

## ► Learning Objectives

1. Identify four purposes for allocating costs to cost objects
2. Understand criteria to guide cost-allocation decisions
3. Discuss decisions faced when collecting costs in indirect-cost pools
4. Discuss why a company's revenues and costs can differ across customers
5. Identify the importance of customer-profitability profiles
6. Subdivide the sales-volume variance into the sales-mix variance and the sales-quantity variance

## Companies desperately want to make their customers happy.

But how far should they go to please them, and at what price? At what point are you better off not doing business with some customers at all? The following article explains why it's so important for managers to be able to figure out how profitable each of their customers is.

## Minding the Store: Analyzing Customers, Best Buy Decides Not All Are Welcome<sup>1</sup>

As the former CEO of Best Buy, Brad Anderson decided to implement a rather unorthodox approach to retail: to separate his 1.5 million daily customers into “angels” and “devils.”

The angels, customers who increase profits by purchasing high-definition televisions, portable electronics, and newly released DVDs without waiting for markdowns or rebates, are favored over the devils, who buy products, apply for rebates, return the purchases, and then buy them back at returned-merchandise discounts. These devils focus their spending on “loss leaders,” discounted merchandise designed to encourage store traffic, but then flip the goods at a profit on sites like eBay.com.

Best Buy found that its most desirable customers fell into five distinct groups: upper-income men, suburban mothers, small-business owners, young family men, and technology enthusiasts. Male technology enthusiasts, nicknamed Buzzes, are early adopters, interested in buying and showing off the latest gadgets. Each store analyzes the demographics of its local market, and then focuses on two of these groups. For example, at stores popular with Buzzes, Best Buy sets up videogame areas with leather chairs and game players hooked to mammoth, plasma-screen televisions.

Best Buy also began working on ways to deter customers who drove profits down. It couldn't bar them from its stores. Starting in 2004, however, it began taking steps to put a stop to their most damaging practices by enforcing a restocking fee of 15% of the purchase price on returned merchandise. To discourage customers who return items with the intention of repurchasing them at an “open-box” discount, Best Buy started reselling the returned items

<sup>1</sup> Sources: Bustillo, Miguel. 2009. Best Buy confronts newer nemesis. *Wall Street Journal*, March 16; McWilliams, Gary. 2004. Minding the store: Analyzing customers, Best Buy decides not all are welcome. *Wall Street Journal*, November 8.

over the Internet, so the goods didn't reappear in the store where they were originally purchased.

This strategy stimulated growth for several years at Best Buy and helped the company survive the economic downturn while Circuit City, its leading competitor, went bankrupt. But Best Buy's angels and devils strategy now must confront a new competitor, Walmart. With Walmart's focus on consumers seeking no-frills bargains, Best Buy intends to match its new competitor's prices while leveraging its tech-savvy sales force to help consumers navigate increasingly complicated technology.

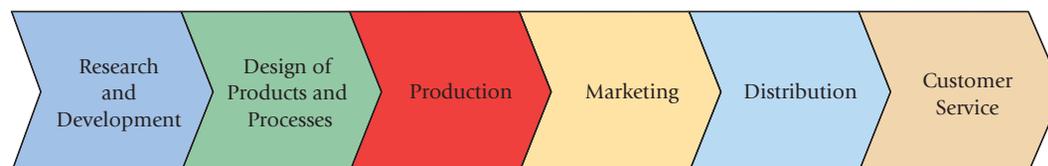
To determine which product, customer, program, or department is profitable, organizations must decide how to allocate costs. Best Buy analyzed its operations and chose to allocate costs towards serving its most profitable customers. In this chapter and the next, we provide insight into cost allocation. The emphasis in this chapter is on macro issues in cost allocation: allocation of costs into divisions, plants, and customers. Chapter 15 describes micro issues in cost allocation—allocating support-department costs to operating departments and allocating costs to various cost objects—as well as revenue allocations.



## Purposes of Cost Allocation

Recall that *indirect costs* of a particular cost object are costs that are related to that cost object but cannot be traced to it in an economically feasible (cost-effective) way. These costs often comprise a large percentage of the overall costs assigned to such cost objects as products, customers, and distribution channels. Why do managers allocate indirect costs to these cost objects? Exhibit 14-1 illustrates four purposes of cost allocation.

Different sets of costs are appropriate for different purposes described in Exhibit 14-1. Consider costs in different business functions of the value chain illustrated as follows:



For some decisions related to the economic-decision purpose (for example, long-run product pricing), the costs in all six functions are relevant. For other decisions, particularly short-run economic decisions (for example, make or buy decisions), costs from only one or two functions, such as design and manufacturing, might be relevant.

### Learning Objective 1

Identify four purposes for allocating costs to cost objects

... to provide information for decisions, motivate managers, justify costs, and measure income

**Exhibit 14-1****Purposes of Cost Allocation**

<b>Purpose</b>	<b>Examples</b>
1. To provide information for economic decisions	To decide whether to add a new airline flight To decide whether to manufacture a component part of a television set or to purchase it from another manufacturer To decide on the selling price for a customized product or service To evaluate the cost of available capacity used to support different products
2. To motivate managers and other employees	To encourage the design of products that are simpler to manufacture or less costly to service To encourage sales representatives to emphasize high-margin products or services
3. To justify costs or compute reimbursement amounts	To cost products at a “fair” price, often required by law and government defense contracts To compute reimbursement for a consulting firm based on a percentage of the cost savings resulting from the implementation of its recommendations
4. To measure income and assets	To cost inventories for reporting to external parties To cost inventories for reporting to tax authorities

For the motivation purpose, costs from more than one but not all business functions are often included to emphasize to decision makers how costs in different functions are related to one another. For example, to estimate product costs, product designers at companies such as Hitachi and Toshiba include costs of production, distribution, and customer service. The goal is to focus designers’ attention on how different product-design alternatives affect total costs.

For the cost-reimbursement purpose, a particular contract will often stipulate what costs will be reimbursed. For instance, cost-reimbursement rules for U.S. government contracts explicitly exclude marketing costs.

For the purpose of income and asset measurement for reporting to external parties under GAAP, only manufacturing costs, and in some cases product-design costs, are inventoriable and allocated to products. In the United States, R&D costs in most industries, marketing, distribution, and customer-service costs are period costs that are expensed as they are incurred. Under International Financial Reporting Standards (IFRS), research costs must be expensed as incurred but development costs must be capitalized if a product/process has reached technical feasibility and the firm has the intention and ability to use or sell the future asset.

**Decision Point**

What are four purposes for allocating costs to cost objects?

**Learning Objective 2**

Understand criteria to guide cost-allocation decisions

... such as identifying factors that cause resources to be consumed

**Criteria to Guide Cost-Allocation Decisions**

After identifying the purposes of cost allocation, managers and management accountants must decide how to allocate costs.

Exhibit 14-2 presents four criteria used to guide cost-allocation decisions. These decisions affect both the number of indirect-cost pools and the cost-allocation base for each indirect-cost pool. We emphasize the superiority of the cause-and-effect and the benefits-received criteria, especially when the purpose of cost allocation is to provide information for economic decisions or to motivate managers and employees.<sup>2</sup> Cause and effect is the primary criterion used in activity-based costing (ABC) applications. ABC systems use the concept of a cost hierarchy to identify the cost drivers that best demonstrate the cause-and-effect relationship between each activity and the costs in the related cost pool. The cost drivers are then chosen as cost-allocation bases.

Fairness and ability-to-bear are less-frequently-used and more problematic criteria than cause-and-effect or benefits-received. Fairness is a difficult criterion on which to

<sup>2</sup> The Federal Accounting Standards Advisory Board (which sets standards for management accounting for U.S. government departments and agencies) recommends the following: “Cost assignments should be performed by: (a) directly tracing costs whenever feasible and economically practicable, (b) assigning costs on a cause-and-effect basis, and (c) allocating costs on a reasonable and consistent basis” (FASAB, 1995, p. 12).

## Exhibit 14-2

## Criteria for Cost-Allocation Decisions

- 1. Cause and Effect.** Using this criterion, managers identify the variables that cause resources to be consumed. For example, managers may use hours of testing as the variable when allocating the costs of a quality-testing area to products. Cost allocations based on the cause-and-effect criterion are likely to be the most credible to operating personnel.
- 2. Benefits Received.** Using this criterion, managers identify the beneficiaries of the outputs of the cost object. The costs of the cost object are allocated among the beneficiaries in proportion to the benefits each receives. Consider a corporatwide advertising program that promotes the general image of the corporation rather than any individual product. The costs of this program may be allocated on the basis of division revenues; the higher the revenues, the higher the division's allocated cost of the advertising program. The rationale behind this allocation is that divisions with higher revenues apparently benefited from the advertising more than divisions with lower revenues and, therefore, ought to be allocated more of the advertising costs.
- 3. Fairness or Equity.** This criterion is often cited in government contracts when cost allocations are the basis for establishing a price satisfactory to the government and its suppliers. Cost allocation here is viewed as a "reasonable" or "fair" means of establishing a selling price in the minds of the contracting parties. For most allocation decisions, fairness is a matter of judgment rather than an operational criterion.
- 4. Ability to Bear.** This criterion advocates allocating costs in proportion to the cost object's ability to bear costs allocated to it. An example is the allocation of corporate executive salaries on the basis of division operating income. The presumption is that the more-profitable divisions have a greater ability to absorb corporate headquarters' costs.

obtain agreement. What one party views as fair, another party may view as unfair.<sup>3</sup> For example, a university may view allocating a share of general administrative costs to government contracts as fair because general administrative costs are incurred to support all activities of the university. The government may view the allocation of such costs as unfair because the general administrative costs would have been incurred by the university regardless of whether the government contract existed. Perhaps the fairest way to resolve this issue is to understand, as well as possible, the cause-and-effect relationship between the government contract activity and general administrative costs. In other words, fairness is more a matter of judgment than an easily implementable choice criterion.

To get a sense of the issues that arise when using the ability-to-bear criterion, consider a product that consumes a large amount of indirect costs and currently sells for a price below its direct costs. This product has no ability to bear any of the indirect costs it uses. However, if the indirect costs it consumes are allocated to other products, these other products are subsidizing the product that is losing money. An integrated airline, for example, might allocate fewer costs to its activities in a highly contested market such as freight transportation, thereby subsidizing it via passenger transport. Some airports cross-subsidize costs associated with serving airline passengers through sales of duty-free goods. Such practices provide a distorted view of relative product and service profitability, and have the potential to invite both regulatory scrutiny as well as competitors attempting to undercut artificially higher-priced services.

Most importantly, companies must weigh the costs and benefits when designing and implementing their cost allocations. Companies incur costs not only in collecting data but also in taking the time to educate managers about cost allocations. In general, the more complex the cost allocations, the higher these education costs.

The costs of designing and implementing complex cost allocations are highly visible. Unfortunately, the benefits from using well-designed cost allocations, such as enabling managers to make better-informed sourcing decisions, pricing decisions, cost-control decisions, and so on, are difficult to measure. Nevertheless, when making cost allocations, managers should consider the benefits as well as the costs. As costs of collecting and processing information decrease, companies are building more-detailed cost allocations.

<sup>3</sup> Kaplow and Shavell, in a review of the legal literature, note that "notions of fairness are many and varied. They are analyzed and rationalized by different writers in different way, and they also typically depend upon the circumstances under consideration. Accordingly, it is not possible to identify and consensus view on these notions..." See L. Kaplow and S. Shavell, "Fairness Versus Welfare," *Harvard Law Review* (February 2001); and L. Kaplow and S. Shavell, *Fairness Versus Welfare* (Boston: Harvard University Press, 2002).

## Decision Point

What criteria should managers use to guide cost-allocation decisions?

## Learning Objective 3

Discuss decisions faced when collecting costs in indirect-cost pools

... determining the number of cost pools and the costs to be included in each cost pool

## Cost Allocation Decisions

In this section, we focus on the first purpose of cost allocation: to provide information for economic decisions, such as pricing, by measuring the full costs of delivering products based on an ABC system.

Chapter 5 described how ABC systems define indirect-cost pools for different activities and use cost drivers as allocation bases to assign costs of indirect-cost pools to products (the second stage of cost allocation). In this section, we focus on the first stage of cost allocation, the assignment of costs to indirect-cost pools.

We will use Consumer Appliances, Inc. (CAI), to illustrate how costs incurred in different parts of a company can be assigned, and then reassigned, for costing products, services, customers, or contracts. CAI has two divisions; each has its own manufacturing plant. The refrigerator division has a plant in Minneapolis, and the clothes dryer division has a plant in St. Paul. CAI's headquarters is in a separate location in Minneapolis. Each division manufactures and sells multiple products that differ in size and complexity.

CAI's management team collects costs at the following levels:

- **Corporate costs**—There are three major categories of corporate costs:
  1. **Treasury costs**—\$900,000 of costs incurred for financing the construction of new assembly equipment in the two divisions. The cost of new assembly equipment is \$5,200,000 in the refrigerator division and \$3,800,000 in the clothes dryer division.
  2. **Human resource management costs**—recruitment and ongoing employee training and development, \$1,600,000.
  3. **Corporate administration costs**—executive salaries, rent, and general administration costs, \$5,400,000.
- **Division costs**—Each division has two direct-cost categories (direct materials and direct manufacturing labor) and seven indirect-cost pools—one cost pool each for the five activities (design, setup, manufacturing, distribution, and administration), one cost pool to accumulate facility costs, and one cost pool for the allocated corporate treasury costs. Exhibit 14-3 presents data for six of the division indirect-cost pools and cost-allocation bases. (In a later section, we describe how corporate treasury

### Exhibit 14-3

Division Indirect-Cost Pools and Cost-Allocation Bases, CAI, for Refrigerator Division (R) and Clothes Dryer Division (CD)

Division Indirect-Cost Pools	Example of Costs	Total Indirect Costs	Cost Hierarchy Category	Cost-Allocation Base	Cause-and-Effect Relationship That Motivates Management's Choice of Allocation Base
Design	Design engineering salaries	(R) \$6,000,000 (CD) 4,250,000	Product sustaining	Parts times cubic feet	Complex products (more parts and larger size) require greater design resources.
Setup of machines	Setup labor and equipment cost	(R) \$3,000,000 (CD) 2,400,000	Batch level	Setup-hours	Overhead costs of the setup activity increase as setup-hours increase.
Manufacturing operations	Plant and equipment, energy	(R) \$25,000,000 (CD) 18,750,000	Output unit level	Machine-hours	Manufacturing-operations overhead costs support machines and, hence, increase with machine usage.
Distribution	Shipping labor and equipment	(R) \$8,000,000 (CD) 5,500,000	Output unit level	Cubic feet	Distribution-overhead costs increase with cubic feet of product shipped.
Administration	Division executive salaries	(R) \$1,000,000 (CD) 800,000	Facility sustaining	Revenues	Weak relationship between division executive salaries and revenues, but justified by CAI on a benefits-received basis.
Facility	Annual building and space costs	(R) \$4,500,000 (CD) 3,500,000	All	Square feet	Facility costs increase with square feet of space.

