity by simply adding the additional minutes. For example, if setup time for a special customer order requires an additional 15 minutes, the assigned setup

EXHIBIT 5.21
Multilevel Activity Cost Flows



⁵ Robert S. Kaplan and Steven R. Anderson, “Time-Driven Activity-Based Costing,” Harvard Business Review, November 2004.

cost would be based on \$40 per minute times the total time of $80 + 15 = 95$ minutes: $95 \text{ minutes} \times \$40 = \$3,800$.

Another advantage of the time-driven approach is that, when the rates are based on practical capacity rather than actual total usage (for example, assume the 1,250 minutes of total setup time above is the practical capacity in the setup activity, not the minutes used), then the approach can be used to determine the cost of unused capacity, much like Bellhaven Homes example shown earlier.

Summary

Many companies have replaced their volume-based costing systems with activity-based accounting systems to gain better product costing and pricing. ABC facilitates activity-based management that improves competitiveness, reduces costs, increases productivity, and augments flexibility in meeting customer needs.

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 (ABC) assigns costs to products or services based on consumption of resources and activities. ABC systems recognize the fact that products or services are results of activities and that activities consume resources and incur costs; it recognizes the causal relationships of cost drivers to activities. ABC systems use a two-stage procedure to assign costs to products or services. The first-stage allocation is a resource cost assignment process by which factory overhead costs are assigned to activity cost pools or groups of activities called *activity centers* using appropriate resource consumption cost drivers. The second-stage allocation is an activity cost assignment process by which the costs of activities are assigned to products or services using appropriate activity consumption cost drivers.

Activity-based costing helps to reduce cost distortions often found in volume-based costing systems and provides more accurate product costs. It also yields a clear view of how a firm's diverse products, services, and activities contribute to the firm's bottom line. Even though developing and implementing an ABC system is expensive and time consuming, many firms found the benefit exceeds the cost of installing an ABC system.

Activity-based management (ABM) improves efficiency and effectiveness of an organization. Uses of ABM increase not only the value received by customers but also the firm's profits.

Customer profitability analysis traces costs to customers to allow management to determine customer profitability and to provide more attentive service to high-profit customers, acquire new high-profit customers, and improve the profitability of current customers.

Numerous factors play important roles in implementing ABC/ABM. To be successful, management accountants need to cooperate with engineers and manufacturing and operating managers to form a design team.

Key Terms

- activity, 000
- activity-based costing, 000
- activity consumption cost driver, 000
- batch-level activity, 000
- customer cost analysis, 000
- customer lifetime value, 000
- customer profitability analysis, 000
- facility-level activity, 000
- high-value-added activity, 000
- low-value-added activity, 000
- product-level activity, 000
- resource, 000
- resource consumption cost driver, 000
- two-stage cost allocation, 000
- unit-level activity, 000

Comments on Cost Management in Action

Customer Profitability: Retention is the Key

The overall cost to acquire a new customer has a strong effect on customer profitability. These costs can be as high as \$50 or more per customer. When customer retention is low, as it is in some industries, these costs lower overall customer profitability. For example, customer retention in the apparel industry is far higher than in the consumer electronics industry. A number of firms use the Web to acquire new customers, and some do it more effectively than others. For example, America Online, Amazon.com, and Dell Computer have sophisticated programs for identifying potential new customers and for improving the retention of existing customers. Interestingly, studies have shown that Web customers tend to be more loyal; their retention rates are somewhat higher than for traditional customers. Studies show that Web customers are most interested in convenience, not the lowest price, as is commonly thought. When they find a convenient Web source that meets their needs, they tend to consolidate their purchases there. E-loyalty is the road to success for these companies.

Source: Frederick F. Reichheld and Pohil Schefter, "E-Loyalty: Your Secret Weapon on the Web," *Harvard Business Review*, July–August 2000, pp. 105–113.

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 2006, the firms budgeted \$1,000,000 total factory overhead cost for these operations.

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

The following information relates to the firm's operations for the month of January, 2006:

	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:

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
	<u>\$1,000,000</u>				

Required

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

Questions

- 5-1 Explain why a costing system that uses a volume-based rate is likely to produce distorted product costs.
- 5-2 “Undercosting a product increases the profit from the product and benefits the firm.” Do you agree? Why?
- 5-3 Firms sell products with high costs at high prices. High selling prices increase revenues and profits. Why then should managers worry about product overcosting?
- 5-4 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 tracing 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 Give three examples of high-value-added activities in an organization that you choose.
- 5-15 Give three examples of low-value-added activities in an organization that you choose.
- 5-16 How can activity-based costing and management be used in service organizations?
- 5-17 Identify opportunities afforded by customer profitability analysis.

