

### ► Learning Objectives

1. Distinguish the single-rate method from the dual-rate method
2. Understand how divisional incentives are affected by the choice between allocation based on budgeted and actual rates, and budgeted and actual usage
3. Allocate multiple support-department costs using the direct method, the step-down method, and the reciprocal method
4. Allocate common costs using the stand-alone method and the incremental method
5. Explain the importance of explicit agreement between contracting parties when the reimbursement amount is based on costs incurred
6. Understand how bundling of products gives rise to revenue allocation issues and the methods for doing so

How a company allocates its overhead and internal support costs—costs related to marketing, advertising, and other internal services—among its various production departments or projects, can have a big impact on how profitable those departments or projects are.

While the allocation won't affect the firm's profit as a whole, if the allocation isn't done properly, it can make some departments and projects (and their managers) look better or worse than they should profit-wise. As the following article shows, the method of allocating costs for a project affects not just the firm but also the consumer. Based on the method used, consumers may spend more, or less, for the same service.

## Cost Allocation and the Future of “Smart Grid” Energy Infrastructure<sup>1</sup>

Across the globe, countries are adopting alternative methods of generating and distributing energy. In the United States, government leaders and companies ranging from GE to Google are advocating the movement towards a “Smart Grid”—that is, making transmission and power lines operate and communicate in a more effective and efficient manner using technology, computers, and software. This proposed system would also integrate with emerging clean energy sources, such as solar farms and geothermal systems, to help create a more sustainable electricity supply that reduces carbon emissions.

According to the Electric Power Resource Institute, the cost of developing the “Smart Grid” is \$165 billion over the next two decades. These costs include new infrastructure and technology improvements—mostly to power lines—as well as traditional indirect costs for the organizations upgrading the power system, which include traditional support-department costs and common costs. Private utilities and the U.S. government will pay for the upfront costs of “Smart Grid” development, but those costs will be recouped over time by charging energy consumers. But one question remains: How should those costs be allocated for reimbursement?

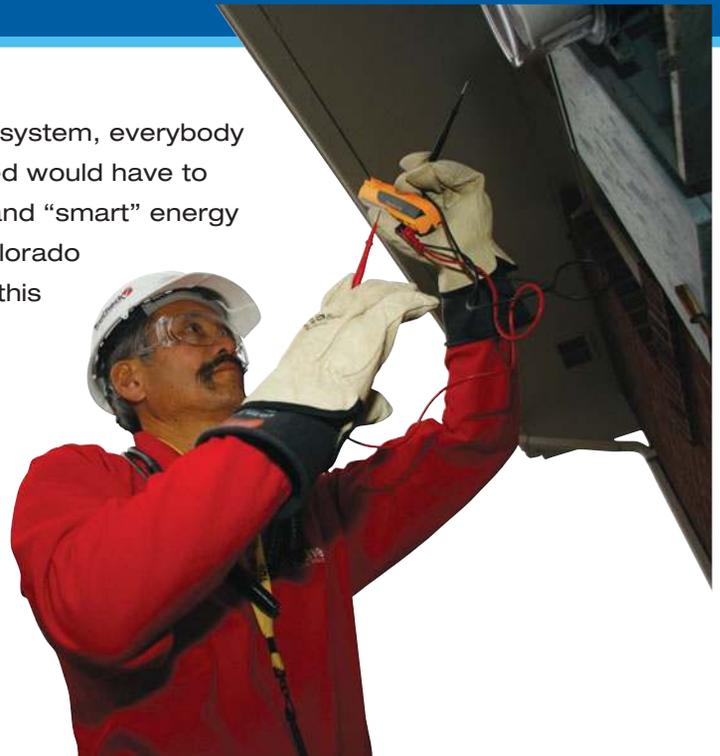
A controversy has emerged as two cost allocation methods are being debated by the U.S. government. One method is

<sup>1</sup> Sources: Garthwaite, Josie. 2009. The \$160B question: Who should foot the bill for transmission buildout? Salon.com, March 12; Jaffe, Mark. 2010. Cost of Smart-Grid projects shocks consumer advocates. *The Denver Post*, February 14.

interconnection-wide cost allocation. Under this system, everybody in the region where a new technology is deployed would have to help pay for it. For example, if new power lines and “smart” energy meters are deployed in Denver, everybody in Colorado would help pay for them. Supporters argue that this method would help lessen the costs consumers would be charged by utilities for the significant investments in new technology.