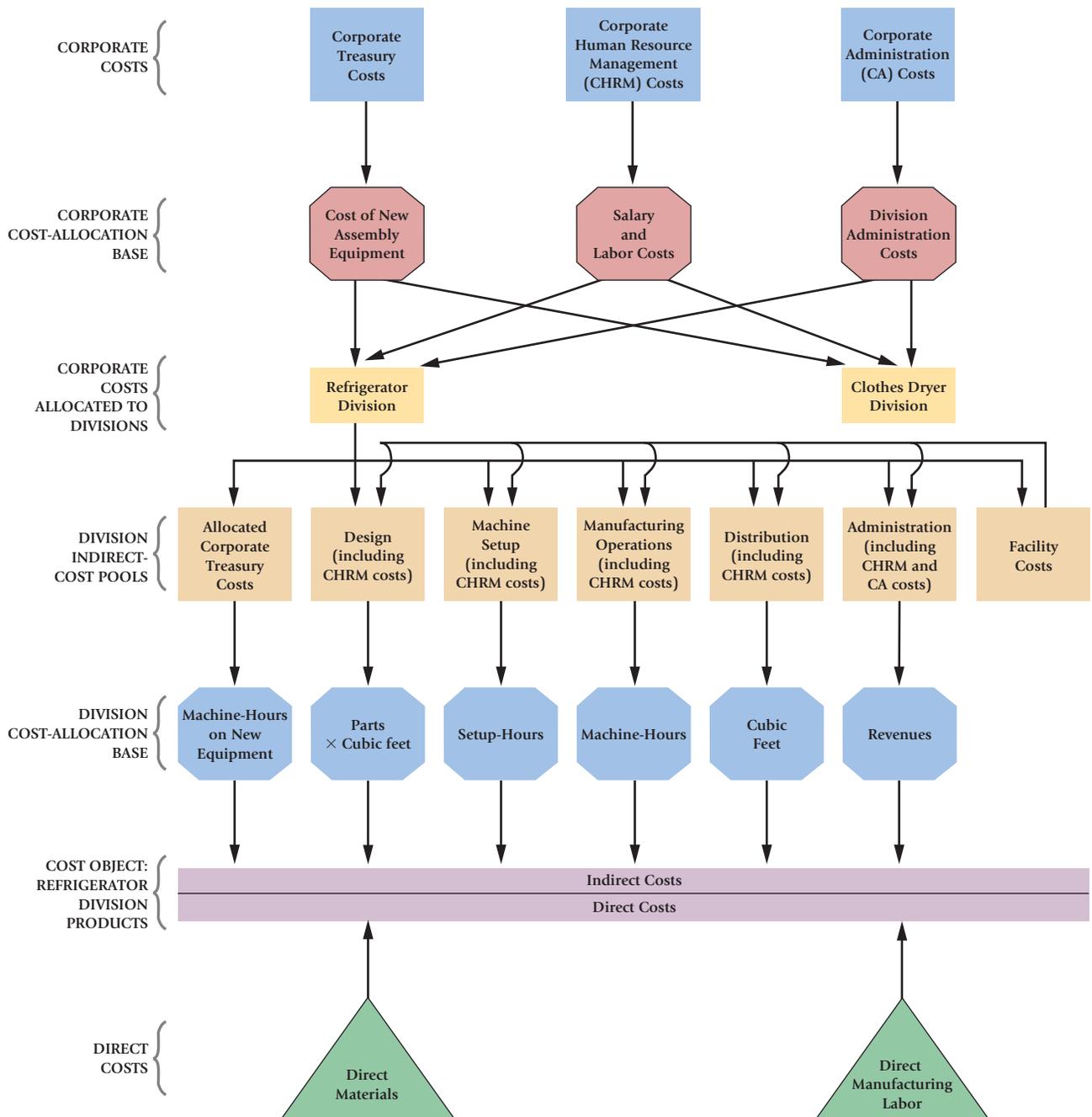
costs are allocated to each division to create the seventh division indirect-cost pool.) CAI identifies the cost hierarchy category for each cost pool: output-unit level, batch level, product sustaining level, and facility-sustaining level (as described in Chapter 5, p. 149).

Exhibit 14-4 presents an overview diagram of the allocation of corporate and division indirect costs to products of the refrigerator division. Note: The clothes dryer division has its own seven indirect-cost pools used to allocate costs to products. These cost pools and cost-allocation bases parallel the indirect-cost pools and allocation bases for the refrigerator division.

Look first at the middle row of the exhibit, where you see “Division Indirect-Cost Pools,” and scan the lower half. It is similar to Exhibit 5-3 (p. 150), which illustrates ABC

**Exhibit 14-4**

Overview Diagram of Allocation of Corporate and Division Indirect Costs to Products of the Refrigerator Division, CAI



systems using indirect-cost pools and cost drivers for different activities. A major difference in the lower half of Exhibit 14-4 is the cost pool called Facility Costs (far right, middle row), which accumulates all annual costs of buildings and furnishings (such as depreciation) incurred in the division. The arrows in Exhibit 14-4 indicate that CAI allocates facility costs to the five activity-cost pools. Recall from Exhibit 14-3 that CAI uses square feet area required for various activities (design, setup, manufacturing, distribution, and administration) to allocate these facility costs. These activity-cost pools then include the costs of the building and facilities needed to perform the various activities.

The costs in the six remaining indirect-cost pools (that is, after costs of the facility cost pool have been allocated to other cost pools) are allocated to products on the basis of cost drivers described in Exhibit 14-3. These cost drivers are chosen as the cost-allocation bases because there is a cause-and-effect relationship between the cost drivers and the costs in the indirect-cost pool. A cost rate per unit is calculated for each cost-allocation base. Indirect costs are allocated to products on the basis of the total quantity of the cost allocation base for each activity used by the product.

Next focus on the upper half of Exhibit 14-4: how corporate costs are allocated to divisions and then to indirect-cost pools.

Before getting into the details of the allocations, let's first consider some broader choices that CAI faces regarding the allocation of corporate costs.

## Allocating Corporate Costs to Divisions and Products

CAI's management team has several choices to make when accumulating and allocating corporate costs to divisions.

1. Which corporate-cost categories should CAI allocate as indirect costs of the divisions? Should CAI allocate all corporate costs or only some of them?
  - Some companies allocate all corporate costs to divisions because corporate costs are incurred to support division activities. Allocating all corporate costs motivates division managers to examine how corporate costs are planned and controlled. Also, companies that want to calculate the full cost of products must allocate all corporate costs to indirect-cost pools of divisions.
  - Other companies do not allocate corporate costs to divisions because these costs are not controllable by division managers.
  - Still other companies allocate only those corporate costs, such as corporate human resources, that are widely perceived as causally related to division activities or that provide explicit benefits to divisions. These companies exclude corporate costs such as corporate donations to charitable foundations because division managers often have no say in making these decisions and because the benefits to the divisions are less evident or too remote. If a company decides not to allocate some or all corporate costs, this results in total company profitability being less than the sum of individual division or product profitabilities.

For some decision purposes, allocating some but not all corporate costs to divisions may be the preferred alternative. Consider the performance evaluation of division managers. The controllability notion (see p. 200) is frequently used to justify excluding some corporate costs from division reports. For example, salaries of the top management at corporate headquarters are often excluded from responsibility accounting reports of division managers. Although divisions tend to benefit from these corporate costs, division managers argue they have no say in ("are not responsible for") how much of these corporate resources they use or how much they cost. The contrary argument is that full allocation is justified because the divisions receive benefits from all corporate costs.

2. When allocating corporate costs to divisions, should CAI allocate only costs that vary with division activity or should the company assign fixed costs as well? Companies allocate both variable and fixed costs to divisions and then to products, because the resulting product costs are useful for making long-run strategic decisions, such as which products to sell and at what price. To make good long-run decisions, managers

need to know the cost of all resources (whether variable or fixed) required to produce products. Why? Because in the long run, firms can manage the levels of virtually all of their costs; very few costs are truly fixed. Moreover, to survive and prosper in the long run, firms must ensure that the prices charged for products exceed the total resources consumed to produce them, regardless of whether these costs are variable or fixed in the short run.

Companies that allocate corporate costs to divisions must carefully identify relevant costs for specific decisions. Suppose a division is profitable before any corporate costs are allocated but “unprofitable” after allocation of corporate costs. Should the division be closed down? The relevant corporate costs in this case are not the allocated corporate costs but those corporate costs that will be saved if the division is closed. If division profits exceed the relevant corporate costs, the division should not be closed.

3. If CAI allocates corporate costs to divisions, how many cost pools should it use? One extreme is to aggregate all corporate costs into a single cost pool. The other extreme is to have numerous individual corporate cost pools. As discussed in Chapter 5, a major consideration is to construct **homogeneous cost pools** so that all of the costs in the cost pool have the same or a similar cause-and-effect or benefits-received relationship with the cost-allocation base.

For example, when allocating corporate costs to divisions, CAI can combine corporate administration costs and corporate human-resource-management costs into a single cost pool if both cost categories have the same or similar cause-and-effect relationship with the same cost-allocation base (such as the number of employees in each division). If, however, each cost category has a cause-and-effect relationship with a different cost-allocation base (for example, number of employees in each division affects corporate human-resource-management costs, whereas revenues of each division affect corporate administration costs), CAI will prefer to maintain separate cost pools for each of these costs. Determining homogeneous cost pools requires judgment and should be revisited on a regular basis.

The benefit of using a multiple cost-pool system must be balanced against the costs of implementing it. Advances in information-gathering technology make it more likely that multiple cost-pool systems will pass the cost-benefit test.

## Implementing Corporate Cost Allocations

After much discussion and debate, CAI’s management team chooses to allocate all corporate costs to divisions. We now illustrate the allocation of corporate costs to divisions in CAI’s ABC system.

The demands for corporate resources by the refrigerator division and the clothes dryer division depend on the demands that each division’s products place on these resources. The top half of Exhibit 14-4 graphically represents the allocations.

1. CAI allocates treasury costs to each division on the basis of the cost of new assembly equipment installed in each division (the cost driver of treasury costs). It allocates the \$900,000 of treasury costs as follows (using information from p. 506):

$$\text{Refrigerator Division: } \$900,000 \times \frac{\$5,200,000}{\$5,200,000 + \$3,800,000} = \$520,000$$

$$\text{Clothes Dryer Division: } \$900,000 \times \frac{\$3,800,000}{\$5,200,000 + \$3,800,000} = \$380,000$$

Each division then creates a *separate cost pool* consisting of the allocated corporate treasury costs and reallocates these costs to products on the basis of machine-hours used on the new equipment. Treasury costs are an output unit-level cost because they represent resources used on activities performed on each individual unit of a product.

2. CAI’s analysis indicates that the demand for corporate human resource management (CHRM) costs for recruitment and training varies with total salary and labor costs in

each division. Suppose salary and labor costs are \$44,000,000 in the refrigerator division and \$36,000,000 in the clothes dryer division. Then CHRM costs are allocated to the divisions as follows:

$$\text{Refrigerator Division: } \$1,600,000 \times \frac{\$44,000,000}{\$44,000,000 + \$36,000,000} = \$880,000$$

$$\text{Clothes Dryer Division: } \$1,600,000 \times \frac{\$36,000,000}{\$44,000,000 + \$36,000,000} = \$720,000$$

Each division reallocates the CHRM costs allocated to it to the indirect-cost pools—design, machine setup, manufacturing operations, distribution, and division administration (the allocated-corporate-treasury cost pool and the facility costs pool have no salary and labor costs, so no CHRM costs are allocated to them)—on the basis of total salary and labor costs of each indirect-cost pool. CHRM costs that are added to division indirect-cost pools are then allocated to products using the cost driver for the respective cost pool. Therefore, CHRM costs are product-sustaining costs (for the portion of CHRM costs allocated to the design cost pool), batch-level costs (for the portion of CHRM costs allocated to the machine-setup cost pool), output unit-level costs (for the portions of CHRM costs allocated to the manufacturing-operations and distribution cost pools), and facility-sustaining costs (for the portion of CHRM costs allocated to the division-administration cost pool).

3. CAI allocates corporate administration costs to each division on the basis of division-administration costs (Exhibit 14-3 shows the amounts of division-administration costs) because corporate administration's main role is to support division administration.

$$\text{Refrigerator Division: } \$5,400,000 \times \frac{\$1,000,000}{\$1,000,000 + \$800,000} = \$3,000,000$$

$$\text{Clothes Dryer Division: } \$5,400,000 \times \frac{\$800,000}{\$1,000,000 + \$800,000} = \$2,400,000$$

Each division adds the allocated corporate-administration costs to the division-administration cost pool. The costs in this cost pool are facility-sustaining costs and do not have a cause-and-effect relationship with individual products produced and sold by each division. CAI's policy, however, is to allocate all costs to products so that CAI's division managers become aware of all costs incurred at CAI in their pricing and other decisions. It allocates the division-administration costs (including allocated corporate-administration costs) to products on the basis of product revenues (a benefits-received criterion).

The issues discussed in this section regarding divisions and products apply nearly identically to customers, as we shall show next. *Instructors and students who, at this point, want to explore more-detailed issues in cost allocation rather than focusing on how activity-based costing extends to customer profitability can skip ahead to Chapter 15.*

### Decision Point

What are two key decisions managers must make when collecting costs in indirect-cost pools?

### Learning Objective 4

Discuss why a company's revenues and costs can differ across customers

... revenues can differ because of differences in the quantity purchased and the price discounts given, while costs can differ because different customers place different demands on a company's resources

## Customer-Profitability Analysis

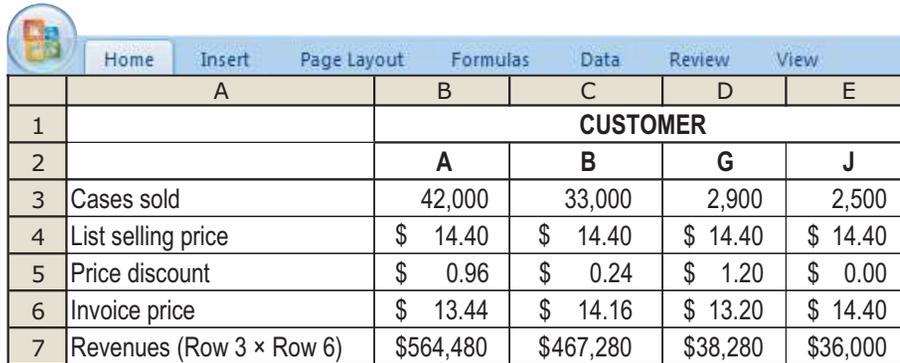
**Customer-profitability analysis** is the reporting and assessment of revenues earned from customers and the costs incurred to earn those revenues. An analysis of customer differences in revenues and costs can provide insight into why differences exist in the operating income earned from different customers. Managers use this information to ensure that customers making large contributions to the operating income of a company receive a high level of attention from the company.

Consider Spring Distribution Company, which sells bottled water. It has two distribution channels: (1) a wholesale distribution channel, in which the wholesaler sells to supermarkets, drugstores, and other stores, and (2) a retail distribution channel for a small number of business customers. We focus mainly on customer-profitability analysis in Spring's retail distribution channel. The list selling price in this channel is \$14.40 per case

(24 bottles). The full cost to Spring is \$12 per case. If every case is sold at list price in this distribution channel, Spring would earn a gross margin of \$2.40 per case.

## Customer-Revenue Analysis

Consider revenues from 4 of Spring's 10 retail customers in June 2012:



	A	B	C	D	E
1	<b>CUSTOMER</b>				
2		<b>A</b>	<b>B</b>	<b>G</b>	<b>J</b>
3	Cases sold	42,000	33,000	2,900	2,500
4	List selling price	\$ 14.40	\$ 14.40	\$ 14.40	\$ 14.40
5	Price discount	\$ 0.96	\$ 0.24	\$ 1.20	\$ 0.00
6	Invoice price	\$ 13.44	\$ 14.16	\$ 13.20	\$ 14.40
7	Revenues (Row 3 × Row 6)	\$564,480	\$467,280	\$38,280	\$36,000

Two variables explain revenue differences across these four customers: (1) the number of cases they purchased and (2) the magnitude of price discounting. A **price discount** is the reduction in selling price below list selling price to encourage customers to purchase more. Companies that record only the final invoice price in their information system cannot readily track the magnitude of their price discounting.<sup>4</sup>

Price discounts are a function of multiple factors, including the volume of product purchased (higher-volume customers receive higher discounts) and the desire to sell to a customer who might help promote sales to other customers. Discounts could also be because of poor negotiating by a salesperson or the unwanted effect of an incentive plan based only on revenues. At no time should price discounts run afoul of the law by way of price discrimination, predatory pricing, or collusive pricing (pp. 451–452).

Tracking price discounts by customer and by salesperson helps improve customer profitability. For example, Spring Distribution may decide to strictly enforce its volume-based price discounting policy. It may also require its salespeople to obtain approval for giving large discounts to customers who do not normally qualify for such discounts. In addition, the company could track the future sales of customers who its salespeople have given sizable price discounts to because of their “high growth potential.” For example, Spring should track future sales to customer G to see if the \$1.20-per-case discount translates into higher future sales.

Customer revenues are one element of customer profitability. The other element that is equally important to understand is the cost of acquiring, serving, and retaining customers. We study this topic next.