Brief Exercises

- 5-18 Tasty Beverage Co. produces soft drinks, specializing in sugar-based drinks. They produce 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?
- 5-19 Montross Lumber processes wood to be shipped to construction companies. In order to keep their products uniform, they conduct 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?
- 5-20 Orange Inc. grows cabbage. Each package shipped out contains 20 vegetables. It costs Orange \$5 to put together each package and \$0.10 to clean and process each vegetable. If they are discussing an order for 50 heads of cabbage, how much higher is the cost of producing 60 heads, considering package size?
- 5-21 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 week for detailing cars?
- 5-22 Stackhouse Computing produces high performance desktop computers. Annual CGS 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?
- 5-23 Scott Cameras produces digital cameras and has decided to switch from a volume-based system to an activity-based system. Scott produced 100,000 digital cameras in the most recent quarter and has determined that total activity costs were: \$3,000,000 of materials cost, \$500,000 of labor costs, \$1,000,000 of inspection costs, and \$500,000 of packaging costs. It takes 30 minutes of labor to produce each camera, inspections are done for 20% of all cameras produced, and cameras are packaged individually. What are the rates for each of these activities?
- 5-24 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?

Exercises

- 5-25 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 100,000 hours of data entry and 30,000 hours of data analysis. What are the activity-based rates for each area of direct labor?
- 5-26 Mattresses-A-Million produces Pillow-Top mattresses. They have been using a volume-based costing system to allocate overhead based on direct labor hours. The Pillow-Top requires two hours of direct labor. The company has been allocating overhead at the rate of \$10 per direct labor hour. The accounting manager thinks they should switch to ABC and wants to know how much they would save. If the Pillow-Top Mattress requires 30 pounds of materials (materials handling costs are \$0.10 per pound) and two setups at \$5 per setup, is the accounting manager correct? According to the activity-based costs, how much was the cost of making a mattress overstated/understated?
- 5-27 Plant overhead for ABC Corp is \$150 million per year, a portion of which (20%) is attributable to inspection costs which are charged to products on the basis of the number of parts in the products. The plant produces 500,000 units per year, and on the average, each product has 20 parts. What is the average inspection cost in a product? What is the inspection cost for a product with 50 parts?
- 5-28 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?
- 5-29 **Activity Levels and Cost Drivers** Al's Speedy Gourmet, a small hamburger shop, has identified the following resources used in its operations:
- | | |
|----------------|--|
| a. Bread | f. Advertising for Triple-Burger special |
| b. Hourly help | g. Salary for the store managers |
| c. Store rent | h. Utilities |
| d. Ground beef | i. \$1-off-coupon for the second order |
| e. Catsup | j. Bags |

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.

- 5-30 **Activity Levels and Cost Drivers** Shroeder Machine Shop has the following activities:
- | | |
|-----------------------------|-------------------------|
| a. Machine operation | f. Machine maintenance |
| b. Machine setup | g. Product improvement |
| c. Production scheduling | h. Parts administration |
| d. Materials receiving | i. Final inspection |
| e. Research and development | 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.

- 5-31 **Activity Levels and Cost Drivers** Richardson Industries manufactures industrial tools after creating a mold for each newly designed tool. Richardson personally inspects every unit during the trial run of a new mold and 10 percent of the units manufactured in the first three batches. Some of the activities of the firm follow:
- | | |
|--------------------------|------------------------------------|
| a. Designing molds | f. Requesting and moving materials |
| b. Creating molds | g. Machining |
| c. Inspecting products | h. Insuring equipment |
| d. Modifying molds | i. Paying suppliers |
| e. Setting up production | j. Heating the factory |

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.

Ex

- 5-32 **Activity Levels and Cost Drivers, Service Company** Platte Valley Laboratories offers complete laboratory service for agriculture and the environment. A subdivision of its Agriculture Testing Department conducts soil tests (ST) and pesticide residues tests (PRT). The current costing system aggregates all \$2,100,000 operating costs of the subdivision into a single overhead cost pool and charges a rate of \$70 per test-hour. ST uses 10,000 test-hours, and PRT uses 20,000 test-hours. In an effort to establish a better costing structure, the controller has identified the following costs:
- Salaries and wages of lab technicians \$1,200,000. These costs can be traced to ST, \$540,000, and PRT, \$660,000.
 - Equipment-related costs such as depreciation, maintenance, insurance and taxes, and energy, \$300,000. The cost driver is the number of test-hours.
 - Setup costs, \$240,000, to be assigned on the basis of the number of setup hours. ST has 8,500 setup hours, and PRT has 11,500 setup hours.
 - Costs of test designs, \$360,000. These costs are to be assigned to ST and PRT on the basis of the time required to design the tests. ST requires 5,800 hours, and PRT requires 4,200 hours.

Required

- Classify each activity cost (a) through (d) as output unit-level, batch-level, product (or service) level, or facility level cost.
- Calculate the cost per test-hour for ST and PRT using an improved costing structure. Explain briefly the reasons for these costs to be different from the \$70 per test-hour under the current costing system.
- Set up a spreadsheet and verify your answer for 2 above.
- Use the spreadsheet you set up for requirement 3 to answer this question. What will be the cost per test hour for ST and PRT if \$360,000 of the salaries and wages should have been included in the setup cost and \$540,000 of the salaries and wages should have been included in the costs of test designs? Should the firm determine cost per testing on the basis of test-hour? (Of the remaining \$300,000 salaries and wages for lab technicians, \$135,000 for 2,500 hours can be traced to ST and \$165,000 for 5,000 hours can be traced to PRT.)