Another competing proposal would only allocate costs to utility ratepayers that actually benefit from the new “Smart Grid” system. Using the previous example, only utility customers in Denver would be charged for the new power lines and energy meters (likely through additional monthly utility costs). Supporters of this method believe that customers with new “Smart Grid” systems should not be subsidized by those not receiving any of the benefits.

Regardless of the method selected, cost allocation is going to play a key role in the future of the U.S. energy generation and distribution system. The same allocation dilemmas apply to the costs of corporate support departments and the apportionment of revenues when products are sold in bundles. These concerns are common to managers at manufacturing companies such as Nestle, service companies such as Comcast, merchandising companies such as Trader Joe’s, and academic institutions such as Auburn University. This chapter focuses on several challenges that arise with regard to cost and revenue allocations.



## Allocating Support Department Costs Using the Single-Rate and Dual-Rate Methods

Companies distinguish operating departments (and operating divisions) from support departments. An **operating department**, also called a **production department**, directly adds value to a product or service. A **support department**, also called a **service department**, provides the services that assist other internal departments (operating departments and other support departments) in the company. Examples of support departments are information systems and plant maintenance. Managers face two questions when allocating the costs of a support department to operating departments or divisions: (1) Should fixed costs of support departments be allocated to operating divisions? (2) If fixed costs are allocated, should variable and fixed costs be allocated in the same way? With regard to the first question, most companies believe that fixed costs of support departments should be allocated because the support department needs to incur fixed costs to provide

### Learning Objective 1

Distinguish the single-rate method

... one rate for allocating costs in a cost pool

from the dual-rate method

... two rates for allocating costs in a cost pool—one for variable costs and one for fixed costs

operating divisions with the services they require. Depending on the answer to the second question, there are two approaches to allocating support-department costs: the *single-rate cost-allocation method* and the *dual-rate cost-allocation method*.

## Single-Rate and Dual-Rate Methods

The **single-rate method** makes no distinction between fixed and variable costs. It allocates costs in each cost pool (support department in this section) to cost objects (operating divisions in this section) using the same rate per unit of a single allocation base. By contrast, the **dual-rate method** partitions the cost of each support department into two pools, a variable-cost pool and a fixed-cost pool, and allocates each pool using a different cost-allocation base. When using either the single-rate method or the dual-rate method, managers can allocate support-department costs to operating divisions based on either a *budgeted* rate or the eventual *actual* cost rate. The latter approach is neither conceptually preferred nor widely used in practice (we explain why in the next section). Accordingly, we illustrate the single-rate and dual-rate methods next based on the use of *budgeted* rates.

Consider the central computer department of Sand Hill Company (SHC). This support department has two users, both operating divisions: the microcomputer division and the peripheral equipment division. The following data relate to the 2012 budget:

Practical capacity	18,750 hours
Fixed costs of operating the computer facility in the 6,000-hour to 18,750-hour relevant range	\$3,000,000
Budgeted long-run usage (quantity) in hours:	
Microcomputer division	8,000 hours
Peripheral equipment division	4,000 hours
Total	<u>12,000</u> hours
Budgeted variable cost per hour in the 6,000-hour to 18,750-hour relevant range	\$200 per hour used
Actual usage in 2012 in hours:	
Microcomputer division	9,000 hours
Peripheral equipment division	3,000 hours
Total	<u>12,000</u> hours

The budgeted rates for central computer department costs can be computed based on either the demand for computer services or the supply of computer services. We consider the allocation of central computer department costs based first on the demand for (or usage of) computer services and then on the supply of computer services.