## Customer-Cost Analysis

We apply to customers the cost hierarchy discussed in the previous section and in Chapter 5 (page 149). A **customer-cost hierarchy** categorizes costs related to customers into different cost pools on the basis of different types of cost drivers, or cost-allocation bases, or different degrees of difficulty in determining cause-and-effect or benefits-received relationships. Spring's ABC system focuses on customers rather than products. It has one direct cost, the cost of bottled water, and multiple indirect-cost pools. Spring identifies five categories of indirect costs in its customer-cost hierarchy:

1. **Customer output unit-level costs**—costs of activities to sell each unit (case) to a customer. An example is product-handling costs of each case sold.

<sup>4</sup> Further analysis of customer revenues could distinguish gross revenues from net revenues. This approach highlights differences across customers in sales returns. Additional discussion of ways to analyze revenue differences across customers is in R. S. Kaplan and R. Cooper, *Cost and Effect* (Boston, MA: Harvard Business School Press, 1998, Chapter 10); and G. Cokins, *Activity-Based Cost Management: An Executive's Guide* (New York: John Wiley & Sons, 2001, Chapter 3).

2. **Customer batch-level costs**—costs of activities related to a group of units (cases) sold to a customer. Examples are costs incurred to process orders or to make deliveries.
3. **Customer-sustaining costs**—costs of activities to support individual customers, regardless of the number of units or batches of product delivered to the customer. Examples are costs of visits to customers or costs of displays at customer sites.
4. **Distribution-channel costs**—costs of activities related to a particular distribution channel rather than to each unit of product, each batch of product, or specific customers. An example is the salary of the manager of Spring's retail distribution channel.
5. **Corporate-sustaining costs**—costs of activities that cannot be traced to individual customers or distribution channels. Examples are top-management and general-administration costs.

Note from these descriptions that four of the five levels of Spring's cost hierarchy closely parallel the cost hierarchy described in Chapter 5, except that Spring focuses on *customers* whereas the cost hierarchy in Chapter 5 focused on *products*. Spring has one additional cost hierarchy category, distribution-channel costs, for the costs it incurs to support its wholesale and retail distribution channels.

## Customer-Level Costs

Spring is particularly interested in analyzing *customer-level indirect costs*—costs incurred in the first three categories of the customer-cost hierarchy: customer output-unit-level costs, customer batch-level costs, and customer-sustaining costs. Spring wants to work with customers to reduce these costs. It believes customer actions will have less impact on distribution-channel and corporate-sustaining costs. The following table shows five activities (in addition to cost of goods sold) that Spring identifies as resulting in customer-level costs. The table indicates the cost drivers and cost-driver rates for each activity, as well as the cost-hierarchy category for each activity.

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	G	H	I	J
1	Activity Area	Cost Driver and Rate		Cost-Hierarchy Category
2	Product handling	\$0.50	per case sold	Customer output-unit-level costs
3	Order taking	\$ 100	per purchase order	Customer batch-level costs
4	Delivery vehicles	\$ 2	per delivery mile traveled	Customer batch-level costs
5	Rush deliveries	\$ 300	per expedited delivery	Customer batch-level costs
6	Visits to customers	\$ 80	per sales visit	Customer-sustaining costs

Information on the quantity of cost drivers used by each of four customers is as follows:

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	A	B	C	D	E
10	CUSTOMER				
11	A	B	G	J	
12	Number of purchase orders	30	25	15	10
13	Number of deliveries	60	30	20	15
14	Miles traveled per delivery	5	12	20	6
15	Number of rush deliveries	1	0	2	0
16	Number of visits to customers	6	5	4	3

Exhibit 14-5 shows a customer-profitability analysis for the four retail customers using information on customer revenues previously presented (p. 511) and customer-level costs from the ABC system.

Spring Distribution can use the information in Exhibit 14-5 to work with customers to reduce the quantity of activities needed to support them. Consider a comparison of customer G and customer A. Customer G purchases only 7% of the cases that customer A purchases (2,900 versus 42,000). Yet, compared with customer A, customer G uses one-half as many purchase orders, two-thirds as many visits to customers, one-third as many deliveries, and twice as many rush deliveries. By implementing charges for each of these services, Spring might be able to induce customer G to make fewer but larger purchase orders, and require fewer customer visits, deliveries, and rush deliveries while looking to increase sales in the future.

Consider Owens and Minor, a distributor of medical supplies to hospitals. It strategically prices each of its services separately. For example, if a hospital wants a rush delivery or special packaging, Owens and Minor charges the hospital an additional price for each particular service. How have Owens and Minor's customers reacted? Hospitals that value these services continue to demand and pay for them while hospitals that do not value these services stop asking for them, saving Owens and Minor some costs. Owens and Minor's pricing strategy influences customer behavior in a way that increases its revenues or decreases its costs.

The ABC system also highlights a second opportunity for cost reduction. Spring can seek to reduce the costs of each activity. For example, improving the efficiency of the ordering process (such as by having customers order electronically) can reduce costs even if customers place the same number of orders.

Exhibit 14-6 shows a monthly operating income statement for Spring Distribution. The customer-level operating income of customers A and B in Exhibit 14-5 are shown in columns 8 and 9 of Exhibit 14-6. The format of Exhibit 14-6 is based on Spring's cost hierarchy. All costs incurred to serve customers are not included in customer-level costs and therefore are not allocated to customers in Exhibit 14-6. For example, distribution-channel costs such as the salary of the manager of the retail distribution channel are not included in customer-level costs and are not allocated to customers. Instead, these costs are identified as costs of the retail channel as a whole, because Spring's management believes that changes in customer behavior will not affect distribution-channel costs. These costs will be affected only by decisions pertaining to the whole channel, such as a decision to discontinue retail distribution. Another reason Spring does not allocate distribution-channel costs to customers is motivation. Spring's managers contend that

**Exhibit 14-5**

Customer-Profitability Analysis for Four Retail Channel Customers of Spring Distribution for June 2012

					
	A	B	C	D	E
1		<b>CUSTOMER</b>			
2		<b>A</b>	<b>B</b>	<b>G</b>	<b>J</b>
3	Revenues at list price: \$14.40 × 42,000; 33,000; 2,900; 2,500	\$604,800	\$475,200	\$41,760	\$36,000
4	Price discount: \$0.96 × 42,000; \$0.24 × 33,000; \$1.20 × 2,900; \$0 × 2,500	40,320	7,920	3,480	0
5	Revenues (at actual price)	564,480	467,280	38,280	36,000
6	Cost of goods sold: \$12 × 42,000; 33,000; 2,900; 2,500	504,000	396,000	34,800	30,000
7	Gross margin	60,480	71,280	3,480	6,000
8	Customer-level operating costs				
9	Product handling \$0.50 × 42,000; 33,000; 2,900; 2,500	21,000	16,500	1,450	1,250
10	Order taking \$100 × 30; 25; 15; 10	3,000	2,500	1,500	1,000
11	Delivery vehicles \$2 × (5 × 60); (12 × 30); (20 × 20); (6 × 15)	600	720	800	180
12	Rush deliveries \$300 × 1; 0; 2; 0	300	0	600	0
13	Visits to customers \$80 × 6; 5; 4; 3	480	400	320	240
14	Total customer-level operating costs	25,380	20,120	4,670	2,670
15	Customer-level operating income	\$ 35,100	\$ 51,160	\$ (1,190)	\$ 3,330

## Exhibit 14-6

Income Statement of Spring Distribution for June 2012

CUSTOMER DISTRIBUTION CHANNELS													
Wholesale Customers													
Retail Customers													
	Total	Total	A1	A2	A3		Total	A <sup>a</sup>	B <sup>a</sup>	C			
	(1) = (2) + (7)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		
5	Revenues (at actual prices)	\$12,138,120	\$10,107,720	\$1,946,000	\$1,476,000		\$2,030,400	\$564,480	\$467,280				
6	Customer-level costs	11,633,760	9,737,280	1,868,000	1,416,000		1,896,480	529,380 <sup>b</sup>	416,120 <sup>b</sup>				
7	Customer-level operating income	504,360	370,440	\$ 78,000	\$ 60,000		133,920	\$ 35,100	\$ 51,160				
8	Distribution-channel costs	160,500	102,500				58,000						
9	Distribution-channel-level operating income	343,860	\$ 267,940				\$ 75,920						
10	Corporate-sustaining costs	263,000											
11	Operating income	\$ 80,860											
13	<sup>a</sup> Full details are presented in Exhibit 14-5.												
14	<sup>b</sup> Cost of goods sold + Total customer-level operating costs from Exhibit 14-5.												

salespersons responsible for managing individual customer accounts would lose motivation if their bonuses were affected by the allocation to customers of distribution-channel costs over which they had minimal influence.

Next, consider corporate-sustaining costs such as top-management and general-administration costs. Spring's managers have concluded that there is no cause-and-effect or benefits-received relationship between any cost-allocation base and corporate-sustaining costs. Consequently, allocation of corporate-sustaining costs serves no useful purpose in decision making, performance evaluation, or motivation. For example, suppose Spring allocated the \$263,000 of corporate-sustaining costs to its distribution channels: \$173,000 to the wholesale channel and \$90,000 to the retail channel. Using information from Exhibit 14-6, the retail channel would then show a loss of \$14,080 (\$75,920 – \$90,000).

If this same situation persisted in subsequent months, should Spring shut down the retail distribution channel? No, because if retail distribution were discontinued, corporate-sustaining costs would be unaffected. Allocating corporate-sustaining costs to distribution channels could give the misleading impression that the potential cost savings from discontinuing a distribution channel would be greater than the likely amount.

Some managers and management accountants advocate fully allocating all costs to customers and distribution channels so that (1) the sum of operating incomes of all customers in a distribution channel (segment) equals the operating income of the distribution channel and (2) the sum of the distribution-channel operating incomes equals company-wide operating income. These managers and management accountants argue that customers and products must eventually be profitable on a full-cost basis. In the previous example, CAI allocated all corporate and division-level costs to its refrigerator and clothes dryer products (see pp. 509–510). For some decisions, such as pricing, allocating all costs ensures that long-run prices are set at a level to cover the cost of all resources used to produce and sell products. Nevertheless, the value of the hierarchical format in Exhibit 14-6 is that it distinguishes among various degrees of objectivity when allocating costs, and it dovetails with the different levels at which decisions are made and performance is evaluated. The issue of when and what costs to allocate is another example of the “different costs for different purposes” theme emphasized throughout this book.

## Decision Point

How can a company's revenues and costs differ across customers?

## Learning Objective 5

Identify the importance of customer-profitability profiles

... highlight that a small percentage of customers contributes a large percentage of operating income.

## Customer-Profitability Profiles

Customer-profitability profiles provide a useful tool for managers. Exhibit 14-7 ranks Spring's 10 retail customers based on customer-level operating income. (Four of these customers are analyzed in Exhibit 14-5.)

Column 4, computed by adding the individual amounts in column 1, shows the cumulative customer-level operating income. For example, customer C has a cumulative

## Exhibit 14-7

Customer-Profitability Analysis for Retail Channel Customers: Spring Distribution, June 2012

Microsoft Excel						
Home Insert Page Layout Formulas Data Review View						
	A	B	C	D	E	F
1	<b>Customers Ranked on Customer-Level Operating Income</b>					
2						<b>Cumulative</b>
3						<b>Customer-Level</b>
4						<b>Operating Income</b>
5				<b>Customer-Level</b>	<b>Cumulative</b>	<b>as a % of Total</b>
6	<b>Retail</b>	<b>Customer-Level</b>	<b>Customer</b>	<b>Operating Income</b>	<b>Customer-Level</b>	<b>Customer-Level</b>
7	<b>Customer</b>	<b>Operating Income</b>	<b>Revenue</b>	<b>Divided by Revenue</b>	<b>Operating Income</b>	<b>Operating Income</b>
8	<b>Code</b>	<b>(1)</b>	<b>(2)</b>	<b>(3) = (1) ÷ (2)</b>	<b>(4)</b>	<b>(5) = (4) ÷ \$133,920</b>
9	B	\$ 51,160	\$ 467,280	10.9%	\$ 51,160	38%
10	A	35,100	564,480	6.2%	86,260	64%
11	C	27,070	295,640	9.2%	113,330	85%
12	D	20,580	277,000	7.4%	133,910	100%
13	F	12,504	143,500	8.7%	146,414	109%
14	J	3,330	41,000	8.1%	149,744	112%
15	E	176	123,000	0.1%	149,920	112%
16	G	-1,190	38,280	-3.1%	148,730	111%
17	H	-5,690	38,220	-14.9%	143,040	107%
18	I	-9,120	42,000	-21.7%	133,920	100%
19		<u>\$133,920</u>	<u>\$2,030,400</u>			
20						

income of \$113,330 in column 4. This \$113,330 is the sum of \$51,160 for customer B, \$35,100 for customer A, and \$27,070 for customer C.

Column 5 shows what percentage the \$113,330 *cumulative* total for customers B, A, and C is of the total customer-level operating income of \$133,920 earned in the retail distribution channel from all 10 customers. The three most profitable customers contribute 85% of total customer-level operating income. These customers deserve the highest service and priority. Companies try to keep their best customers happy in a number of ways: special phone numbers and upgrade privileges for elite-level frequent flyers, free usage of luxury hotel suites and big credit limits for high-rollers at casinos, and so on. In many companies, it is common for a small number of customers to contribute a high percentage of operating income. Microsoft uses the phrase “not all revenue dollars are endowed equally in profitability” to stress this point.

Column 3 shows the profitability per dollar of revenue by customer. This measure of customer profitability indicates that, although customer A contributes the second-highest operating income, the profitability per dollar of revenue is lower because of high price discounts. Spring’s goal is to increase profit margins for customer A by decreasing the price discounts or saving customer-level costs while maintaining or increasing sales. Customer J has a higher profit margin but has lower total sales. Spring’s challenge with customer J is to maintain margins while increasing sales.

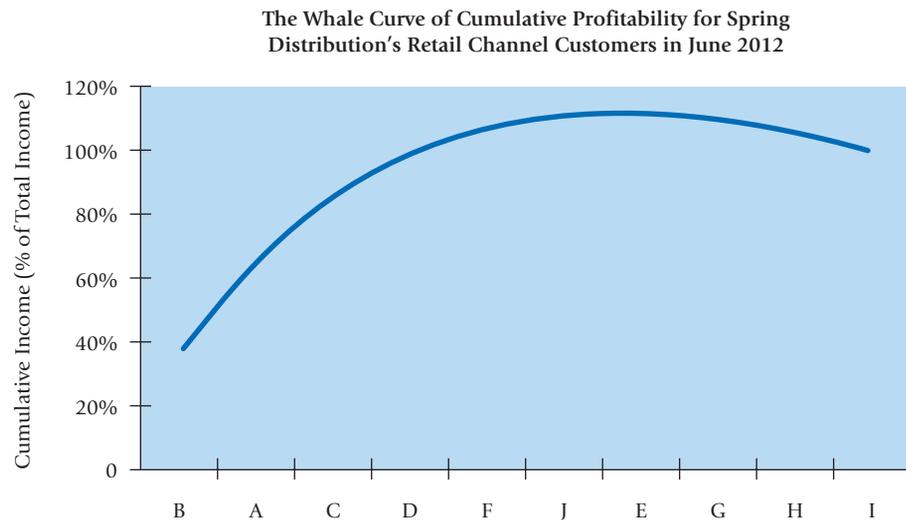
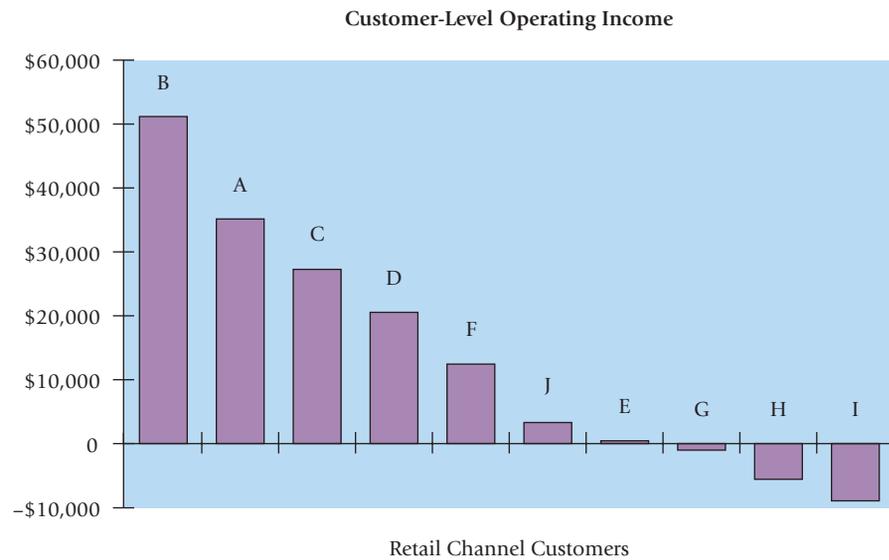
## Presenting Profitability Analysis

There are two common ways of presenting the results of customer-profitability analysis. Managers often find the bar chart presentation in Exhibit 14-8, Panel A, to be an intuitive way to visualize customer profitability. The highly profitable customers clearly stand out. Moreover, the number of “unprofitable” customers and the magnitude of their losses are apparent. A popular alternative way to express customer profitability is

**Exhibit 14-8**

Panel A: Bar Chart of Customer-Level Operating Income for Spring Distribution's Retail Channel Customers in June 2012

Panel B: The Whale Curve of Cumulative Profitability for Spring Distribution's Retail Channel Customers in June 2012



by plotting the contents of column 5 of Exhibit 14-7. This chart is called the **whale curve** since it is backward bending at the point where customers start to become unprofitable, and thus resembles a humpback whale.<sup>5</sup>

Spring's managers must explore ways to make unprofitable customers profitable. Exhibits 14-5 to 14-8 emphasize short-run customer profitability. Other factors managers should consider in deciding how to allocate resources among customers include the following:

- **Likelihood of customer retention.** The more likely a customer will continue to do business with a company, the more valuable the customer. Customers differ in their loyalty and their willingness to frequently “shop their business.”
- **Potential for sales growth.** The higher the likely growth of the customer's industry and the customer's sales, the more valuable the customer. Customers to whom a company can cross-sell other products are more desirable.
- **Long-run customer profitability.** This factor will be influenced by the first two factors specified and the cost of customer-support staff and special services required to retain customer accounts.