(CMA Adapted)

- 5-33 **Volume-Based Costing Versus ABC** Many companies recognize that their cost systems are inadequate for today's powerful global competition. Managers in companies selling multiple products are making important product decisions based on distorted cost information. This happens because most volume-based cost systems focused on inventory valuation. To elevate the level of management information, current literature suggests that companies should have as many as three cost systems for (1) inventory valuation, (2) operational control, and (3) activity-based costing.

Required

- Discuss why the volume-based cost system developed to value inventory distorts product cost information.
- Identify the purpose and characteristics of each of the following cost systems:
 - Inventory valuation
 - Operational control
 - Activity-based costing
- Describe the benefits that management can expect from activity-based costing.
- List the steps that a company using a volume-based cost system would take to implement activity-based costing.

(CMA Adapted)

- 5-34 **Activity-Based Costing** Hakara Company has identified the following overhead cost pools and cost drivers:

Cost Pools	Activity Costs	Cost Driver	Driver Consumption
Machine setup	\$360,000	Setup hours	3,000
Materials handling	100,000	Pounds of materials	25,000
Electric power	40,000	Kilowatt-hours	40,000

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

	A	B
Number of units produced	4,000	20,000
Direct materials cost (\$)	\$40,000	\$50,000
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 Use activity-based costing to calculate the unit cost for each product.

5-35 **Customer Profitability Analysis: Luxury Hotel Industry** The luxury hotel chain Ritz-Carlton recently 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?

5-36 **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 wild-life/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 help these organizations 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.

5-37 **Activity-Based Costing in the Fashion Apparel Industry** Fashion House, 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%). Fashion House 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 (all figures in £)	10,000
Price	\$ 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
Net 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 trouser's 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 net margin for trousers using ABC and comment on the difference in comparison to the volume-based calculations.

5-38 **Volume-Based Versus ABC Overhead Rate** GWS Hospital uses a hospitalwide overhead rate based on nurse-hours. The intensive care unit (ICU), which has 30 beds, applies overhead using patient-days. Its budgeted cost and operating data for the year follow:

Budget Information	
Hospital total overhead	\$69,120,000
Hospital total nurse-hours	1,152,000

Budget Cost Driver Information for ICU for the Month of June			
Cost Pool	Budget Cost	Cost Driver	Budget Cost Driver Activity
Beds	\$810,000	Number of bed-days	900
Equipment	422,500	Number of patient-days	845
Nursing care	457,500	Number of nurse-hours	6,000

In June, GWS's intensive care unit had the following operating data:

5,900 nurse-hours
870 patient-days

Required

- Calculate the ICU's overhead costs for the month of June using
 - The hospitalwide rate
 - The ICU departmentwide rate
 - The cost drivers for the ICU department
- Explain the differences and determine which overhead assignment method is more appropriate.

5-39 **Product Selection Strategy** Johans Computer Company has two product lines, Desktop and Tablet. The firm's costing system shows that each Desktop costs \$550 to manufacture. Johans sells 9,000 Desktops at \$660 per unit. A national low-price store has introduced a similar desktop computer with a market price of \$380. Tablet computer is a new model that a handful of companies, including Johans, introduced recently. Each Tablet computer costs Johans \$750 to produce and sells for \$2,750. Johans sells approximately 150 Tablet computers. The marketing vice president suggests shifting the sales mix in favor of Tablet computer. Unfortunately, Tablet computer is more complicated to make and few are produced.

Required Should Johans focus its sales on the Desktop or Tablet computer? Explain your answer.



5-40 **High-Value-Added and Low-Value-Added Activities** The Radiology Department of the Lindex General Hospital has the following activities:

- | | |
|--|--|
| a. Admitting patients | f. Taking images |
| b. Retrieving patients from the waiting area | g. Checking images to determine the need for more images |
| c. Assessing need for lab work | h. Taking more images to get right pictures |
| d. Sending patients to the lab | i. Preparing report to the primary physician |
| e. Bringing patient to the MRI machine | |

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

5-41 **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 | f. Accompany attending physician |
| b. Visit each patient and take her/his temperature | g. Explain treatments to patients |
| c. Update patients' records | h. Call kitchen to have the wrong meal tray replaced |
| d. Coordinate lab and radiology works | i. Perform CPR |
| e. Wait for the attending physician to arrive | |

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

5-42 **High-Value-Added and Low-Value-Added Activities** Mazon.com sells merchandise through orders placed on its Web site. Some of the firm's activities are

- Print order forms
- Review orders to ensure the accuracy of prices and the totals
- Secure approval of charges on credit cards
- Deliver order forms to supervisor to secure her/his approval
- Make a copy of each order to send to the warehouse
- Pick and pack items ordered
- E-mail customer for items not in stock
- E-mail customer on the shipment of the order with a thank-you note

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

5-43 **ABC and Job-Costing** Hood 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 percent 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 overheads for printed-circuit boards follows:

Activity Cost Pool	Cost Driver	Overhead Rate per Units of Cost Driver	Unit of Cost Driver per Board	Factory Overhead per Board
Axial insertion	Number of axial insertions	\$0.15	30	\$A?
Hardware insertion	Number of hardware insertions	1.85	B?	37.00
Hand load	Boothroyd time	C?	5	35.50
Masking	Number of points masked	0.08	100	D?
Final test	Test time	F?	10	E?