## Allocation Based on the Demand for (or Usage of) Computer Services

We present the single-rate method followed by the dual-rate method.

### Single-Rate Method

In this method, a combined budgeted rate is used for fixed and variable costs. The rate is calculated as follows:

Budgeted usage	12,000 hours
Budgeted total cost pool: $\$3,000,000 + (12,000 \text{ hours} \times \$200/\text{hour})$	\$5,400,000
Budgeted total rate per hour: $\$5,400,000 \div 12,000 \text{ hours}$	\$450 per hour used
Allocation rate for microcomputer division	\$450 per hour used
Allocation rate for peripheral equipment division	\$450 per hour used

Note that the budgeted rate of \$450 per hour is substantially higher than the \$200 budgeted *variable* cost per hour. That's because the \$450 rate includes an allocated amount of \$250 per hour (budgeted fixed costs, \$3,000,000,  $\div$  budgeted usage, 12,000 hours) for the *fixed* costs of operating the facility.

Under the single-rate method, divisions are charged the budgeted rate for each hour of *actual* use of the central facility. Applying this to our example, SHC allocates central

computer department costs based on the \$450 per hour budgeted rate and actual hours used by the operating divisions. The support costs allocated to the two divisions under this method are as follows:

Microcomputer division: 9,000 hours × \$450 per hour	\$4,050,000
Peripheral equipment division: 3,000 hours × \$450 per hour	\$1,350,000

### Dual-Rate Method

When the dual-rate method is used, allocation bases must be chosen for both the variable and fixed cost pools of the central computer department. As in the single-rate method, variable costs are assigned based on the *budgeted* variable cost per hour of \$200 for *actual* hours used by each division. However, fixed costs are assigned based on *budgeted* fixed costs per hour and the *budgeted* number of hours for each division. Given the budgeted usage of 8,000 hours for the microcomputer division and 4,000 hours for the peripheral equipment division, the budgeted fixed-cost rate is \$250 per hour (\$3,000,000 ÷ 12,000 hours), as before. Since this rate is charged on the basis of the *budgeted* usage, however, the fixed costs are effectively allocated in advance as a lump-sum based on the relative proportions of the central computing facilities expected to be used by the operating divisions.

The costs allocated to the microcomputer division in 2012 under the dual-rate method would be as follows:

Fixed costs: \$250 per hour × 8,000 (budgeted) hours	\$2,000,000
Variable costs: \$200 per hour × 9,000 (actual) hours	<u>1,800,000</u>
Total costs	<u>\$3,800,000</u>

The costs allocated to the peripheral equipment division in 2012 would be as follows:

Fixed costs: \$250 per hour × 4,000 (budgeted) hours	\$1,000,000
Variable costs: \$200 per hour × 3,000 (actual) hours	<u>600,000</u>
Total costs	<u>\$1,600,000</u>

Note that each operating division is charged the same amount for variable costs under the single-rate and dual-rate methods (\$200 per hour multiplied by the actual hours of use). However, the overall assignment of costs differs under the two methods because the single-rate method allocates fixed costs of the support department based on actual usage of computer resources by the operating divisions, whereas the dual-rate method allocates fixed costs based on budgeted usage.

We next consider the alternative approach of allocating central computer department costs based on the capacity of computer services supplied.

### Allocation Based on the Supply of Capacity

We illustrate this approach using the 18,750 hours of practical capacity of the central computer department. The budgeted rate is then determined as follows:

Budgeted fixed-cost rate per hour, \$3,000,000 ÷ 18,750 hours	\$160 per hour
Budgeted variable-cost rate per hour	<u>200 per hour</u>
Budgeted total-cost rate per hour	<u>\$360 per hour</u>

Using the same procedures for the single-rate and dual-rate methods as in the previous section, the support cost allocations to the operating divisions are as follows:

#### Single-Rate Method

Microcomputer division: \$360 per hour × 9,000 (actual) hours	\$3,240,000
Peripheral equipment division: \$360 per hour × 3,000 (actual) hours	1,080,000
Fixed costs of unused computer capacity:	
\$160 per hour × 6,750 hours <sup>a</sup>	1,080,000

<sup>a</sup>6,750 hours = Practical capacity of 18,750 – (9,000 hours used by microcomputer division + 3,000 hours used by peripheral equipment division).