<sup>5</sup> In practice, the curve of the chart can be quite steep. The whale curve for cumulative profitability usually reveals that the most profitable 20% of customers generate between 150% and 300% of total profits, the middle 70% of customers break even, and the least profitable 10% of customers lose from 50% to 200% of total profits (see Robert Kaplan and V.G. Narayanan, *Measuring and Managing Customer Profitability*, *Journal of Cost Management*, Sept/Oct 2001, pp. 1–11).

- **Increases in overall demand from having well-known customers.** Customers with established reputations help generate sales from other customers through product endorsements.
- **Ability to learn from customers.** Customers who provide ideas about new products or ways to improve existing products are especially valuable.

Managers should be cautious when deciding to discontinue customers. In Exhibit 14-7, the current unprofitability of customer G, for example, may provide misleading signals about G's profitability in the long-run. Moreover, as in any ABC-based system, the costs assigned to customer G are not all variable. In the short run, it may well have been efficient for Spring to use its spare capacity to serve G on a contribution-margin basis. Discontinuing customer G will not eliminate all the costs assigned to that customer, and will leave the firm worse off than before.

Of course, particular customers might be chronically unprofitable and hold limited future prospects. Or they might fall outside a firm's target market or require unsustainably high levels of service relative to the firm's strategies and capabilities. In such cases, organizations are becoming increasingly aggressive in severing customer relationships. For example, ING Direct, the largest direct lender and fastest growing financial services organization in the United States, asks 10,000 "high maintenance" customers to close their accounts each month.<sup>6</sup> The Concepts in Action feature on page 518 provides an example of a company that is struggling with the question of how to manage its resources and profitability without affecting the satisfaction of its customers.

## Using the Five-Step Decision-Making Process to Manage Customer Profitability

The different types of customer analyses that we have just covered provide companies with key information to guide the allocation of resources across customers. Use the five-step decision-making process, introduced in Chapter 1, to think about how managers use these analyses to make customer-management decisions.

1. *Identify the problem and uncertainties.* The problem is how to manage and allocate resources across customers.
2. *Obtain information.* Managers identify past revenues generated by each customer and customer-level costs incurred in the past to support each customer.
3. *Make predictions about the future.* Managers estimate the revenues they expect from each customer and the customer-level costs they will incur in the future. In making these predictions, managers consider the effects that future price discounts will have on revenues, the effect that pricing for different services (such as rush deliveries) will have on the demand for these services by customers, and ways to reduce the cost of providing services. For example, Deluxe, Corp., a leading check printer, initiated process reductions to rein in its cost to serve customers by opening an electronic channel to shift customers from paper to automated ordering.
4. *Make decisions by choosing among alternatives.* Managers use the customer-profitability profiles to identify the small set of customers who deserve the highest service and priority. They also identify ways to make less-profitable customers (such as Spring's customer G) more profitable. Banks, for example, often impose minimum balance requirements on customers. Distribution firms may require minimum order quantities or levy a surcharge for smaller or customized orders. In making resource-allocation decisions, managers also consider long-term effects, such as the potential for future sales growth and the opportunity to leverage a particular customer account to make sales to other customers.
5. *Implement the decision, evaluate performance, and learn.* After the decision is implemented, managers compare actual results to predicted outcomes to evaluate the decision they made, its implementation, and ways in which they might improve profitability.

<sup>6</sup> See, for example, "The New Math of Customer Relationships" at <http://hbswk.hbs.edu/item/5884.html>.

**Decision Point**

How do customer-profitability profiles help managers?

## Concepts in Action

### iPhone “Apps” Challenge Customer Profitability at AT&T



AT&T is the second largest wireless provider in the United States. The company provides mobile telephone and data access to more than 85 million individuals, businesses, and government agencies. AT&T uses cost accounting to price its various wireless service plans and calculate overall profitability for its customers, including more than 10 million owners of Apple’s iPhone. AT&T is the exclusive wireless provider for the popular iPhone smart phone.

Traditionally, the cost of serving different wireless customers varied. Most business customers, for example, required reliable service during business hours and large amounts of data bandwidth for e-mail and Internet access. In contrast, many individuals use their wireless devices extensively on nights and weekends and use features such as text messages and music ringtones. Accordingly, wireless providers considered the costs for these services when developing pricing plans and calculating customer profitability. Therefore, individuals using their phone service sparingly could select a less-expensive plan with fewer minutes, for use mostly at night and on weekends, whereas more-demanding individuals and lucrative business customers chose

plans with more telephone minutes, large amounts of wireless data bandwidth, and guaranteed reliability . . . for a higher price.

When AT&T began selling the iPhone in mid-2007, cost accountants projected the profitability for its new customers, and new plans were designed accordingly. Similar to traditional wireless plans, iPhone buyers were offered subscription options with different amounts of telephone minutes at different price points. For example, 450 telephone minutes cost \$59.99, while 1,350 minutes were \$99.99. However, to showcase the iPhone’s wireless and Internet capabilities, Apple insisted that AT&T offer only one data package, an unlimited plan.

While the unlimited data package proved initially lucrative, technology developments added significant costs to AT&T. When Apple introduced the iPhone 3G in 2008, the third-generation data capabilities encouraged software developers to build new programs for the iPhone platform. Within two years, nearly 140,000 applications, ranging from Pandora’s mobile music player to Mint’s on-the-go budgeting program, were downloaded more than 3 billion times by iPhone users. Each of the applications, however, uses a lot of data bandwidth.

Recall that AT&T does not charge iPhone subscribers for marginal bandwidth use. As a result, subscribers who download and use many iPhone applications quickly became unprofitable for the company. With each 100MB of bandwidth costing AT&T \$1, the company is currently considering cost-reducing options, such as limiting data access and changing its all-you-can-eat data subscription plan, but it is very concerned about alienating its customers.

iPhone application usage has also created a bigger cost problem for the company. With data bandwidth on the AT&T wireless network increasing by 5,000% between 2006 and 2009, the company’s network is showing signs of strain and poor performance. To act on these concerns, AT&T will spend \$18–19 billion making improvements to its data network in 2010, and more in the years to come. As a result, AT&T will need to balance customer satisfaction with ensuring that its iPhone customers remain profitable for the carrier.

*Sources:* AT&T Inc. and Apple Inc. 2007. AT&T and Apple announce simple, affordable service plans for iPhone. AT&T Inc. and Apple Inc. Press Release, June 26. <http://www.apple.com/pr/library/2007/06/26plans.html>; Fazard, Roben. 2010. AT&T’s iPhone mess. *BusinessWeek*, February 3; Sheth, Niraj. 2010. AT&T, boosted and stressed by iPhone, lays out network plans. *Wall Street Journal*, January 29; Sheth, Niraj. 2010. For wireless carriers, iPad signals further loss of clout. *Wall Street Journal*, January 28.

## Sales Variances

The customer-profitability analysis in the previous section focused on the actual profitability of individual customers within a distribution channel (retail, for example) and their effect on Spring Distribution’s profitability for June 2012. At a more-strategic

level, however, recall that Spring operates in two different markets: wholesale and retail. The operating margins in the retail market are much higher than the operating margins in the wholesale market. In June 2012, Spring had budgeted to sell 80% of its cases to wholesalers and 20% to retailers. It sold more cases in total than it had budgeted, but its actual sales mix (in cases) was 84% to wholesalers and 16% to retailers. Regardless of the profitability of sales to individual customers within each of the retail and wholesale channels, Spring's actual operating income, relative to the master budget, is likely to be positively affected by the higher sales of cases and negatively affected by the shift in mix away from the more-profitable retail customers. Sales-quantity and sales-mix variances can identify the effect of each of these factors on Spring's profitability. Companies such as Cisco, GE, and Hewlett-Packard perform similar analyses because they sell their products through multiple distribution channels like the Internet, over the telephone, and retail stores.

Spring classifies all customer-level costs as variable costs and distribution-channel and corporate-sustaining costs as fixed costs. To simplify the sales-variances analysis and calculations, we assume that all of the variable costs are variable with respect to units (cases) sold. (This means that average batch sizes remain the same as the total cases sold vary.) Without this assumption, the analysis would become more complex and would have to be done using the ABC-variance analysis approach described in Chapter 8, page 281–285. The basic insights, however, would not change.

Budgeted and actual operating data for June 2012 are as follows:

#### Budget Data for June 2012

	Selling Price (1)	Variable Cost per Unit (2)	Contribution Margin per Unit (3) = (1) – (2)	Sales Volume in Units (4)	Sales Mix (Based on Units) (5)	Contribution Margin (6) = (3) × (4)
Wholesale channel	\$13.37	\$12.88	\$0.49	712,000	80% <sup>a</sup>	\$348,880
Retail channel	14.10	13.12	0.98	178,000	20%	174,440
Total				890,000	100%	\$523,320

<sup>a</sup> Percentage of unit sales to wholesale channel = 712,000 units ÷ 890,000 total unit = 80%.

#### Actual Results for June 2012

	Selling Price (1)	Variable Cost per Unit (2)	Contribution Margin per Unit (3) = (1) – (2)	Sales Volume in Units (4)	Sales Mix (Based on Units) (5)	Contribution Margin (6) = (3) × (4)
Wholesale channel	\$13.37	\$12.88	\$0.49	756,000	84% <sup>a</sup>	\$370,440
Retail channel	14.10	13.17	0.93	144,000	16%	133,920
Total				900,000	100%	\$504,360

<sup>a</sup> Percentage of unit sales to wholesale channel = 756,000 units ÷ 900,000 total unit = 84%.

The budgeted and actual fixed distribution-channel costs and corporate-sustaining costs are \$160,500 and \$263,000, respectively (see Exhibit 14-6, p. 514).

Recall that the levels of detail introduced in Chapter 7 (pages 230–233) included the static-budget variance (level 1), the flexible-budget variance (level 2), and the sales-volume variance (level 2). The sales-quantity and sales-mix variances are level 3 variances that subdivide the sales-volume variance.<sup>7</sup>

## Learning Objective 6

Subdivide the sales-volume variance into the sales-mix variance

... the variance arises because actual sales mix differs from budgeted sales mix

and the sales-quantity variance

... this variance arises because actual total unit sales differ from budgeted total unit sales

<sup>7</sup> The presentation of the variances in this chapter and the appendix draws on teaching notes prepared by J. K. Harris.

### Static-Budget Variance

The *static-budget variance* is the difference between an actual result and the corresponding budgeted amount in the static budget. Our analysis focuses on the difference between actual and budgeted contribution margins (column 6 in the preceding tables). The total static-budget variance is \$18,960 U (actual contribution margin of \$504,360 – budgeted contribution margin of \$523,320). Exhibit 14-9 (columns 1 and 3) uses the columnar format introduced in Chapter 7 to show detailed calculations of the static-budget variance. Managers can gain more insight about the static-budget variance by subdividing it into the flexible-budget variance and the sales-volume variance.

### Flexible-Budget Variance and Sales-Volume Variance

The *flexible-budget variance* is the difference between an actual result and the corresponding flexible-budget amount based on actual output level in the budget period. The flexible budget contribution margin is equal to budgeted contribution margin per unit times actual units sold of each product. Exhibit 14-9, column 2, shows the flexible-budget calculations. The flexible budget measures the contribution margin that Spring would have budgeted for the actual quantities of cases sold. The flexible-budget variance is the difference between columns 1 and 2 in Exhibit 14-9. The only difference between columns 1 and 2 is that actual units sold of each product is multiplied by actual contribution margin per unit in column 1 and budgeted contribution margin per unit in column 2. The \$7,200 U flexible-budget variance arises because actual contribution margin on retail sales of \$0.93 per case is lower than the budgeted amount of \$0.98 per case. Spring’s management is aware that this difference of \$0.05 per case resulted from excessive price discounts, and it has put in place action plans to reduce discounts in the future.

The *sales-volume variance* is the difference between a flexible-budget amount and the corresponding static-budget amount. In Exhibit 14-9, the sales-volume variance shows the effect on budgeted contribution margin of the difference between actual quantity of units sold and budgeted quantity of units sold. The sales-volume variance of \$11,760 U is the difference between columns 2 and 3 in Exhibit 14-9. In this case, it is unfavorable overall because while wholesale unit sales were higher than budgeted, retail sales, which are expected to be twice as profitable on a per unit basis, were below budget. Spring’s

**Exhibit 14-9** Flexible-Budget and Sales-Volume Variance Analysis of Spring Distribution for June 2012

	<b>Actual Results:</b> <b>Actual Units of</b> <b>All Products Sold</b> × Actual Sales Mix × Actual Contribution Margin per Unit (1)	<b>Flexible Budget:</b> <b>Actual Units of</b> <b>All Products Sold</b> × Actual Sales Mix × Budgeted Contribution Margin per Unit (2)	<b>Static Budget:</b> <b>Budgeted Units of</b> <b>All Products Sold</b> × Budgeted Sales Mix × Budgeted Contribution Margin per Unit (3)
Wholesale	$900,000 \times 0.84 \times \$0.49 = \$370,440$	$900,000 \times 0.84 \times \$0.49 = \$370,440$	$890,000 \times 0.80 \times \$0.49 = \$348,880$
Retail	$900,000 \times 0.16 \times \$0.93 = 133,920$	$900,000 \times 0.16 \times \$0.98 = 141,120$	$890,000 \times 0.20 \times \$0.98 = 174,440$
	<u>\$504,360</u>	<u>\$511,560</u>	<u>\$523,320</u>
Level 2		\$7,200 U	\$11,760 U
Level 1		\$18,960 U	
		Static-budget variance	

F = favorable effect on operating income; U = unfavorable effect on operating income.

managers can gain substantial insight into the sales-volume variance by subdividing it into the sales-mix variance and the sales-quantity variance.