Required Fill in the unknowns identified as A through F.

5-44 **Cost of Meal** The following excerpt appeared in a syndicated advice column (March 20, 2003).

Dear Annie:

I attend out-of-town meetings and often am invited to join clients and associates for dinner. There is no way for me to politely refuse. The problem is, I can only afford so much for my meal. However, when the server comes to take our orders, one of the Big Shots invariably says to put the meal on one check. The others proceed to order expensive meals and wine, and we split the bill equally. I end up paying for a dinner that I can't afford, yet to ask for a separate check would be embarrassing.

How can I handle this situation?

Bottom of the Totem Pole in Wisconsin

Required If you were Annie, how would you respond to this reader?

5-45 **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	\$90,000	\$158,125
Cost of goods sold	105,000	67,000	110,000

SFS estimates that store support expenses are approximately 20 percent 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:

	Frozen Food	Baked Goods	Fresh Produce
Order processing (number of purchase orders)	10	55	90
Receiving (number of deliveries)	10	70	120
Shelf-stocking (number of hours per delivery)	2	0.5	4
Customer support (items 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 per hour
Customer support	\$0.20 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 new information the controller provides.
3. What new insights does the ABC system in requirement 2 provide to SFS managers?

5-46 **Customer Profitability Analysis** Doreen Company has gathered the following data pertaining to activities it performed for two of its major customers.

	Jerry Inc.	Donald 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

Doreen sells its products at \$200 per unit, net 30. The firm's gross margin ratio is 25 percent. Both Jerry and Donald 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 and compute the total cost for Doreen Company to service Jerry Inc. and Donald Co.
2. Compare the profitability of these two customers (ignore cost of funds).

5-47 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 percent 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 her 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 \$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?

5-48 Activity Based Costing; Customer Group Cost Analysis Hawler/Perkins Inc. (HPI) manufactures bedroom furniture in sets (a set includes a dresser, two queen-size beds, and one bedside table) for use in motels and hotels. HPI 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. HPI 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. HPI has used a volume-based rate based on direct labor hours for some time. Direct labor cost is \$12 per hour.



Problems

	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	285,000	Number of orders shipped
	<u>\$3,380,100</u>	
General, selling, and adm. costs	\$ 500,000	

The production data for the three product lines follows.

Product Lines	Value	Quality	Luxury
Units produced	15,000	5,000	500
Price	\$ 300	\$ 400	\$500
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

- Determine the unit cost for each of the three products and the total production cost of each of the three product lines using activity-based costing.
- Determine the unit production cost for each of the three products using HPI's current volume-based approach.
- 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.

- Compare the two approaches and discuss the strategic and competitive issues of using each of the two methods.
- 5-49 **Cost Pools and Cost Drivers** Based on a recent study of its manufacturing operations Johnston Manufacturing Corporation has identified six resource consumption cost drivers. These cost drivers and their budgeted activity levels for the coming year are:

Cost Driver	Activity Level
Number of purchase orders	6
Number of production runs (2,500 per production run)	40
Machine hours	100,000
Factory space (square feet)	24,000
Units of production	100,000
Engineering hours	20,000

The firm has budgeted the following costs for the year:

Engineering design	\$600,000
Depreciation—building	50,000
Depreciation—machine	40,000
Electrical power (for factory building)	6,000
Electrical power (for machining)	30,000
Insurance	20,000
Property taxes	15,000
Machine maintenance—labor	11,000
Machine maintenance—materials	9,000
Natural gas (for heating)	8,000
Inspection of finished goods	7,000
Setup wages	20,000
Receiving	10,000
Inspection of direct materials on receiving	3,000
Purchasing	20,000
Custodial labor	51,000

With the exception of the factory space cost pool, which uses machine hours as the activity consumption cost driver, other cost pools have identical resource and activity consumption cost drivers.

Required

1. Identify the most appropriate activity cost pool for each of the cost items and cost driver for each activity cost pool you identified.
2. Johnston has received a request to quote the price for 4,000 units of a new product. The production will require 100 engineering-hours and 4,250 machine-hours. What is the manufacturing overhead per unit the firm should use in determining the price?

5-50 **Activity-Based Costing, Value Chain Activities** Hoover Company uses activity-based costing and provides this information:

Manufacturing Activity	Cost Driver	Overhead Rate
Materials handling	Number of parts	\$ 0.45
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 \$1,200 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 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.