**Dual-Rate Method**

Microcomputer division	
Fixed costs: \$160 per hour × 8,000 (budgeted) hours	\$1,280,000
Variable costs: \$200 per hour × 9,000 (actual) hours	<u>1,800,000</u>
Total costs	<u>\$3,080,000</u>
Peripheral equipment division	
Fixed costs: \$160 per hour × 4,000 (budgeted) hours	\$ 640,000
Variable costs: \$200 per hour × 3,000 (actual) hours	<u>600,000</u>
Total costs	<u>\$1,240,000</u>
Fixed costs of unused computer capacity:	
\$160 per hour × 6,750 hours <sup>b</sup>	\$1,080,000

<sup>b</sup>6,750 hours = Practical capacity of 18,750 hours – (8,000 hours budgeted to be used by microcomputer division + 4,000 hours budgeted to be used by peripheral equipment division).

When practical capacity is used to allocate costs, the single-rate method allocates only the actual fixed-cost resources used by the microcomputer and peripheral equipment divisions, while the dual-rate method allocates the budgeted fixed-cost resources to be used by the operating divisions. Unused central computer department resources are highlighted but usually not allocated to the divisions.<sup>2</sup>

The advantage of using practical capacity to allocate costs is that it focuses management's attention on managing unused capacity (described in Chapter 9, pp. 317–318, and Chapter 13, pp. 486–487). Using practical capacity also avoids burdening the user divisions with the cost of unused capacity of the central computer department. In contrast, when costs are allocated on the basis of the demand for computer services, all \$3,000,000 of budgeted fixed costs, including the cost of unused capacity, are allocated to user divisions. If costs are used as a basis for pricing, then charging user divisions for unused capacity could result in the downward demand spiral (see p. 316).

## Single-Rate Versus Dual-Rate Method

There are benefits and costs of both the single-rate and dual-rate methods. One benefit of the single-rate method is the low cost to implement it. The single-rate method avoids the often-expensive analysis necessary to classify the individual cost items of a department into fixed and variable categories. Also, by conditioning the final allocations on the actual usage of central facilities, rather than basing them solely on uncertain forecasts of expected demand, it offers the user divisions some operational control over the charges they bear.

A problem with the single-rate method is that it makes the allocated fixed costs of the support department appear as variable costs to the operating divisions. Consequently, the single-rate method may lead division managers to make outsourcing decisions that are in their own best interest but that may be inefficient from the standpoint of the organization as a whole. Consider the setting where allocations are made on the basis of the demand for computer services. In this case, each user division is charged \$450 per hour under the single-rate method (recall that \$250 of this charge relates to the allocated fixed costs of the central computer department). Suppose an external vendor offers the microcomputer division computer services at a rate of \$340 per hour, at a time when the central computer department has unused capacity. The microcomputer division's managers would be tempted to use this vendor because it would lower the division's costs (\$340 per hour instead of the \$450 per hour internal charge for computer services). In the short run, however, the fixed costs of the central computer department remain unchanged in the relevant range (between 6,000 hours of usage and the practical capacity of 18,750 hours). SHC will therefore incur an additional cost of \$140 per hour if the managers were to take this offer—the difference between the \$340 external purchase price and the true internal variable cost of \$200 of using the central computer department.

<sup>2</sup> In our example, the cost of unused capacity under the single-rate and the dual-rate methods coincide (each equals \$1,080,000). This occurs because the total actual usage of the facility matches the total expected usage of 12,000 hours. The budgeted cost of unused capacity (in the dual-rate method) can be either greater or lower than the actual cost (in the single-rate method), depending on whether the total actual usage is lower or higher than the budgeted usage.