## Sales-Mix Variance

The **sales-mix variance** is the difference between (1) budgeted contribution margin for the *actual sales mix* and (2) budgeted contribution margin for the *budgeted sales mix*. The formula and computations (using data from p. 519) are as follows:

	Actual Units of All Products Sold	×	( Actual Sales - Mix Percentage – Budgeted Sales - Mix Percentage )	×	Budgeted Contribution Margin per Unit	=	Sales-Mix Variance
Wholesale	900,000 units	×	(0.84 – 0.80)	×	\$0.49 per unit	=	\$17,640 F
Retail	900,000 units	×	(0.16 – 0.20)	×	\$0.98 per unit	=	35,280 U
Total sales-mix variance							<u>\$17,640 U</u>

A favorable sales-mix variance arises for the wholesale channel because the 84% actual sales-mix percentage exceeds the 80% budgeted sales-mix percentage. In contrast, the retail channel has an unfavorable variance because the 16% actual sales-mix percentage is less than the 20% budgeted sales-mix percentage. The sales-mix variance is unfavorable because actual sales mix shifted toward the less-profitable wholesale channel relative to budgeted sales mix.

The concept underlying the sales-mix variance is best explained in terms of composite units. A **composite unit** is a hypothetical unit with weights based on the mix of individual units. Given the budgeted sales for June 2012, the composite unit consists of 0.80 units of sales to the wholesale channel and 0.20 units of sales to the retail channel. Therefore, the budgeted contribution margin per composite unit for the budgeted sales mix is as follows:

$$(0.80) \times (\$0.49) + (0.20) \times (\$0.98) = \$0.5880.^8$$

Similarly, for the actual sales mix, the composite unit consists of 0.84 units of sales to the wholesale channel and 0.16 units of sales to the retail channel. The budgeted contribution margin per composite unit for the actual sales mix is therefore as follows:

$$(0.84) \times (\$0.49) + (0.16) \times (\$0.98) = \$0.5684.$$

The impact of the shift in sales mix is now evident. Spring obtains a lower budgeted contribution margin per composite unit of \$0.0196 (\$0.5880 – \$0.5684). For the 900,000 units actually sold, this decrease translates to a \$17,640 U sales-mix variance (\$0.0196 per unit × 900,000 units).

Managers should probe why the \$17,640 U sales-mix variance occurred in June 2012. Is the shift in sales mix because, as the analysis in the previous section showed, profitable retail customers proved to be more difficult to find? Is it because of a competitor in the retail channel providing better service at a lower price? Or is it because the initial sales-volume estimates were made without adequate analysis of the potential market?

Exhibit 14-10 uses the columnar format to calculate the sales-mix variance and the sales-quantity variances.

## Sales-Quantity Variance

The **sales-quantity variance** is the difference between (1) budgeted contribution margin based on *actual units sold of all products* at the budgeted mix and (2) contribution margin in the static budget (which is based on *budgeted units of all products to*

<sup>8</sup> Budgeted contribution margin per composite unit can be computed in another way by dividing total budgeted contribution margin of \$523,320 by total budgeted units of 890,000 (p. 519): \$523,320 ÷ 890,000 units = \$0.5880 per unit.

**Exhibit 14-10**

Sales-Mix and Sales-Quantity Variance Analysis of Spring Distribution for June 2012

	Flexible Budget: Actual Units of All Products Sold × Actual Sales Mix × Budgeted Contribution Margin per Unit (1)	Actual Units of All Products Sold × Budgeted Sales Mix × Budgeted Contribution Margin per Unit (2)	Static Budget: Budgeted Units of All Products Sold × Budgeted Sales Mix × Budgeted Contribution Margin per Unit (3)
Wholesale	$900,000 \times 0.84 \times \$0.49 = \$370,440$	$900,000 \times 0.80 \times \$0.49 = \$352,800$	$890,000 \times 0.80 \times \$0.49 = \$348,880$
Retail	$900,000 \times 0.16 \times \$0.98 = 141,120$	$900,000 \times 0.20 \times \$0.98 = 176,400$	$890,000 \times 0.20 \times \$0.98 = 174,440$
	<u>\$511,560</u>	<u>\$529,200</u>	<u>\$523,320</u>
Level 3		\$17,640 U	\$5,880 F
Level 2		Sales-mix variance                      Sales-quantity variance	
		\$11,760 U	
		Sales-volume variance	

F = favorable effect on operating income; U = unfavorable effect on operating income.

be sold at budgeted mix). The formula and computations (using data from p. 519) are as follows:

		Budgeted Sales-Mix Percentages	×	Budgeted Contribution Margin per Unit	×	=	Sales- Quantity Variance
Wholesale	(900,000 units – 890,000 units)	0.80	×	\$0.49 per unit	×	=	\$3,920 F
Retail	(900,000 units – 890,000 units)	0.20	×	\$0.98 per unit	×	=	1,960 F
Total sales-quantity variance							<u>\$5,880 F</u>

This variance is favorable when actual units of all products sold exceed budgeted units of all products sold. Spring sold 10,000 more cases than were budgeted, resulting in a \$5,880 F sales-quantity variance (also equal to budgeted contribution margin per composite unit for the budgeted sales mix times additional cases sold,  $\$0.5880 \times 10,000$ ). Managers would want to probe the reasons for the increase in sales. Did higher sales come as a result of a competitor’s distribution problems? Better customer service? Or growth in the overall market? Additional insight into the causes of the sales-quantity variance can be gained by analyzing changes in Spring’s share of the total industry market and in the size of that market. The sales-quantity variance can be decomposed into market-share and market-size variances, as illustrated in the appendix to Chapter 7.<sup>9</sup>

Exhibit 14-11 presents an overview of the sales-mix and sales-quantity variances for the Spring example. The sales-mix variance and sales-quantity variance can also be calculated in a multiproduct company, in which each individual product has a different contribution margin per unit. The Problem for Self-Study takes you through such a setting, and also demonstrates the link between these sales variances and the market-share and market-size variances studied earlier. The appendix to this chapter describes mix and quantity variances for production inputs.

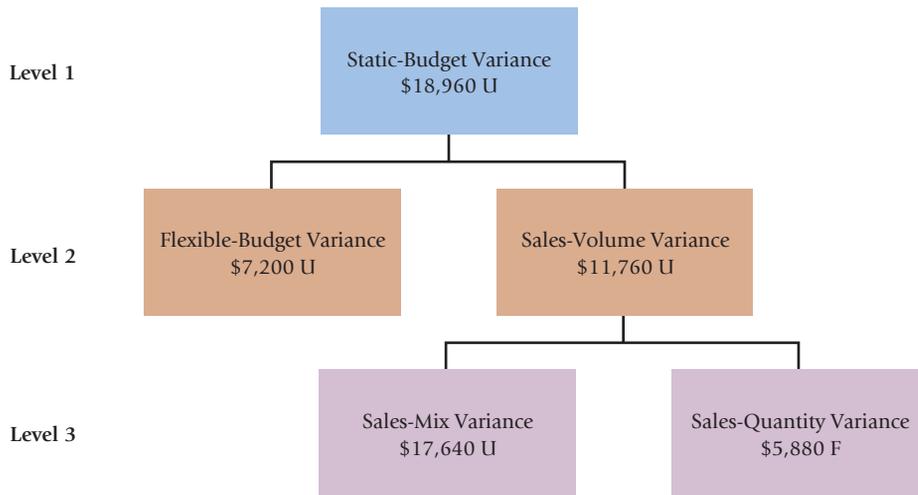
**Decision Point**

What are the two components of the sales-volume variance?

<sup>9</sup> Recall that the market-share and market-size variances in the appendix to Chapter 7 (pp. 248–249) were computed for Webb Company, which sold a single product (jackets) using a single distribution channel. The calculation of these variances is virtually unaffected when multiple distribution channels exist, as in the Spring example. The only change required is to replace the phrase “Budgeted Contribution Margin per Unit” in the market-share and market-size variance formulas with “Budgeted Contribution Margin per Composite Unit for Budgeted Sales Mix” (which equals \$0.5880 in the Spring example). For additional details and an illustration, see the Problem for Self-Study for this chapter.

**Exhibit 14-11**

Overview of Variances for Spring Distribution for June 2012



F = favorable effect on operating income; U = unfavorable effect on operating income

## Problem for Self-Study

The Payne Company manufactures two types of vinyl flooring. Budgeted and actual operating data for 2012 are as follows:

	Static Budget			Actual Results		
	Commercial	Residential	Total	Commercial	Residential	Total
Unit sales in rolls	20,000	60,000	80,000	25,200	58,800	84,000
Contribution margin	\$10,000,000	\$24,000,000	\$34,000,000	\$11,970,000	\$24,696,000	\$36,666,000

In late 2011, a marketing research firm estimated industry volume for commercial and residential vinyl flooring for 2012 at 800,000 rolls. Actual industry volume for 2012 was 700,000 rolls.

1. Compute the sales-mix variance and the sales-quantity variance by type of vinyl flooring and in total. (Compute all variances in terms of contribution margins.)
2. Compute the market-share variance and the market-size variance (see Chapter 7, pp. 248–249).
3. What insights do the variances calculated in requirements 1 and 2 provide about Payne Company’s performance in 2012?

**Required**

### Solution

1. Actual sales-mix percentage:

$$\text{Commercial} = 25,200 \div 84,000 = 0.30, \text{ or } 30\%$$

$$\text{Residential} = 58,800 \div 84,000 = 0.70, \text{ or } 70\%$$

Budgeted sales-mix percentage:

$$\text{Commercial} = 20,000 \div 80,000 = 0.25, \text{ or } 25\%$$

$$\text{Residential} = 60,000 \div 80,000 = 0.75, \text{ or } 75\%$$

Budgeted contribution margin per unit:

$$\text{Commercial} = \$10,000,000 \div 20,000 \text{ units} = \$500 \text{ per unit}$$

$$\text{Residential} = \$24,000,000 \div 60,000 \text{ units} = \$400 \text{ per unit}$$



## Decision Points

The following question-and-answer format summarizes the chapter's learning objectives. Each decision presents a key question related to a learning objective. The guidelines are the answer to that question.

### Decision

1. What are four purposes for allocating costs to cost objects?
2. What criteria should managers use to guide cost-allocation decisions?
3. What are two key decisions managers must make when collecting costs in indirect-cost pools?
4. How can a company's revenues and costs differ across customers?
5. How do customer-profitability profiles help managers?
6. What are the two components of the sales-volume variance?

### Guidelines

Four purposes of cost allocation are (a) to provide information for economic decisions, (b) to motivate managers and other employees, (c) to justify costs or compute reimbursement amounts, and (d) to measure income and assets for reporting to external parties. Different cost allocations are appropriate for different purposes.

Managers should use the cause-and-effect and the benefits-received criteria to guide most cost-allocation decisions. Other criteria are fairness or equity and ability to bear.

Two key decisions related to indirect-cost pools are the number of indirect-cost pools to form and the individual cost items to be included in each cost pool to make homogeneous cost pools.

Revenues can differ because of differences in the quantity purchased and price discounts given from the list selling price. Costs can differ as different customers place different demands on a company's resources in terms of processing purchase orders, making deliveries, and customer support.

Companies should be aware of and devote sufficient resources to maintaining and expanding relationships with customers who contribute significantly to profitability. Customer-profitability profiles often highlight that a small percentage of customers contributes a large percentage of operating income.

The two components of sales-volume variance are (a) the difference between actual sales mix and budgeted sales mix (the sales-mix variance) and (b) the difference between actual unit sales and budgeted unit sales (the sales-quantity variance).

## Appendix

### Mix and Yield Variances for Substitutable Inputs

The framework for calculating the sales-mix variance and the sales-quantity variance can also be used to analyze production-input variances in cases in which managers have some leeway in combining and substituting inputs. For example, Del Monte can combine material inputs (such as pineapples, cherries, and grapes) in varying proportions for its cans of fruit cocktail. Within limits, these individual fruits are *substitutable inputs* in making the fruit cocktail.

We illustrate how the efficiency variance discussed in Chapter 7 (pp. 236–237) can be subdivided into variances that highlight the financial impact of input mix and input yield when inputs are substitutable. Consider Delpino Corporation, which makes tomato ketchup. Our example focuses on direct material inputs and substitution among three of these inputs. The same approach can also be used to examine substitutable direct manufacturing labor inputs.

To produce ketchup of a specified consistency, color, and taste, Delpino mixes three types of tomatoes grown in different regions: Latin American tomatoes (Latoms), California tomatoes (Caltoms), and Florida tomatoes

(Flotoms). Delpino's production standards require 1.60 tons of tomatoes to produce 1 ton of ketchup; 50% of the tomatoes are budgeted to be Latoms, 30% Caltoms, and 20% Flotoms. The direct material inputs budgeted to produce 1 ton of ketchup are as follows:

0.80 (50% of 1.6) ton of Latoms at \$70 per ton	\$ 56.00
0.48 (30% of 1.6) ton of Caltoms at \$80 per ton	38.40
0.32 (20% of 1.6) ton of Flotoms at \$90 per ton	<u>28.80</u>
Total budgeted cost of 1.6 tons of tomatoes	<u>\$123.20</u>

Budgeted average cost per ton of tomatoes is  $\$123.20 \div 1.60 \text{ tons} = \$77$  per ton.

Because Delpino uses fresh tomatoes to make ketchup, no inventories of tomatoes are kept. Purchases are made as needed, so all price variances relate to tomatoes purchased and used. Actual results for June 2012 show that a total of 6,500 tons of tomatoes were used to produce 4,000 tons of ketchup:

3,250 tons of Latoms at actual cost of \$70 per ton	\$227,500
2,275 tons of Caltoms at actual cost of \$82 per ton	186,550
975 tons of Flotoms at actual cost of \$96 per ton	<u>93,600</u>
<u>6,500</u> tons of tomatoes	<u>507,650</u>
Budgeted cost of 4,000 tons of ketchup at \$123.20 per ton	<u>492,800</u>
Flexible-budget variance for direct materials	<u>\$ 14,850 U</u>

Given the standard ratio of 1.60 tons of tomatoes to 1 ton of ketchup, 6,400 tons of tomatoes should be used to produce 4,000 tons of ketchup. At standard mix, quantities of each type of tomato required are as follows:

Latoms:	$0.50 \times 6,400 = 3,200$ tons
Caltoms:	$0.30 \times 6,400 = 1,920$ tons
Flotoms:	$0.20 \times 6,400 = 1,280$ tons

## Direct Materials Price and Efficiency Variances

Exhibit 14-12 presents in columnar format the analysis of the flexible-budget variance for direct materials discussed in Chapter 7. The materials price and efficiency variances are calculated separately for each input material and then added together. The variance analysis prompts Delpino to investigate the unfavorable price and efficiency variances. Why did it pay more for tomatoes and use greater quantities than it had budgeted? Were actual market prices of tomatoes higher, in general, or could the purchasing department have negotiated lower prices? Did the inefficiencies result from inferior tomatoes or from problems in processing?

**Exhibit 14-12**

Direct Materials Price and Efficiency Variances for the Delpino Corporation June 2012

	Actual Costs Incurred: Actual Input Quantity × Actual Price (1)	Actual Input Quantity × Budgeted Price (2)	Flexible Budget: Budgeted Input Quantity Allowed for Actual Output × Budgeted Price (3)
Latoms:	$3,250 \times \$70 = \$227,500$	$3,250 \times \$70 = \$227,500$	$3,200 \times \$70 = \$224,000$
Caltoms:	$2,275 \times \$82 = 186,550$	$2,275 \times \$80 = 182,000$	$1,920 \times \$80 = 153,600$
Flotoms:	$975 \times \$96 = \underline{93,600}$	$975 \times \$90 = \underline{87,750}$	$1,280 \times \$90 = \underline{115,200}$
	<u>\$507,650</u>	<u>\$497,250</u>	<u>\$492,800</u>
Level 3		\$10,400 U	\$4,450 U
		Price variance	Efficiency variance
Level 2			\$14,850 U
			Flexible-budget variance

F = favorable effect on operating income; U = unfavorable effect on operating income.

## Direct Materials Mix and Direct Materials Yield Variances

Managers sometimes have discretion to substitute one material for another. The manager of Delpino's ketchup plant has some leeway in combining Latoms, Caltoms, and Flotoms without affecting the ketchup's quality. We will assume that to maintain quality, mix percentages of each type of tomato can only vary up to 5% from standard mix. For example, the percentage of Caltoms in the mix can vary between 25% and 35% ( $30\% \pm 5\%$ ). When inputs are substitutable, direct materials efficiency improvement relative to budgeted costs can come from two sources: (1) using a cheaper mix to produce a given quantity of output, measured by the direct materials mix variance, and (2) using less input to achieve a given quantity of output, measured by the direct materials yield variance.