5-51 **Volume-Based Costing Versus ABC** The California Cooking Oil Company (CCO) has been using machine-hours as the basis to determine overhead costs for all products. An ABC project team points out that the firm manufactures several products, each of which use significantly different factory

supporting resources. As a start, the team suggests the following overhead cost pools, cost drivers, and estimated cost driver levels for manufacturing overheads:

Overhead Cost Pool	Cost Driver	Estimated Cost	
		Driver Level	Budgeted Overhead
Machine setups	Number of setups	100	\$100,000
Materials handling	Number of barrels	8,000	80,000
Quality control	Number of inspections	1,000	200,000
Other overhead cost	Machine-hours	10,000	100,000

CCO has recently completed production of 500 barrels each of P5 and G23. P5 is a cornbased oil distributed primarily through supermarkets. G23 is made from olive oil, flaxseed oil, and other exotic ingredients and sold to up-scale restaurants as gourmet foods. The productions require the following operations:

Overhead Cost Pool	Number of Cost Drivers	
	P5	G23
Machine setups	1 setup	50 setups
Materials handling	500 barrels	500 barrels
Quality inspections	2 times	20 times
Machine-hours	1,000 hours	1,000 hours

Required

1. Determine the overhead costs per barrel of P5 and G23 using the current single cost driver system based on machine-hours.
2. Determine the overhead costs per barrel of P5 and G23 using the multiple cost driver system suggested by the ABC project team.
3. Explain how the choice of costing system can be an important competitive factor for CCO. How can the costing system help the firm become more profitable and competitive?

5-52 **Volume-Based Costing Versus ABC** West Chemical Company produces three products. The operating results of 2007 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 percent 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 percent 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 2007 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 estimate 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	<u>\$70.00</u>	<u>\$126.40</u>	<u>\$75.00</u>



The controller noticed that not all products consumed factory overheads similarly. Upon further investigations, she identified the following usages of factory overheads during 2007:

	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				<u>\$493,000</u>

Required

- Determine the amount of overhead cost per unit and the total overhead for each of the products.
- Is Product B the least profitable and Product C the most profitable under both the current and the ABC costing systems?
- What is the new target price for each product based on 150 percent of the new costs under the ABC system? Compare this price with the actual selling price.
- 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.



5-53 **Ethics, Cost System Selection** Aero Dynamics manufactures airplane parts and engines for a variety of military and civilian aircrafts. The company is the sole provider of rocket engines for the U.S. military that it sells for full cost plus a 5 percent 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?



5-54 **Volume-Based Costing Versus ABC** Gorden Company produces a variety of electronic products. One of its plants produces two laser printers, Speedy and Deluxe. At the beginning of 2006, the following data were prepared for this plant:

	Deluxe	Speedy
Quantity	50,000	400,000
Selling price	\$475.00	\$300.00
Unit prime cost	\$180.00	\$110.00
Unit overhead cost	\$ 20.00	\$153.60

The unit overhead cost is calculated using the predetermined overhead application rate based on direct labor-hours.

Upon examining the data, the marketing manager was particularly impressed with the per-unit profitability of the Deluxe printer and suggested that more emphasis be placed on producing and selling this product. The plant supervisor objected to this strategy, arguing that the Deluxe model required a very delicate manufacturing process. The supervisor believed that the cost of the Deluxe printer was likely to be much higher than reported.

The controller suggests an activity-based costing system and provides the following budget data pertaining to the period:

Overhead Activity	Cost Driver	Activity Consumption		
		Pool Rate*	Deluxe	Speedy
Setups	Number of setups	\$2,800	200	100
Machine costs	Machine-hours	100	100,000	400,000
Engineering	Engineering-hours	40	45,000	120,000
Packing	Packing orders	20	50,000	200,000

* Cost per unit of cost driver

Required

- Using the projected data based on the firm's current costing system, calculate gross profit per unit and gross profit percentage for each product.
 - Using the suggested multiple cost drivers overhead rates, calculate the overhead cost per unit for each product and determine gross profit per unit and gross profit percentage for each product.
 - Based on your results, evaluate the suggestion of the marketing manager to emphasize the Deluxe model.
 - How does ABC contribute to Gorden's competitive advantage?
- 5-55 **Volume-Based Costing Versus ABC** Hairless Company manufactures a variety of plastic shavers for men and women. The company's plant is partially automated. The company uses an activity-based cost system based on the following budget data:

Overhead Cost Pool	Overhead		
	Cost	Cost Driver	Level for Cost Driver
Machine depreciation/maintenance	\$135,000	Machine-hours	27,000 Machine-hours
Factory depreciation/utilities/insurance	\$120,000	Machine-hours	30,000 Machine-hours
Product design	\$504,000	Hours in design	42,000 Design hours
Material purchasing/storage	\$147,000	Raw materials cost	\$980,000

Two current product orders have these requirements:

	15,000 Men's Shavers	20,000 Women's Shavers
Direct labor-hours	24	12
Raw materials cost	\$30,000	\$26,000
Hours in design	15	37.5
Machine-hours	50	40

Required

- What total overhead should be assigned to each product order?
 - What is the overhead cost per shaver?
 - Compute the predetermined overhead rate if the firm uses a volume-based overhead rate based on direct labor-hours. The direct labor budget for the year is 3,020 hours.
 - Compute the total overhead cost assigned to each production order using the plantwide overhead rate.
 - What is the overhead cost per shaver using the volume-based overhead rate?
- 5-56 **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
	<u>\$1,550,000</u>

EEI uses ABC costing to determine the unit costs of its products. The firm uses resource consumption cost drivers based on an estimate 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. Additionally, direct material of \$3.50 and \$6 is required for the Safe-V and Safe-T products, respectively.