The divergence created under the single-rate method between SHC's interests and those of its division managers is lessened when allocation is done on the basis of practical capacity. The variable cost per hour perceived by the operating division managers is now \$360 (rather than the \$450 rate when allocation is based on budgeted usage). However, any external offer above \$200 (SHC's true variable cost) and below \$360 (the single-rate charge per hour) will still result in the user manager preferring to outsource the service at the expense of SHC's overall profits.

A benefit of the dual-rate method is that it signals to division managers how variable costs and fixed costs behave differently. This information guides division managers to make decisions that benefit the organization as a whole, as well as each division. For example, using a third-party computer provider that charges more than \$200 per hour would result in SHC's being worse off than if its own central computer department were used, because the latter has a variable cost of \$200 per hour. Under the dual-rate method, neither division manager has an incentive to pay more than \$200 per hour for an external provider because the internal charge for computer services is precisely that amount. By charging the fixed costs of resources budgeted to be used by the divisions as a lump-sum, the dual-rate method succeeds in removing fixed costs from the division managers' consideration when making marginal decisions regarding the outsourcing of services. It thus avoids the potential conflict of interest that can arise under the single-rate method.

Recently, the dual-rate method has been receiving more attention. Resource Consumption Accounting (RCA), an emerging management accounting system, employs an allocation procedure akin to a dual-rate system. For each cost/resource pool, cost assignment rates for fixed costs are based on practical capacity supplied, while rates for proportional costs (i.e., costs that vary with regard to the output of the resource pool) are based on planned quantities.<sup>3</sup>

## Budgeted Versus Actual Costs, and the Choice of Allocaton Base

The allocation methods previously outlined follow specific procedures in terms of the support department costs that are considered as well as the manner in which costs are assigned to the operating departments. In this section, we examine these choices in greater detail and consider the impact of alternative approaches. We show that the decision whether to use actual or budgeted costs, as well as the choice between actual and budgeted usage as allocation base, has a significant impact on the cost allocated to each division and the incentives of the division managers.

### Budgeted Versus Actual Rates

In both the single-rate and dual-rate methods, we use budgeted rates to assign support department costs (fixed as well as variable costs). An alternative approach would involve using the actual rates based on the support costs realized during the period. This method is much less common because of the level of uncertainty it imposes on user divisions. When allocations are made using budgeted rates, managers of divisions to which costs are allocated know with certainty the rates to be used in that budget period. Users can then determine the amount of the service to request and—if company policy allows—whether to use the internal source or an external vendor. In contrast, when actual rates are used for cost allocation, user divisions are kept unaware of their charges until the end of the budget period.

Budgeted rates also help motivate the manager of the support (or supplier) department (for example, the central computer department) to improve efficiency. During the

<sup>3</sup> Other salient features of Resource Consumption Accounting (RCA) include the selective use of activity-based costing, the nonassignment of fixed costs when causal relationships cannot be established, and the depreciation of assets based on their replacement cost. RCA has its roots in the nearly fifty-year-old German cost accounting system called Grenzplankostenrechnung (GPK), which is used by organizations such as Mercedes-Benz, Porsche, and Stihl. For further details, as well as illustrations of the use of RCA and GPK in organizations, see S. Webber and B. Clinton, "Resource Consumption Accounting Applied: The Cloday Case," *Management Accounting Quarterly* (Fall 2004) and B. Mackie, "Merging GPK and ABC on the Road to RCA," *Strategic Finance* (November 2006).

### Decision Point

When should managers use the dual-rate method over the single-rate method?

### Learning Objective 2

Understand how divisional incentives are affected by the choice between allocation based on budgeted and actual rates,

... budgeted rates provide certainty to users about charges and motivate the support division to engage in cost control

and budgeted and actual usage

... budgeted usage helps in planning and efficient utilization of fixed resources, actual usage controls consumption of variable resources

budget period, the support department, not the user divisions, bears the risk of any unfavorable cost variances. That's because user divisions do not pay for any costs or inefficiencies of the supplier department that cause actual rates to exceed budgeted rates.