Holding actual total quantity of all direct materials inputs used constant, the total **direct materials mix variance** is the difference between (1) budgeted cost for actual mix of actual total quantity of direct materials used and (2) budgeted cost of budgeted mix of actual total quantity of direct materials used. Holding budgeted input mix constant, the **direct materials yield variance** is the difference between (1) budgeted cost of direct materials based on actual total quantity of direct materials used and (2) flexible-budget cost of direct materials based on budgeted total quantity of direct materials allowed for actual output produced. Exhibit 14-13 presents the direct materials mix and yield variances for the Delpino Corporation.

### Direct Materials Mix Variance

The total direct materials mix variance is the sum of the direct materials mix variances for each input:

$$\text{Direct materials mix variance for each input} = \text{Actual total quantity of all direct materials inputs used} \times \left( \text{Actual direct materials input mix percentage} - \text{Budgeted direct materials input mix percentage} \right) \times \text{Budgeted price of direct materials input}$$

The direct materials mix variances are as follows:

$$\begin{aligned} \text{Latoms:} & \quad 6,500 \text{ tons} \times (0.50 - 0.50) \times \$70 \text{ per ton} = 6,500 \times 0.00 \times \$70 = \$ \quad 0 \\ \text{Caltoms:} & \quad 6,500 \text{ tons} \times (0.35 - 0.30) \times \$80 \text{ per ton} = 6,500 \times 0.05 \times \$80 = \quad 26,000 \text{ U} \\ \text{Flotoms:} & \quad 6,500 \text{ tons} \times (0.15 - 0.20) \times \$90 \text{ per ton} = 6,500 \times -0.05 \times \$90 = \quad 29,250 \text{ F} \\ \text{Total direct materials mix variance} & \quad \underline{\underline{\$ \quad 3,250 \text{ F}}} \end{aligned}$$

The total direct materials mix variance is favorable because relative to the budgeted mix, Delpino substitutes 5% of the cheaper Caltoms for 5% of the more-expensive Flotoms.

#### Exhibit 14-13

Total Direct Materials Yield and Mix Variances for the Delpino Corporation for June 2012

	Actual Total Quantity of All Inputs Used × Actual Input Mix × Budgeted Price (1)	Actual Total Quantity of All Inputs Used × Budgeted Input Mix × Budgeted Price (2)	Flexible Budget: Budgeted Total Quantity of All Inputs Allowed for Actual Output × Budgeted Input Mix × Budgeted Price (3)
Latoms:	$6,500 \times 0.50 \times \$70 = \$227,500$	$6,500 \times 0.50 \times \$70 = \$227,500$	$6,400 \times 0.50 \times \$70 = \$224,500$
Caltoms:	$6,500 \times 0.35 \times \$80 = 182,000$	$6,500 \times 0.30 \times \$80 = 156,000$	$6,400 \times 0.30 \times \$80 = 153,600$
Flotoms:	$6,500 \times 0.15 \times \$90 = 87,750$	$6,500 \times 0.20 \times \$90 = 117,000$	$6,400 \times 0.20 \times \$90 = 115,200$
	<u>\$497,250</u>	<u>\$500,500</u>	<u>\$492,800</u>
Level 4		\$3,250 F	\$7,700 U
		Mix variance	Yield variance
Level 3		\$4,450 U	
		Efficiency variance	

F = favorable effect on operating income; U = unfavorable effect on operating income.

## Direct Materials Yield Variance

The direct materials yield variance is the sum of the direct materials yield variances for each input:

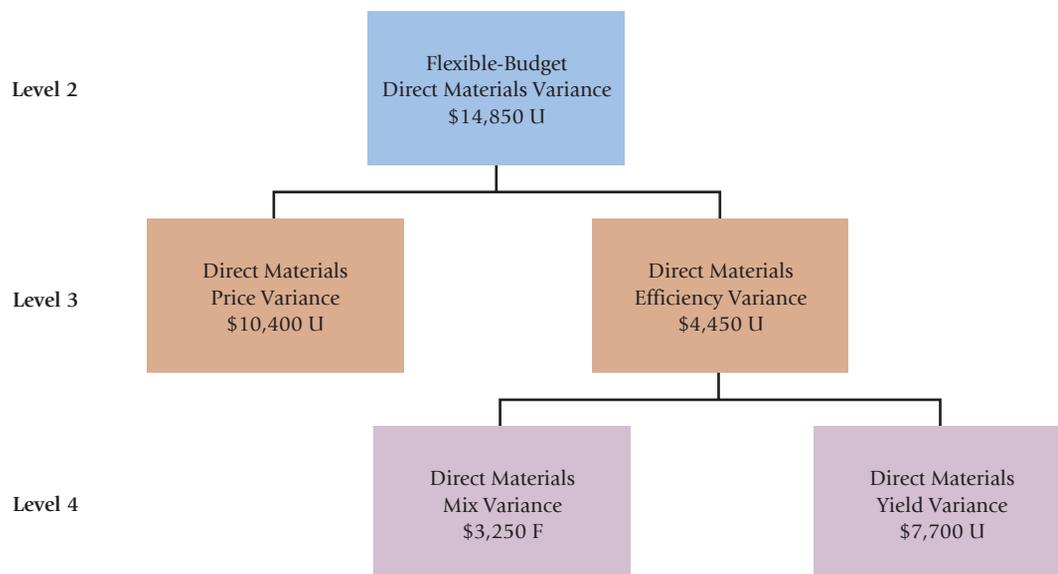
$$\text{Direct materials yield variance for each input} = \left( \begin{array}{l} \text{Actual total} \\ \text{quantity of} \\ \text{all direct} \\ \text{materials} \\ \text{inputs used} \end{array} - \begin{array}{l} \text{Budgeted total} \\ \text{quantity of all} \\ \text{direct materials} \\ \text{inputs allowed} \\ \text{for actual output} \end{array} \right) \times \begin{array}{l} \text{Budgeted} \\ \text{direct materials} \\ \text{input mix} \\ \text{percentage} \end{array} \times \begin{array}{l} \text{Budgeted} \\ \text{price of} \\ \text{direct materials} \\ \text{input} \end{array}$$

The direct materials yield variances are as follows:

$$\begin{array}{l} \text{Latoms: } (6,500 - 6,400) \text{ tons} \times 0.50 \times \$70 \text{ per ton} = 100 \times 0.50 \times \$70 = \$3,500 \text{ U} \\ \text{Caltoms: } (6,500 - 6,400) \text{ tons} \times 0.30 \times \$80 \text{ per ton} = 100 \times 0.30 \times \$80 = 2,400 \text{ U} \\ \text{Flotoms: } (6,500 - 6,400) \text{ tons} \times 0.20 \times \$90 \text{ per ton} = 100 \times 0.20 \times \$90 = \underline{1,800 \text{ U}} \\ \text{Total direct materials yield variance} \qquad \qquad \qquad \underline{\underline{\$7,700 \text{ U}}} \end{array}$$

The total direct materials yield variance is unfavorable because Delpino used 6,500 tons of tomatoes rather than the 6,400 tons that it should have used to produce 4,000 tons of ketchup. Holding the budgeted mix and budgeted prices of tomatoes constant, the budgeted cost per ton of tomatoes in the budgeted mix is \$77 per ton. The unfavorable yield variance represents the budgeted cost of using 100 more tons of tomatoes,  $(6,500 - 6,400) \text{ tons} \times \$77 \text{ per ton} = \$7,700 \text{ U}$ . Delpino would want to investigate reasons for this unfavorable yield variance. For example, did the substitution of the cheaper Caltoms for Flotoms that resulted in the favorable mix variance also cause the unfavorable yield variance?

The direct materials variances computed in Exhibits 14-12 and 14-13 can be summarized as follows:



## Terms to Learn

This chapter and the Glossary at the end of the book contain definitions of the following important terms:

composite unit (p. 521)

customer-cost hierarchy (p. 511)

customer-profitability analysis (p. 510)

direct materials mix variance (p. 527)

direct materials yield variance (p. 527)

homogeneous cost pool (p. 509)

price discount (p. 511)

sales-mix variance (p. 521)

sales-quantity variance (p. 521)

whale curve (p. 516)

# Assignment Material



## Questions

- 14-1** “I am going to focus on the customers of my business and leave cost-allocation issues to my accountant.” Do you agree with this comment by a division president? Why?
- 14-2** A given cost may be allocated for one or more purposes. List four purposes.
- 14-3** What criteria might be used to guide cost-allocation decisions? Which are the dominant criteria?
- 14-4** “A company should not allocate all of its corporate costs to its divisions.” Do you agree? Explain.
- 14-5** “Once a company allocates corporate costs to divisions, these costs should not be reallocated to the indirect-cost pools of the division.” Do you agree? Explain.
- 14-6** Why is customer-profitability analysis a vitally important topic to managers?
- 14-7** How can the extent of price discounting be tracked on a customer-by-customer basis?
- 14-8** “A customer-profitability profile highlights those customers who should be dropped to improve profitability.” Do you agree? Explain.
- 14-9** Give examples of three different levels of costs in a customer-cost hierarchy.
- 14-10** What information does the whale curve provide?
- 14-11** Show how managers can gain insight into the causes of a sales-volume variance by subdividing the components of this variance.
- 14-12** How can the concept of a composite unit be used to explain why an unfavorable total sales-mix variance of contribution margin occurs?
- 14-13** Explain why a favorable sales-quantity variance occurs.
- 14-14** How can the sales-quantity variance be decomposed further?
- 14-15** Explain how the direct materials mix and yield variances provide additional information about the direct materials efficiency variance.

## Exercises



**14-16 Cost allocation in hospitals, alternative allocation criteria.** Dave Meltzer vacationed at Lake Tahoe last winter. Unfortunately, he broke his ankle while skiing and spent two days at the Sierra University Hospital. Meltzer’s insurance company received a \$4,800 bill for his two-day stay. One item that caught Meltzer’s attention was an \$11.52 charge for a roll of cotton. Meltzer is a salesman for Johnson & Johnson and knows that the cost to the hospital of the roll of cotton is in the \$2.20 to \$3.00 range. He asked for a breakdown of the \$11.52 charge. The accounting office of the hospital sent him the following information:

a. Invoiced cost of cotton roll	\$ 2.40
b. Cost of processing of paperwork for purchase	0.60
c. Supplies-room management fee	0.70
d. Operating-room and patient-room handling costs	1.60
e. Administrative hospital costs	1.10
f. University teaching-related costs	0.60
g. Malpractice insurance costs	1.20
h. Cost of treating uninsured patients	2.72
i. Profit component	0.60
Total	\$11.52

Meltzer believes the overhead charge is obscene. He comments, “There was nothing I could do about it. When they come in and dab your stitches, it’s not as if you can say, ‘Keep your cotton roll. I brought my own.’”

1. Compute the overhead rate Sierra University Hospital charged on the cotton roll.
2. What criteria might Sierra use to justify allocation of the overhead items b–i in the preceding list? Examine each item separately and use the allocation criteria listed in Exhibit 14-2 (p. 505) in your answer.
3. What should Meltzer do about the \$11.52 charge for the cotton roll?

**Required**

**14-17 Cost allocation and decision making.** Greenbold Manufacturing has four divisions named after its locations: Arizona, Colorado, Delaware, and Florida. Corporate headquarters is in Minnesota. Greenbold corporate headquarters incurs \$5,600,000 per period, which is an indirect cost of the divisions. Corporate headquarters currently allocates this cost to the divisions based on the revenues of each division. The CEO has asked each division manager to suggest an allocation base for the indirect headquarters costs from

among revenues, segment margin, direct costs, and number of employees. The following is relevant information about each division:

	Arizona	Colorado	Delaware	Florida
Revenues	\$7,800,000	\$8,500,000	\$6,200,000	\$5,500,000
Direct costs	<u>5,300,000</u>	<u>4,100,000</u>	<u>4,300,000</u>	<u>4,600,000</u>
Segment margin	<u>\$2,500,000</u>	<u>\$4,400,000</u>	<u>\$1,900,000</u>	<u>\$ 900,000</u>
Number of employees	2,000	4,000	1,500	500

**Required**

1. Allocate the indirect headquarters costs of Greenbold Manufacturing to each of the four divisions using revenues, direct costs, segment margin, and number of employees as the allocation bases. Calculate operating margins for each division after allocating headquarters costs.
2. Which allocation base do you think the manager of the Florida division would prefer? Explain.
3. What factors would you consider in deciding which allocation base Greenbold should use?
4. Suppose the Greenbold CEO decides to use direct costs as the allocation base. Should the Florida division be closed? Why or why not?

**14-18 Cost allocation to divisions.** Rembrandt Hotel & Casino is situated on beautiful Lake Tahoe in Nevada. The complex includes a 300-room hotel, a casino, and a restaurant. As Rembrandt's new controller, you are asked to recommend the basis to be used for allocating fixed overhead costs to the three divisions in 2012. You are presented with the following income statement information for 2011:

	Hotel	Restaurant	Casino
Revenues	\$16,425,000	\$5,256,000	\$12,340,000
Direct costs	<u>9,819,260</u>	<u>3,749,172</u>	<u>4,248,768</u>
Segment margin	<u>\$ 6,605,740</u>	<u>\$1,506,828</u>	<u>\$ 8,091,232</u>

You are also given the following data on the three divisions:

	Hotel	Restaurant	Casino
Floor space (square feet)	80,000	16,000	64,000
Number of employees	200	50	250

You are told that you may choose to allocate indirect costs based on one of the following: direct costs, floor space, or the number of employees. Total fixed overhead costs for 2011 was \$14,550,000.

**Required**

1. Calculate division margins in percentage terms prior to allocating fixed overhead costs.
2. Allocate indirect costs to the three divisions using each of the three allocation bases suggested. For each allocation base, calculate division operating margins after allocations in dollars and as a percentage of revenues.
3. Discuss the results. How would you decide how to allocate indirect costs to the divisions? Why?
4. Would you recommend closing any of the three divisions (and possibly reallocating resources to other divisions) as a result of your analysis? If so, which division would you close and why?

**14-19 Cost allocation to divisions.** Lenzig Corporation has three divisions: pulp, paper, and fibers. Lenzig's new controller, Ari Bardem, is reviewing the allocation of fixed corporate-overhead costs to the three divisions. He is presented with the following information for each division for 2012:

	A	B	C	D
		<b>Pulp</b>	<b>Paper</b>	<b>Fibers</b>
1				
2	Revenues	\$8,500,000	\$17,500,000	\$24,000,000
3	Direct manufacturing costs	4,100,000	8,600,000	11,300,000
4	Division administrative costs	<u>2,000,000</u>	<u>1,800,000</u>	<u>3,200,000</u>
5	Division margin	<u>\$2,400,000</u>	<u>\$ 7,100,000</u>	<u>\$ 9,500,000</u>
6				
7	Number of employees	350	250	400
8	Floor space (square feet)	35,000	24,000	66,000

Until now, Lenzig Corporation has allocated fixed corporate-overhead costs to the divisions on the basis of division margins. Bardem asks for a list of costs that comprise fixed corporate overhead and suggests the following new allocation bases:

	F	G	H
1	<b>Fixed Corporate Overhead Costs</b>		<b>Suggested Allocation Bases</b>
2	Human resource management	\$1,800,000	Number of employees
3	Facility	2,700,000	Floor space (square feet)
4	Corporate Administration	4,500,000	Division administrative costs
5	Total	<u>\$9,000,000</u>	

1. Allocate 2012 fixed corporate-overhead costs to the three divisions using division margin as the allocation base. What is each division's operating margin percentage (division margin minus allocated fixed corporate-overhead costs as a percentage of revenues)?
2. Allocate 2012 fixed costs using the allocation bases suggested by Bardem. What is each division's operating margin percentage under the new allocation scheme?
3. Compare and discuss the results of requirements 1 and 2. If division performance is linked to operating margin percentage, which division would be most receptive to the new allocation scheme? Which division would be the least receptive? Why?
4. Which allocation scheme should Lenzig Corporation use? Why? How might Bardem overcome any objections that may arise from the divisions?