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 total cost for each of the products.
4. What is the strategic role of the information obtained in part 3?

5-57 **Resource and Activity-Based Cost Drivers (Continuation of 5-56)** Assume the same information as in problem 5-56 above, except that EEI has determined resource-consumption rates based on cost drivers instead of estimated-percentage-consumption rates. The cost drivers and driver levels are given below:

	Factory Costs	Resource -Driver	Resource Total
Salaries	\$ 850,000	Number of employees	17
Supplies	150,000	Number of machines	10
Factory Expense	550,000	Square feet, floor space	22,000
	<u>\$1,550,000</u>		

The resource consumption drivers are used by the activities as follows:

Resource Driver	Resource Total	Setup	Assembly	Inspect & Finishing	Packaging
Number of employees	17	1	10	5	1
Number of machines	10	1	5	4	
Square feet, floor space	22,000	2,000	11,000	5,000	4,000

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 total cost for each of the products.

5-58 **Volume-Based Costing Versus ABC** Moden Lighting Inc. (MLC) manufactures and sells lighting fixtures. The company has two main product lines, ceiling fixtures and luxury pendants. Its products



are sold through industry and wholesale suppliers. During a recent executive meeting, Bob Brighten, the vice president of marketing, made three observations: First, the price of the Ceiling Fixture (CF), a high-volume product for the firm, is often higher than that of competitors' products. Second, MLC has been struggling to maintain its market share of CF. Third, the firm has sold approximately the same number of units of Luxury Pendant (LP), a high margin product, despite a 7.5 percent increase in price. Noting that the profit margin per unit of LP is higher than that of CF, Brighten has suggested that MLC should push for producing and selling of LP. Regina Jones, the plant manager, objected to this strategy because the manufacturing processes of LP were much more complicated than those for CF. The total manufacturing costs would increase substantially if MLC shifted its product line to emphasize LP.

Aaron Higgins, the vice president of finance, observes that MLC uses a direct labor cost-based system to determine the amount of manufacturing overhead for all of its products. For each direct labor dollar the firm attaches \$2.00 overhead cost. Selected operating data for the year 2007 follow:

Product	Units Sold	Cost per Unit		Selling Price per Unit
		Direct Materials	Direct Labor	
LP	4,000	\$20	\$8	\$70
CF	40,000	10	5	40

Aaron also has collected the following data on activity cost pools and their cost drivers:

Cost Pools/Activities	Cost Drivers
Machine operation	Machine-hours
Support labor overhead	Direct labor costs
Machine setup	Setup hours
Assembly	Number of parts
Inspection	Inspection hours

Estimated Overhead Costs and Activity Consumption Information for Cost Pools and Activities

Activity Cost Pool	Overhead	Activity Consumption Levels		
		Total Activity	LP	CF
Machine operation	\$160,000	10,000	1,500	8,500
Support labor	81,200	232,000	32,000	200,000
Machine setup	68,000	2,500	1,000	1,500
Assembly	88,550	402,500	192,500	210,000
Inspection	66,250	4,000	1,600	2,400
Total	<u>\$464,000</u>			

Aaron explained why these cost drivers were appropriate:

- The overhead costs for machine operation had nothing to do with the direct labor-hours. These costs were more likely to vary with the number of machine-hours.
- The support labor included allowances for benefits, break periods and costs related to the supervising and engineering staff. This overhead was indirect to the products but was related to the direct labor costs.
- The setup overhead was generated by changing the job to be run and should be related to the setup hours rather than the direct labor-hours.
- The assembly overheads related to costs incurred to assemble parts. The more parts needed, the higher the overhead costs. Therefore, the correct cost driver should be the number of parts.
- The inspection overhead arose from checking the finished goods. The higher the number of finished units, the higher the inspection overhead costs. The appropriate cost driver should be the number of hours spent on the inspection.

Required

1. Using the current costing system, which uses direct labor costs as the basis to determine overhead costs, calculate the unit manufacturing costs of the two products.
2. Using the activity-based costing system, calculate the unit manufacturing costs of the two products.

3. Under ABC, is the Luxury Pendant as profitable as the vice president of marketing thinks it is under the existing costing system?
4. Evaluate the marketing vice president's suggestion to shift the sales mix in favor of the Luxury Pendant units.
5. Give at least two reasons for the differences between the results for the two different costing systems.

5-59 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 Akpaffiong, the president of ADA Enterprises, 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		<u>\$200,000</u>	

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 Enterprises? 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?

5-60 **Volume-Based Costing Versus ABC** Alaire Corporation manufactures several different printed-circuit boards, but two of the boards account for the majority of the company's sales. The first product, a television (TV) circuit board, has been a standard in the industry for several years. The market for this board is competitive and price sensitive. Alaire plans to sell 65,000 of the TV boards in 2007 at \$150 per unit. The second product, a personal computer (PC) circuit board, is a recent addition to Alaire's product line. Because it incorporates the latest technology, it can be sold at a premium price. The 2007 plans include the sale of 40,000 PC boards at \$300 per unit.