The manager of the supplier department would likely view the budgeted rates negatively if unfavorable cost variances occur due to price increases outside of his or her control. Some organizations try to identify these uncontrollable factors and relieve the support department manager of responsibility for these variances. In other organizations, the supplier department and the user division agree to share the risk (through an explicit formula) of a large, uncontrollable increase in the prices of inputs used by the supplier department. This procedure avoids imposing the risk completely on either the supplier department (as when budgeted rates are used) or the user division (as in the case of actual rates).

For the rest of this chapter, we will continue to consider only allocation methods that are based on the budgeted cost of support services.

## Budgeted Versus Actual Usage

In both the single-rate and dual-rate methods, the variable costs are assigned on the basis of budgeted rates and actual usage. Since the variable costs are directly and causally linked to usage, charging them as a function of the actual usage is appropriate. Moreover, allocating variable costs on the basis of budgeted usage would provide the user departments with no incentive to control their consumption of support services.

What about the fixed costs? Consider the budget of \$3,000,000 fixed costs at the central computer department of SHC. Recall that budgeted usage is 8,000 hours for the microcomputer division and 4,000 hours for the peripheral equipment division. Assume that actual usage by the microcomputer division is always equal to budgeted usage. We consider three cases: when actual usage by the peripheral equipment division equals (Case 1), is greater than (Case 2), and is less than (Case 3) budgeted usage.

### Fixed Cost Allocation Based on Budgeted Rates and Budgeted Usage

This is the dual-rate procedure outlined in the previous section. When budgeted usage is the allocation base, regardless of the actual usage of facilities (i.e., whether Case 1, 2, or 3 occurs), user divisions receive a preset lump-sum fixed cost charge. If rates are based on expected demand (\$250 per hour), the microcomputer division is assigned \$2,000,000 and the peripheral equipment division, \$1,000,000. If rates are set using practical capacity (\$160 per hour), the microcomputer division is charged \$1,280,000, the peripheral equipment division is allocated \$640,000, and the remaining \$1,080,000 is the unallocated cost of excess capacity.

The advantage of knowing the allocations in advance is that it helps the user divisions with both short-run and long-run planning. Companies commit to infrastructure costs (such as the fixed costs of a support department) on the basis of a long-run planning horizon; budgeted usage measures the long-run demands of the user divisions for support-department services.

Allocating fixed costs on the basis of budgeted long-run usage may tempt some managers to underestimate their planned usage. Underestimating will result in their divisions bearing a lower percentage of fixed costs (assuming all other managers do not similarly underestimate their usage). To discourage such underestimates, some companies offer bonuses or other rewards—the “carrot” approach—to managers who make accurate forecasts of long-run usage. Other companies impose cost penalties—the “stick” approach—for underestimating long-run usage. For instance, a higher cost rate is charged after a division exceeds its budgeted usage.

### Fixed Cost Allocation Based on Budgeted Rates and Actual Usage

Column 2 of Exhibit 15-1 provides the allocations when the budgeted rate is based on expected demand (\$250 per hour), while column 3 shows the allocations when practical capacity is used to derive the rate (\$160 per hour). Note that each operating division's

## Exhibit 15-1

## Effect of Variations in Actual Usage on Fixed Cost Allocation to Operating Divisions

Case	(1) Actual Usage		(2) Budgeted Rate Based on Expected Demand <sup>a</sup>		(3) Budgeted Rate Based on Practical Capacity <sup>b</sup>		(4) Allocation of Budgeted Total Fixed Cost	
	Micro. Div.	Periph. Div.	Micro. Div.	Periph. Div.	Micro. Div.	Periph. Div.	Micro. Div.	Periph. Div.
1	8,000 hours	4,000 hours	\$2,000,000	\$1,000,000	\$1,280,000	\$ 640,000	\$2,000,000 <sup>c</sup>	\$1,000,000 <sup>d</sup>
2	8,000 hours	7,000 hours	\$2,000,000	\$1,750,000	\$1,280,000	\$1,120,000	\$1,600,000 <sup>e</sup>	\$1,400,000 <sup>f</sup>
3	8,000 hours	2,000 hours	\$2,000,000	\$ 500,000	\$1,280,000	\$ 320,000	\$2,400,000 <sup>g</sup>	\$ 600,000 <sup>h</sup>