**Required**

**14-20 Customer profitability, customer-cost hierarchy.** Orsack Electronics has only two retail and two wholesale customers. Information relating to each customer for 2012 follows (in thousands):

	A	B	C	D	E
1		<b>Wholesale Customers</b>		<b>Retail Customers</b>	
2		<b>North America Wholesaler</b>	<b>South America Wholesaler</b>	<b>Big Sam Stereo</b>	<b>World Market</b>
3	Revenues at list price	\$435,000	\$550,000	\$150,000	\$115,000
4	Discounts from list prices	30,000	44,000	7,200	520
5	Cost of goods sold	330,000	475,000	123,000	84,000
6	Delivery costs	475	690	220	130
7	Order processing costs	750	1,020	175	120
8	Costs of sales visits	5,400	2,500	2,500	1,400

Orsack's annual distribution-channel costs are \$34 million for wholesale customers and \$5 million for retail customers. Its annual corporate-sustaining costs, such as salary for top management and general-administration costs, are \$61 million. There is no cause-and-effect or benefits-received relationship between any cost-allocation base and corporate-sustaining costs. That is, corporate-sustaining costs could be saved only if Orsack Electronics were to completely shut down.

1. Calculate customer-level operating income using the format in Exhibit 14-5.
2. Prepare a customer-cost hierarchy report, using the format in Exhibit 14-6.
3. Orsack's management decides to allocate all corporate-sustaining costs to distribution channels: \$48 million to the wholesale channel and \$13 million to the retail channel. As a result, distribution channel costs are now \$82 million (\$34 million + \$48 million) for the wholesale channel and \$18 million (\$5 million + \$13 million) for the retail channel. Calculate the distribution-channel-level operating income. On the basis of these calculations, what actions, if any, should Orsack's managers take? Explain.

**Required**

**14-21 Customer profitability, service company.** Instant Service (IS) repairs printers and photocopiers for five multisite companies in a tristate area. IS's costs consist of the cost of technicians and equipment that are directly traceable to the customer site and a pool of office overhead. Until recently, IS estimated

customer profitability by allocating the office overhead to each customer based on share of revenues. For 2012, IS reported the following results:

	A	B	C	D	E	F	G
1		<b>Avery</b>	<b>Okie</b>	<b>Wizard</b>	<b>Grainger</b>	<b>Duran</b>	<b>Total</b>
2	Revenues	\$260,000	\$200,000	\$322,000	\$122,000	\$212,000	\$1,116,000
3	Technician and equipment cost	182,000	175,000	225,000	107,000	178,000	867,000
4	Office overhead allocated	<u>31,859</u>	<u>24,507</u>	<u>39,457</u>	<u>14,949</u>	<u>25,978</u>	<u>136,750</u>
5	Operating income	<u>\$ 46,141</u>	<u>\$ 493</u>	<u>\$ 57,543</u>	<u>\$ 51</u>	<u>\$ 8,022</u>	<u>\$ 112,250</u>

Tina Sherman, IS's new controller, notes that office overhead is more than 10% of total costs, so she spends a couple of weeks analyzing the consumption of office overhead resources by customers. She collects the following information:

	I	J	K
1	<b>Activity Area</b>	<b>Cost Driver Rate</b>	
2	Service call handling	\$75	per service call
3	Parts ordering	\$80	per Web-base parts order
4	Billing and collection	\$50	per bill (or reminder)
5	Customer database maintenance	\$10	per service call

	A	B	C	D	E	F
8		<b>Avery</b>	<b>Okie</b>	<b>Wizard</b>	<b>Grainger</b>	<b>Duran</b>
9	Number of service calls	150	240	40	120	180
10	Number of Web-based parts orders	120	210	60	150	150
11	Number of bills (or reminders)	30	90	90	60	120

**Required**

1. Compute customer-level operating income using the new information that Sherman has gathered.
2. Prepare exhibits for IS similar to Exhibits 14-7 and 14-8. Comment on the results.
3. What options should IS consider, with regard to individual customers, in light of the new data and analysis of office overhead?

**14-22 Customer profitability, distribution.** Figure Four is a distributor of pharmaceutical products. Its ABC system has five activities:

Activity Area	Cost Driver Rate in 2012
1. Order processing	\$40 per order
2. Line-item ordering	\$3 per line item
3. Store deliveries	\$50 per store delivery
4. Carton deliveries	\$1 per carton
5. Shelf-stocking	\$16 per stocking-hour

Rick Flair, the controller of Figure Four, wants to use this ABC system to examine individual customer profitability within each distribution market. He focuses first on the Ma and Pa single-store distribution market. Two customers are used to exemplify the insights available with the ABC approach. Data pertaining to these two customers in August 2012 are as follows:

	Charleston Pharmacy	Chapel Hill Pharmacy
Total orders	13	10
Average line items per order	9	18
Total store deliveries	7	10
Average cartons shipped per store delivery	22	20
Average hours of shelf-stocking per store delivery	0	0.5
Average revenue per delivery	\$2,400	\$1,800
Average cost of goods sold per delivery	\$2,100	\$1,650

1. Use the ABC information to compute the operating income of each customer in August 2012. Comment on the results and what, if anything, Flair should do.
2. Flair ranks the individual customers in the Ma and Pa single-store distribution market on the basis of monthly operating income. The cumulative operating income of the top 20% of customers is \$55,680. Figure Four reports operating losses of \$21,247 for the bottom 40% of its customers. Make four recommendations that you think Figure Four should consider in light of this new customer-profitability information.

**Required**

**14-23 Variance analysis, multiple products.** The Detroit Penguins play in the American Ice Hockey League. The Penguins play in the Downtown Arena (owned and managed by the City of Detroit), which has a capacity of 15,000 seats (5,000 lower-tier seats and 10,000 upper-tier seats). The Downtown Arena charges the Penguins a per-ticket charge for use of its facility. All tickets are sold by the Reservation Network, which charges the Penguins a reservation fee per ticket. The Penguins' budgeted contribution margin for each type of ticket in 2012 is computed as follows:

	Lower-Tier Tickets	Upper-Tier Tickets
Selling price	\$35	\$14
Downtown Arena fee	10	6
Reservation Network fee	5	3
Contribution margin per ticket	<u>\$20</u>	<u>\$ 5</u>

The budgeted and actual average attendance figures per game in the 2012 season are as follows:

	Budgeted Seats Sold	Actual Seats Sold
Lower tier	4,000	3,300
Upper tier	<u>6,000</u>	<u>7,700</u>
Total	<u>10,000</u>	<u>11,000</u>

There was no difference between the budgeted and actual contribution margin for lower-tier or upper-tier seats.

The manager of the Penguins was delighted that actual attendance was 10% above budgeted attendance per game, especially given the depressed state of the local economy in the past six months.

1. Compute the sales-volume variance for each type of ticket and in total for the Detroit Penguins in 2012. (Calculate all variances in terms of contribution margins.)
2. Compute the sales-quantity and sales-mix variances for each type of ticket and in total in 2012.
3. Present a summary of the variances in requirements 1 and 2. Comment on the results.

**Required**

**14-24 Variance analysis, working backward.** The Jinwa Corporation sells two brands of wine glasses: Plain and Chic. Jinwa provides the following information for sales in the month of June 2011:

Static-budget total contribution margin	\$11,000
Budgeted units to be sold of all glasses	2,000 units
Budgeted contribution margin per unit of Plain	\$4 per unit
Budgeted contribution margin per unit of Chic	\$10 per unit
Total sales-quantity variance	\$2,200 U
Actual sales-mix percentage of Plain	60%

All variances are to be computed in contribution-margin terms.

**Required**

1. Calculate the sales-quantity variances for each product for June 2011.
2. Calculate the individual-product and total sales-mix variances for June 2011. Calculate the individual-product and total sales-volume variances for June 2011.
3. Briefly describe the conclusions you can draw from the variances.

**14-25 Variance analysis, multiple products.** Soda-King manufactures and sells three soft drinks: Kola, Limor, and Orlem. Budgeted and actual results for 2011 are as follows:

Product	Budget for 2011			Actual for 2011		
	Selling Price	Variable Cost per Carton	Cartons Sold	Selling Price	Variable Cost per Carton	Cartons Sold
Kola	\$8.00	\$5.00	480,000	\$8.20	\$5.50	467,500
Limor	\$6.00	\$3.80	720,000	\$5.75	\$3.75	852,500
Orlem	\$7.50	\$5.50	1,200,000	\$7.80	\$5.60	1,430,000

**Required**

1. Compute the total sales-volume variance, the total sales-mix variance, and the total sales-quantity variance. (Calculate all variances in terms of contribution margin.) Show results for each product in your computations.
2. What inferences can you draw from the variances computed in requirement 1?

**14-26 Market-share and market-size variances (continuation of 14-25).** Soda-King prepared the budget for 2011 assuming a 12% market share based on total sales in the western region of the United States. The total soft drinks market was estimated to reach sales of 20 million cartons in the region. However, actual total sales volume in the western region was 27.5 million cartons.

**Required**

Calculate the market-share and market-size variances for Soda-King in 2011. (Calculate all variances in terms of contribution margin.) Comment on the results.



## Problems

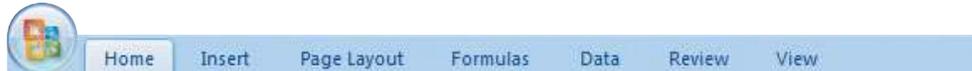
**14-27 Allocation of corporate costs to divisions.** Dusty Rhodes, controller of Richfield Oil Company, is preparing a presentation to senior executives about the performance of its four divisions. Summary data (dollar amounts in millions) related to the four divisions for the most recent year are as follows:

	A	B	C	D	E	F
1	<b>DIVISIONS</b>					
2		<b>Oil &amp; Gas Upstream</b>	<b>Oil &amp; Gas Downstream</b>	<b>Chemical Products</b>	<b>Copper Mining</b>	<b>Total</b>
3	Revenues	\$ 8,000	\$16,000	\$4,800	\$3,200	\$32,000
4	Operating Costs	<u>3,000</u>	<u>15,000</u>	<u>3,800</u>	<u>3,500</u>	<u>25,300</u>
5	Operating Income	<u>\$ 5,000</u>	<u>\$ 1,000</u>	<u>\$1,000</u>	<u>\$ (300)</u>	<u>\$ 6,700</u>
6						
7	Identifiable assets	\$14,000	\$ 6,000	\$3,000	\$2,000	\$25,000
8	Number of employees	9,000	12,000	6,000	3,000	30,000

Under the existing accounting system, costs incurred at corporate headquarters are collected in a single cost pool (\$3,228 million in the most recent year) and allocated to each division on the basis of its actual

revenues. The top managers in each division share in a division-income bonus pool. Division income is defined as operating income less allocated corporate costs.

Rhodes has analyzed the components of corporate costs and proposes that corporate costs be collected in four cost pools. The components of corporate costs for the most recent year (dollar amounts in millions) and Rhodes' suggested cost pools and allocation bases are as follows:

						
	A	B	C	D	E	F
11	<b>Corporate Cost Category</b>	<b>Amount</b>	<b>Suggested Cost Pool</b>	<b>Suggested Allocation Base</b>		
12	Interest on debt	\$2,000	Cost Pool 1	Identifiable assets		
13	Corporate salaries	150	Cost Pool 2	Division revenues		
14	Accounting and control	110	Cost Pool 2			
15	General marketing	200	Cost Pool 2			
16	Legal	140	Cost Pool 2			
17	Research and development	200	Cost Pool 2			
18	Public affairs	203	Cost Pool 3	Positive operating income*		
19	Personnel and payroll	225	Cost Pool 4	Number of employees		
20	Total	\$3,228				
21						
22	*Since public affairs cost includes the cost of public relations staff, lobbyists, and donations to					
23	environmental charities, Rhodes proposes that this cost be allocated using operating income (if positive)					
24	of divisions, with only divisions with positive operating income included in the allocation base.					

1. Discuss two reasons why Richfield Oil should allocate corporate costs to each division.
2. Calculate the operating income of each division when all corporate costs are allocated based on revenues of each division.
3. Calculate the operating income of each division when all corporate costs are allocated using the four cost pools.
4. How do you think the new proposal will be received by the division managers? What are the strengths and weaknesses of Rhodes' proposal relative to the existing single-cost-pool method?

**Required**

**14-28 Cost allocation to divisions.** Forber Bakery makes baked goods for grocery stores, and has three divisions: bread, cake, and doughnuts. Each division is run and evaluated separately, but the main headquarters incurs costs that are indirect costs for the divisions. Costs incurred in the main headquarters are as follows:

Human resources (HR) costs	\$1,900,000
Accounting department costs	1,400,000
Rent and depreciation	1,200,000
Other	600,000
Total costs	<u>\$5,100,000</u>

The Forber upper management currently allocates this cost to the divisions equally. One of the division managers has done some research on activity-based costing and proposes the use of different allocation bases for the different indirect costs—number of employees for HR costs, total revenues for accounting department costs, square feet of space for rent and depreciation costs, and equal allocation among the divisions of "other" costs. Information about the three divisions follows:

	Bread	Cake	Doughnuts
Total revenues	\$20,900,000	\$4,500,000	\$13,400,000
Direct costs	14,500,000	3,200,000	7,250,000
Segment margin	<u>\$ 6,400,000</u>	<u>\$1,300,000</u>	<u>\$ 6,150,000</u>
Number of employees	400	100	300
Square feet of space	10,000	4,000	6,000

1. Allocate the indirect costs of Forber to each division equally. Calculate division operating income after allocation of headquarter costs.

**Required**

- Allocate headquarter costs to the individual divisions using the proposed allocation bases. Calculate the division operating income after allocation. Comment on the allocation bases used to allocate headquarter costs.
- Which division manager do you think suggested this new allocation. Explain briefly. Which allocation do you think is “better?”

**14-29 Customer profitability.** Ring Delights is a new company that manufactures custom jewelry. Ring Delights currently has six customers referenced by customer number: 01, 02, 03, 04, 05, and 06. Besides the costs of making the jewelry, the company has the following activities:

- Customer orders. The salespeople, designers, and jewelry makers spend time with the customer. The cost driver rate is \$40 per hour spent with a customer.
- Customer fittings. Before the jewelry piece is completed the customer may come in to make sure it looks right and fits properly. Cost driver rate is \$25 per hour.
- Rush orders. Some customers want their jewelry quickly. The cost driver rate is \$100 per rush order.
- Number of customer return visits. Customers may return jewelry up to 30 days after the pickup of the jewelry to have something refitted or repaired at no charge. The cost driver rate is \$30 per return visit.

Information about the six customers follows. Some customers purchased multiple items. The cost of the jewelry is 70% of the selling price.

Customer number	01	02	03	04	05	06
Sales revenue	\$600	\$4,200	\$300	\$2,500	\$4,900	\$700
Cost of item(s)	\$420	\$2,940	\$210	\$1,750	\$3,430	\$490
Hours spent on customer order	2	7	1	5	20	3
Hours on fittings	1	2	0	0	4	1
Number of rush orders	0	0	1	1	3	0
Number of returns visits	0	1	0	1	5	1

**Required**

- Calculate the customer-level operating income for each customer. Rank the customers in order of most to least profitable and prepare a customer-profitability analysis, as in Exhibit 14-7.
- Are any customers unprofitable? What is causing this? What should Ring Delights do with respect to these customers?

**14-30 Customer profitability, distribution.** Spring Distribution has decided to analyze the profitability of five new customers (see pp. 510–517). It buys bottled water at \$12 per case and sells to retail customers at a list price of \$14.40 per case. Data pertaining to the five customers are as follows:

	Customer				
	P	Q	R	S	T
Cases sold	2,080	8,750	60,800	31,800	3,900
List selling price	\$14.40	\$14.40	\$14.40	\$14.40	\$14.40
Actual selling price	\$14.40	\$14.16	\$13.20	\$13.92	\$12.96
Number of purchase orders	15	25	30	25	30
Number of customer visits	2	3	6	2	3
Number of deliveries	10	30	60	40	20
Miles traveled per delivery	14	4	3	8	40
Number of expedited deliveries	0	0	0	0	1

Its five activities and their cost drivers are as follows:

Activity	Cost Driver Rate
Order taking	\$100 per purchase order
Customer visits	\$80 per customer visit
Deliveries	\$2 per delivery mile traveled
Product handling	\$0.50 per case sold
Expedited deliveries	\$300 per expedited delivery

**Required**

- Compute the customer-level operating income of each of the five retail customers now being examined (P, Q, R, S, and T). Comment on the results.