Alaire's management group is meeting to discuss strategies for 2007. The current topic of conversation is how to spend the sales and promotion dollars for 2007. The sales manager believes that the market share for the TV board could be expanded by concentrating Alaire's promotional efforts in this area. In response to this suggestion, the production manager said, "Why don't you go after a bigger market for the PC board? The cost sheets that I get show the contribution from the PC board is about double the contribution from the TV board. I know we get a premium price for the PC board; selling it should help overall profitability."

Alaire's current volume-based costing system shows these data for TV and PC boards:

	TV Board	PC Board
Direct materials	\$80	\$140
Direct labor	1.5 hours	4 hours
Machine time	.5 hour	1.5 hours

The current costing system uses three types of factory overhead: variable factory, materials handling, and machine time. Variable factory overhead is applied on the basis of direct labor hours. For 2007, Alaire budgeted at \$1,120,000 variable factory overhead and 280,000 direct labor-hours. The hourly rates for machine time and direct labor are \$10 and \$14, respectively. Alaire applies a materials-handling charge at 10 percent of direct materials cost, which is not included in variable factory overhead. Total 2007 expenditures for direct materials are budgeted at \$10,800,000.

The company conducted an activity analysis and collected the following information for 10 activities:

Budgeted Overhead Costs		Cost Driver	Annual Activity for Cost Driver
Materials-related overhead			
Procurement	\$ 400,000	Number of parts	4,000,000
Production scheduling	220,000	Number of boards	110,000
Packaging and shipping	440,000	Number of boards	110,000
	<u>\$1,060,000</u>		
Variable overhead			
Machine setup	\$ 446,000	Number of setups	278,750
Hazardous waste disposal	48,000	Pounds of waste	16,000
Quality control	560,000	Number of inspections	160,000
General supplies	66,000	Number of boards	110,000
	<u>\$1,120,000</u>		
Manufacturing overhead			
Machine insertion	\$1,200,000	Number of insertions	3,000,000
Manual insertion	4,000,000	Number of insertions	1,000,000
Wave soldering	132,000	Number of boards	110,000
	<u>\$5,332,000</u>		

(Continued)

Required per Unit	TV Board	PC Board
Parts	25	55
Machine insertions	24	35
Manual insertions	1	20
Machine setups	2	3
Hazardous waste	0.02lb.	0.35lb.
Inspections	1	2

Ed Welch, Alaire's controller, believes that before the management group proceeds with the discussion about allocating sales and promotional dollars to individual products, it might be worthwhile to look at these products on the basis of the activities involved in their production. As Ed explained to the group, "Activity-based costing integrates the cost of all activities, known as cost drivers, into individual product costs rather than including these costs in overhead pools." He prepared the preceding information to help the management group understand this concept.

"Using this information," Ed explained, "we can calculate an activity-based cost for each TV board and each PC board and then compare it to the standard cost we have been using. The only cost that remains the same for both cost methods is the cost of direct materials. The cost drivers will replace the direct labor, machine time, and overhead costs in the old standard cost figures."

Required

- On the basis of Alaire's current costing system and its cost data (direct materials, direct labor, materials-handling charge, variable overhead, and machine time overhead) given in the problem, calculate the total contribution margin expected in 2007 for Alaire Corporation's TV board and PC board.
- On the basis of activity-based costs, calculate the total contribution margin expected in 2007 for Alaire Corporation's TV board and PC board.
- Explain how the comparison of the results of the two costing methods might affect the sales, pricing, and promotion decisions made by Alaire Corporation's management group. How would it affect the strategic, competitive position of the firm.

5-61 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 percent. 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 2007 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 2007 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 2007 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

(Continued)



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			<u>\$3,000,000</u>

Data regarding the 2007 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

- Using Coffee Bean, Inc.'s current product costing system,
 - Determine the company's predetermined overhead rate using direct labor cost as the single cost driver.
 - Determine the full product costs and selling prices of one pound of Mona Loa coffee and one pound of Malaysian coffee.
- 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.
- 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)

- 5-62 **Cost of Capacity (Continuation of 5-61)** 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

- Determine the activity rates based on practical capacity and the cost of unused capacity for each activity.
- Explain the strategic role of the information you have developed in part (1) above.
- Assume the same information used in parts (1) and (2) above, but now assume also that the costs 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?



5-63 **Customer Profitability Analysis** Boston Depot sells office supplies to area corporations and organizations. Tom Delayne, founder and CEO, has been disappointed with the operating results and the profit margin for the last two years. Business forms are mostly a “commodity” business with low profit margins. To increase profit margins and gain competitive advantages, Delayne introduced “Desk-Top Delivery” service. The business seems to be as busy as ever. Yet, the operating income has been declining. To help identify the root cause of declining profits, he decided to analyze the profitability of two of the firm’s major customers: Omega International (OI) and City of Albion (CA).