<sup>a</sup>	$\frac{\$3,000,000}{(8,000 + 4,000) \text{ hours}} = \$250 \text{ per hour}$	<sup>b</sup>	$\frac{\$3,000,000}{18,750 \text{ hours}} = \$160 \text{ per hour}$	<sup>c</sup>	$\frac{8,000}{(8,000 + 4,000)} \times \$3,000,000$	<sup>d</sup>	$\frac{4,000}{(8,000 + 4,000)} \times \$3,000,000$
<sup>e</sup>	$\frac{8,000}{(8,000 + 7,000)} \times \$3,000,000$	<sup>f</sup>	$\frac{7,000}{(8,000 + 7,000)} \times \$3,000,000$	<sup>g</sup>	$\frac{8,000}{(8,000 + 2,000)} \times \$3,000,000$	<sup>h</sup>	$\frac{2,000}{(8,000 + 2,000)} \times \$3,000,000$

fixed cost allocation varies based on its actual usage of support facilities. However, variations in actual usage in one division do not affect the costs allocated to the other division. The microcomputer division is allocated either \$2,000,000 or \$1,280,000, depending on the budgeted rate chosen, independent of the peripheral equipment division's actual usage. Therefore, combining actual usage as the allocation base with budgeted rates provides user divisions with advanced knowledge of rates, as well as control over the costs charged to them.<sup>4</sup>

Note, however, that this allocation procedure for fixed costs is exactly the same as that under the single-rate method. As such, the procedure shares the disadvantages of the single-rate method discussed in the previous section, such as charging excessively high costs, including the cost of unused capacity, when rates are based on expected usage. Moreover, even when rates are based on practical capacity, recall that allocating fixed cost rates based on actual usage induces conflicts of interest between the user divisions and the firm when evaluating outsourcing possibilities.

### Allocating Budgeted Fixed Costs Based on Actual Usage

Finally, consider the impact of having actual usage as the allocation base when the firm assigns total budgeted fixed costs to operating divisions (rather than specifying budgeted fixed cost rates, as we have thus far). If the budgeted fixed costs of \$3,000,000 are allocated using budgeted usage, we are back in the familiar dual-rate setting. On the other hand, if the actual usage of the facility is the basis for allocation, the charges would equal the amounts in Exhibit 15-1, column 4. In Case 1, the fixed-cost allocation equals the budgeted amount (which is also the same as the charge under the dual-rate method). In Case 2, the fixed-cost allocation is \$400,000 less to the microcomputer division than the amount based on budgeted usage (\$1,600,000 versus \$2,000,000). In Case 3, the fixed-cost allocation is \$400,000 more to the microcomputer division than the amount based on budgeted usage (\$2,400,000 versus \$2,000,000). Why does the microcomputer division receive \$400,000 more in costs in Case 3, even though its actual usage equals its budgeted usage? Because the total fixed costs of \$3,000,000 are now spread over 2,000 fewer hours of actual total usage. In other words, the lower usage by the peripheral equipment division leads to an increase in the fixed costs allocated to the microcomputer division. When budgeted fixed costs are allocated based on actual usage, user divisions will not know their fixed cost allocations until the end of the budget period. This method therefore shares the same flaw as those that rely on the use of actual cost realizations rather than budgeted cost rates.

To summarize, there are excellent economic and motivational reasons to justify the precise forms of the single-rate and dual-rate methods considered in the previous section, and in particular, to recommend the dual-rate allocation procedure.