2. What insights are gained by reporting both the list selling price and the actual selling price for each customer?
3. What factors should Spring Distribution consider in deciding whether to drop one or more of the five customers?

**14-31 Customer profitability in a manufacturing firm.** Bizzan Manufacturing makes a component called P14-31. This component is manufactured only when ordered by a customer, so Bizzan keeps no inventory of P14-31. The list price is \$100 per unit, but customers who place “large” orders receive a 10% discount on price. Currently, the salespeople decide whether an order is large enough to qualify for the discount. When the product is finished, it is packed in cases of 10. When a customer order is not a multiple of 10, Bizzan uses a full case to pack the partial amount left over (e.g., if customer C orders 25 units, three cases will be required). Customers pick up the order so Bizzan incurs costs of holding the product in the warehouse until customer pick up. The customers are manufacturing firms; if the component needs to be exchanged or repaired, customers can come back within 10 days for free exchange or repair.

The full cost of manufacturing a unit of P14-31 is \$80. In addition, Bizzan incurs customer-level costs. Customer-level cost-driver rates are as follows:

Order taking	\$390 per order
Product handling	\$10 per case
Warehousing (holding finished product)	\$55 per day
Rush order processing	\$540 per rush order
Exchange and repair costs	\$45 per unit

Information about Bizzan’s five biggest customers follows:

	A	B	C	D	E
Number of units purchased	6,000	2,500	1,300	4,200	7,800
Discounts given	10%	0	10%	0	10% on half the units
Number of orders	10	12	52	18	12
Number of cases	600	250	120	420	780
Days in warehouse (total for all orders)	14	18	0	12	140
Number of rush orders	0	3	0	0	6
Number of units exchanged/repaired	0	25	4	25	80

The salesperson gave customer C a price discount because, although customer C ordered only 1,300 units in total, 52 orders (one per week) were placed. The salesperson wanted to reward customer C for repeat business. All customers except E ordered units in the same order size. Customer E’s order quantity varied, so E got a discount part of the time but not all the time.

1. Calculate the customer-level operating income for these five customers. Use the format in Exhibit 14-5. Prepare a customer-profitability analysis by ranking the customers from most to least profitable, as in Exhibit 14-7
2. Discuss the results of your customer-profitability analysis. Does Bizzan have unprofitable customers? Is there anything Bizzan should do differently with its five customers?

**Required**

**14-32 Variance analysis, sales-mix and sales-quantity variances.** Chicago Infonautics, Inc., produces handheld Windows CE™-compatible organizers. Chicago Infonautics markets three different handheld models: PalmPro is a souped-up version for the executive on the go, PalmCE is a consumer-oriented version, and PalmKid is a stripped-down version for the young adult market. You are Chicago Infonautics’ senior vice president of marketing. The CEO has discovered that the total contribution margin came in lower than budgeted, and it is your responsibility to explain to him why actual results are different from the budget. Budgeted and actual operating data for the company’s third quarter of 2012 are as follows:

**Budgeted Operating Data, Third Quarter 2012**

	Selling Price	Variable Cost per Unit	Contribution Margin per Unit	Sales Volume in Units
PalmPro	\$374	\$185	\$189	13,580
PalmCE	272	96	176	35,890
PalmKid	144	66	78	47,530
				<u>97,000</u>

**Actual Operating Data, Third Quarter 2012**

	<b>Selling Price</b>	<b>Variable Cost per Unit</b>	<b>Contribution Margin per Unit</b>	<b>Sales Volume in Units</b>
PalmPro	\$365	\$175	\$190	10,120
PalmCE	288	94	194	32,200
PalmKid	110	75	35	49,680
				<u>92,000</u>

**Required**

1. Compute the actual and budgeted contribution margins in dollars for each product and in total for the third quarter of 2012.
2. Calculate the actual and budgeted sales mixes for the three products for the third quarter of 2012.
3. Calculate total sales-volume, sales-mix, and sales-quantity variances for the third quarter of 2012. (Calculate all variances in terms of contribution margins.)
4. Given that your CEO is known to have temper tantrums, you want to be well prepared for this meeting. In order to prepare, write a paragraph or two comparing actual results to budgeted amounts.

**14-33 Market-share and market-size variances (continuation of 14-32).** Chicago Infonautics' senior vice president of marketing prepared his budget at the beginning of the third quarter assuming a 25% market share based on total sales. The total handheld-organizer market was estimated by Foolinstead Research to reach sales of 388,000 units worldwide in the third quarter. However, actual sales in the third quarter were 400,000 units.

**Required**

1. Calculate the market-share and market-size variances for Chicago Infonautics in the third quarter of 2012 (calculate all variances in terms of contribution margins).
2. Explain what happened based on the market-share and market-size variances.
3. Calculate the actual market size, in units, that would have led to no market-size variance (again using budgeted contribution margin per unit). Use this market-size figure to calculate the actual market share that would have led to a zero market-share variance.

**14-34 Variance analysis, multiple products.** The Split Banana, Inc., operates a chain of Italian gelato stores. Although the Split Banana charges customers the same price for all flavors, production costs vary, depending on the type of ingredients. Budgeted and actual operating data of its three Washington, DC, stores for August 2011 are as follows:

**Budget for August 2011**

	<b>Selling Price per Pint</b>	<b>Variable Cost per Pint</b>	<b>Contribution Margin per Pints</b>	<b>Sales Volume in Pints</b>
Mint chocolate chip	\$9.00	\$4.80	\$4.20	25,000
Vanilla	9.00	3.20	5.80	35,000
Rum Raisin	9.00	5.00	4.00	5,000
Peach	9.00	5.40	3.60	15,000
Coffee	9.00	3.90	5.10	20,000
				<u>100,000</u>

**Actual for August 2011**

	<b>Selling Price per Pint</b>	<b>Variable Cost per Pound</b>	<b>Contribution Margin per Pound</b>	<b>Sales Volume in Pounds</b>
Mint chocolate chip	\$9.00	\$4.60	\$4.40	30,800
Vanilla	9.00	3.25	5.75	27,500
Rum Raisin	9.00	5.15	3.85	8,800
Peach	9.00	5.40	3.60	14,300
Coffee	9.00	4.00	5.00	28,600
				<u>110,000</u>

The Split Banana focuses on contribution margin in its variance analysis.

**Required**

1. Compute the total sales-volume variance for August 2011.
2. Compute the total sales-mix variance for August 2011.
3. Compute the total sales-quantity variance for August 2011.
4. Comment on your results in requirements 1, 2, and 3.

**14-35 Direct materials efficiency, mix, and yield variances.** Nature’s Best Nuts produces specialty nut products for the gourmet and natural foods market. Its most popular product is Zesty Zingers, a mixture of roasted nuts that are seasoned with a secret spice mixture, and sold in one-pound tins. The direct materials used in Zesty Zingers are almonds, cashews, pistachios, and seasoning. For each batch of 100 tins, the budgeted quantities and budgeted prices of direct materials are as follows:

	Quantity for One Batch	Price of Input
Almonds	180 cups	\$1 per cup
Cashews	300 cups	\$2 per cup
Pistachios	90 cups	\$3 per cup
Seasoning	30 cups	\$6 per cup

Changing the standard mix of direct material quantities slightly does not significantly affect the overall end product, particularly for the nuts. In addition, not all nuts added to production end up in the finished product, as some are rejected during inspection.

In the current period, Nature’s Best made 2,500 tins of Zesty Zingers in 25 batches with the following actual quantity, cost and mix of inputs:

	Actual Quantity	Actual Cost	Actual Mix
Almonds	5,280 cups	\$ 5,280	33%
Cashews	7,520 cups	15,040	47%
Pistachios	2,720 cups	8,160	17%
Seasoning	480 cups	2,880	3%
Total actual	<u>16,000 cups</u>	<u>\$31,360</u>	<u>100%</u>

1. What is the budgeted cost of direct materials for the 2,500 tins?
2. Calculate the total direct materials efficiency variance.
3. Why is the total direct materials price variance zero?
4. Calculate the total direct materials mix and yield variances. What are these variances telling you about the 2,500 tins produced this period? Are the variances large enough to investigate?

**Required**

**14-36 Direct labor variances: price, efficiency, mix, and yield.** Trevor Joseph employs two workers in his guitar-making business. The first worker, George, has been making guitars for 20 years and is paid \$30 per hour. The second worker, Earl, is less experienced, and is paid \$20 per hour. One guitar requires, on average, 10 hours of labor. The budgeted direct labor quantities and prices for one guitar are as follows:

	Quantity	Price per Hour of Labor	Cost for One Guitar
George	6 hours	\$30 per hour	\$180
Earl	4 hours	\$20 per hour	80

That is, each guitar is budgeted to require 10 hours of direct labor, comprised of 60% of George’s labor and 40% of Earl’s, although sometimes Earl works more hours on a particular guitar and George less, or vice versa, with no obvious change in the quality or function of the guitar.

During the month of August, Joseph manufactures 25 guitars. Actual direct labor costs are as follows:

George (145 hours)	\$4,350
Earl (108 hours)	<u>2,160</u>
Total actual direct labor cost	<u>\$6,510</u>

1. What is the budgeted cost of direct labor for 25 guitars?
2. Calculate the total direct labor price and efficiency variances.
3. For the 25 guitars, what is the total actual amount of direct labor used? What is the actual direct labor input mix percentage? What is the budgeted amount of George’s and Earl’s labor that should have been used for the 25 guitars?
4. Calculate the total direct labor mix and yield variances. How do these numbers relate to the total direct labor efficiency variance? What do these variances tell you?

**Required**

**14-37 Purposes of cost allocation.** Sarah Reynolds recently started a job as an administrative assistant in the cost accounting department of Mize Manufacturing. New to the area of cost accounting, Sarah is puzzled by the fact that one of Mize’s manufactured products, SR460, seem to have a different cost,

depending on who asks for it. When the marketing department requested the cost of SR460 in order to determine pricing for the new catalog, Sarah was told to report one amount, but when a request came in the very next day from the financial reporting department, the cost of SR460, she was told the cost was very different. Sarah runs a report using Mize's cost accounting system, which produces the following cost elements for one unit of SR460:

Direct materials	\$28.50
Direct manufacturing labor	16.35
Variable manufacturing overhead	8.76
Allocated fixed manufacturing overhead	32.84
Research and development costs specific to SR460 <sup>a</sup>	6.20
Marketing costs <sup>a</sup>	5.95
Sales commissions <sup>a</sup>	11.40
Allocated administrative costs of production department	5.38
Allocated administrative costs of corporate headquarters	18.60
Customer service costs <sup>a</sup>	3.05
Distribution costs <sup>a</sup>	8.80

<sup>a</sup>These costs are specific to SR460, but would not be eliminated if SR460 were purchased from an outside supplier.

### Required

1. Explain to Sarah why the cost given to the marketing and financial reporting departments would be different.
2. Calculate the cost of one unit of SR460 to determine the following:
  - a. The selling price of SR460
  - b. The cost of inventory for financial reporting
  - c. Whether to continue manufacturing SR460, or to purchase it from an outside source (Assume that SR460 is used as a component in one of Mize's other products.)
  - d. The ability of Mize's production manager to control costs

**14-38 Customer-cost hierarchy, customer profitability.** Denise Nelson operates Interiors by Denise, an interior design consulting and window treatment fabrication business. Her business is made up of two different distribution channels, a consulting business in which Denise serves two architecture firms (Attractive Abodes and Better Buildings), and a commercial window treatment business in which Denise designs and constructs window treatments for three commercial clients (Cheery Curtains, Delightful Drapes, and Elegant Extras). Denise would like to evaluate the profitability of her two architecture firm clients and three commercial window treatment clients, as well as evaluate the profitability of each of the two divisions, and the business as a whole. Information about her most recent quarter follow:

Gross revenue from Attractive Abodes (AA)	\$58,500
Gross revenue from Better Buildings (BB)	47,200
Gross revenue from Cheery Curtains (CC)	89,345
Gross revenue from Delightful Drapes (DD)	36,960
Gross revenue from Elegant Extras (EE)	18,300
Costs specific to AA	36,750
Costs specific to BB	29,300
Costs specific to CC	54,645
Costs specific to DD	28,930
Costs specific to EE	14,260
Overhead costs <sup>a</sup>	85,100

<sup>a</sup>Denise has determined that 25% of her overhead costs relate directly to her architectural business, 40% relate directly to her window treatment business, and the remainder is general in nature.

Denise gave a 10% discount to Attractive Abodes in order to lure it away from a competitor, and gave a 5% discount to Elegant Extras for advance payment in cash.

### Required

1. Prepare a customer-cost hierarchy report for Interiors by Denise, using the format in Exhibit 14-6.
2. Prepare a customer-profitability analysis for the five customers, using the format in Exhibit 14-7.
3. Comment on the results of the preceding reports. What recommendations would you give Denise?

## Collaborative Learning Problem

**14-39 Customer profitability and ethics.** Snark Corporation manufactures a product called the snark, which it sells to merchandising firms such as Snark Republic (SR), Snarks-R-U's (SRU), Neiman Snark-us (NS), Snark Buy (SB), Snark-Mart (SM), and Wal-Snark (WS). The list price of a snark is \$50, and the full manufacturing costs are \$35. Salespeople receive a commission on sales, but the commission is based on number of orders taken, not on sales revenue generated or number of units sold. Salespeople receive a commission of \$25 per order (in addition to regular salary).

Snark Corporation makes products based on anticipated demand. Snark Corporation carries an inventory of snarks so rush orders do not result in any extra manufacturing costs over and above the \$35 per snark. Snark Corporation ships finished product to the customer at no additional charge to the customer for either regular or expedited delivery. Snark incurs significantly higher costs for expedited deliveries than for regular deliveries. Customers occasionally return shipments to Snark, and these returns are subtracted from gross revenue. The customers are not charged a restocking fee for returns

Budgeted (expected) customer-level cost driver rates are as follows:

Order taking (excluding sales commission)	\$30 per order
Product handling	\$2 per unit
Delivery	\$0.50 per mile driven
Expedited (rush) delivery	\$325 per shipment
Restocking	\$100 per returned shipment
Visits to customers	\$150 per customer

Because salespeople are paid \$25 per order, they often break up large orders into multiple smaller orders. This practice reduces the actual order taking cost by \$16 per smaller order (from \$30 per order to \$14 per order) because the smaller orders are all written at the same time. This lower cost rate is not included in budgeted rates because salespeople create smaller orders without telling management or the accounting department. All other actual costs are the same as budgeted costs.

Information about Snark's clients follows:

	SR	SRU	NS	SB	SM	WS
Total number of units purchased	250	550	320	130	450	1,200
Number of actual orders	3	15	3	4	5	15
Number of written orders	6	15*	8	7	20	30
Total number of miles driven to deliver all products	420	620	470	280	806	900
Total number of units returned	20	35	0	0	40	60
Number of returned shipments	2	1	0	0	2	6
Number of expedited deliveries	0	6	0	0	2	5

\*Because SRU places 15 separate orders, its order costs are \$30 per order. All other orders are multiple smaller orders and so have actual order costs of \$14 each.

1. Classify each of the customer-level operating costs as a customer output-unit-level, customer batch-level, or customer-sustaining cost.
2. Using the preceding information, calculate the expected customer-level operating income for the six customers of Snark Corporation. Use the number of written orders at \$30 each to calculate expected order costs.
3. Recalculate the customer-level operating income using the number of written orders but at their actual \$14 cost per order instead of \$30 (except for SRU, whose actual cost is \$30 per order). How will Snark Corporation evaluate customer-level operating cost performance this period?
4. Recalculate the customer-level operating income if salespeople had not broken up actual orders into multiple smaller orders. Don't forget to also adjust sales commissions.
5. How is the behavior of the salespeople affecting the profit of Snark Corporation? Is their behavior ethical? What could Snark Corporation do to change the behavior of the salespeople?

**Required**