According to the customer profitability analysis that Boston Depot conducts regularly, Boston Depot has the same amount of total sales with both OI and CA. However, the firm earns a higher gross margin and gross margin ratio from CA than those from the sales to OI, as demonstrated here:

Customer Profitability Analysis		
	Omega International	City of Albion
Sales	\$ 80,000	\$ 80,000
Product cost	(50,000)	(48,000)
Service fees (17.5% of sales)	(14,000)	(14,000)
Gross margin	<u>\$ 16,000</u>	<u>\$ 18,000</u>
Gross margin percent	20%	22.5%

Boston Depot adds a flat 17.5 percent to all sales for expenses incurred in such activities as handling customers’ requests, pick-packing, order delivery, warehousing, and data entry. However, not all customers require the same level of services. Operation Manager, Jamie Steel, points out that CA has been a much heavier service user than OI. She shows the following data to support her belief:

Distribution Services Activities for OI and CA		
	OI	CA
Number of requisitions	300	700
Requisition line (all pick-packing)	900	2,100
Average number of cartons in warehouse	50	500
Number of miles per delivery	5	6

Controller Rod Jay has been investigating ways to determine the costs of performing various activities. He summarized his findings:

Activity	Total Estimated Annual Expense	Cost Driver	Estimated Annual Activity Level
Requisitions handling	\$3,000,000	Requisitions	300,000
Warehouse	1,050,000	Number of cartons	70,000
Pick-packing	900,000	Pick-pack lines	600,000
Data entry	600,000	Pick-pack lines	600,000
Delivery charge	\$10 per requisition (delivery) plus \$0.30 per mile		

Steel points out that activities cost money. Two customers who request different service activities most likely are not costing the firm the same.

Required

- Using activity-based costing, compute the charges per unit of service activities.
- Using activity-based costing, compute the total distribution costs for each of the customers.
- Is the City of Albion a more profitable customer?
- Is Omega International a better customer for Boston Depot?

5-64 **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 2006 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	<u>\$ 127</u>	<u>\$ 92</u>	<u>\$ (24)</u>	<u>\$ 195</u>

Miami Valley accumulates overhead items in one overhead pool and allocates it to the branches based on direct labor dollars. For 2006, 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 2006 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
	<u>\$1,261,000</u>

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

(Continued)



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.

5-65 **Customer Profitability Analysis** Spring Company collected the following data pertaining to its activities with selected customers.

	HS Inc.	Adventix	Baldwin
Total sales	\$600,000	\$750,000	\$900,000
Sales discount	2%	3%	2%
Sales terms	2/10, n/30	1/15, n/60	2/10, n/eom
Shipping terms	FOB Shipping point	FOB Destination	FOB Destination
Sales returns	2%	1%	3%
Number of orders	10	5	50
Units per order	100	250	30
Expedited order	0	2	5
Sales visits	1	1	2
Number of sales returns	3	4	10

Spring Company mails monthly statements on or before the first day of each month. HS pays all of its account payables within the cash discount periods. Baldwin does not take advantage of cash discounts. However, it pays its accounts on the specified due dates. Adventix pays half of its accounts on the date that these accounts are due and pays the remainder at the end of the following month. Joan Lieberman, the controller of Spring Company, has estimated that the cost of working capital is approximately 2 percent per month.

Lieberman also gathered the following cost data:

Activity	Cost Driver and Rate
Order taking	\$ 50 per order
Order processing	\$ 75 per order
Delivery	\$300 per delivery
Expedited orders	\$500 per order
Restocking	\$ 10 per unit plus \$200 per return
Sales visits	\$800 per visit

Required Prepare and interpret a customer profitability analysis for Spring Company. How does it help Spring Company become more competitive and profitable?

Solution to Self-Study Problem

Volume-Based Costing Versus ABC

1. Volume-based costing system

Stage 1 Allocation	
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		
	Per Unit Cost	
	Deluxe	Regular
Overhead allocated to		
Department A		
$(\$200,000/20,000) \times 2 =$	\$ 20	
$(\$200,000/20,000) \times 2 =$		\$ 20
Department B		
$(\$800,000/10,000) \times 1 =$	80	
$(\$800,000/10,000) \times 1 =$		80
Total	<u>\$100</u>	<u>\$100</u>

Product cost per unit:

	Deluxe	Regular
Direct materials	\$100	\$ 50
Direct labor		
$\$25 \times (2 + 1) =$	75	
$\$20 \times (2 + 1) =$		60
Factory overhead	<u>100</u>	<u>100</u>
Unit cost	<u>\$275</u>	<u>\$210</u>

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
Number of setups	400,000	500	800
Number of units	588,000	19,600	30
Number of shipments	<u>5,000</u>	250	20
	<u>\$1,000,000</u>		

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	<u>\$27,300</u>	<u>\$66,400</u>
Unit overhead cost	\$136.50	\$ 83
Product cost per unit		
Direct materials	\$ 100	\$ 50
Direct labor	75	60
Factory overhead	<u>136.50</u>	<u>83</u>
Unit cost	<u>\$311.50</u>	<u>\$ 193</u>

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