<sup>4</sup> The total amount of fixed costs allocated to divisions will in general not equal the actual realized costs. Adjustments for overallocations and underallocations would then be made using the methods discussed previously in chapters 4, 7 and 8.

### Decision Point

What factors should managers consider when deciding between allocation based on budgeted and actual rates, and budgeted and actual usage?

## Learning Objective 3

Allocate multiple support-department costs using the direct method,

... allocates support-department costs directly to operating departments

the step-down method,

... partially allocates support-department costs to other support departments

and the reciprocal method

... fully allocates support-department costs to other support departments

## Allocating Costs of Multiple Support Departments

We just examined general issues that arise when allocating costs from one support department to operating divisions. In this section, we examine the special cost-allocation problems that arise when two or more of the support departments whose costs are being allocated provide reciprocal support to each other as well as to operating departments. An example of reciprocal support is a firm's human resource department providing recruiting, training, and performance management services to all employees of a firm, including those who work in the legal department, while also utilizing the services of the legal department for compliance activities, drafting of contracts, checking stock option plan documents, etc. More accurate support-department cost allocations result in more accurate product, service, and customer costs.

Consider Castleford Engineering, which operates at practical capacity to manufacture engines used in electric-power generating plants. Castleford has two support departments and two operating departments in its manufacturing facility:

Support Departments	Operating Departments
Plant (and equipment) maintenance	Machining
Information systems	Assembly

The two support departments at Castleford provide reciprocal support to each other as well as support to the two operating departments. Costs are accumulated in each department for planning and control purposes. Exhibit 15-2 displays the data for this example. To understand the percentages in this exhibit, consider the plant maintenance department. This support department provides a total of 20,000 hours of support work: 20% ( $4,000 \div 20,000 = 0.20$ ) for the information systems department, 30% ( $6,000 \div 20,000 = 0.30$ ) for the machining department, and 50% ( $10,000 \div 20,000 = 0.50$ ) for the assembly department.

We now examine three methods of allocating the costs of reciprocal support departments: *direct*, *step-down*, and *reciprocal*. To simplify the explanation and to focus on concepts, we use the single-rate method to allocate the costs of each support department using budgeted rates and budgeted hours used by the other departments. (The Problem for Self-Study illustrates the dual-rate method for allocating reciprocal support-department costs.)

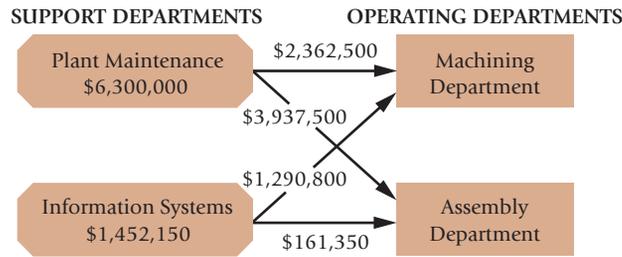
### Direct Method

The **direct method** allocates each support department's costs to operating departments only. The direct method does not allocate support-department costs to other support departments. Exhibit 15-3 illustrates this method using the data in Exhibit 15-2. The

**Exhibit 15-2**

Data for Allocating Support-Department Costs at Castleford Engineering for 2012

		A	B	C	D	E	F	G
		SUPPORT DEPARTMENTS			OPERATING DEPARTMENTS			
		Plant Maintenance	Information Systems		Machining	Assembly	Total	
1								
2								
3	Budgeted overhead costs							
4	before any interdepartment cost allocations	\$6,300,000	\$1,452,150		\$4,000,000	\$2,000,000	\$13,752,150	
5	Support work furnished:							
6	By plant maintenance							
7	Budgeted labor-hours	—	4,000		6,000	10,000	20,000	
8	Percentage	—	20%		30%	50%	100%	
9	By information systems							
10	Budgeted computer hours	500	—		4,000	500	5,000	
11	Percentage	10%	—		80%	10%	100%	



**Exhibit 15-3**

Direct Method of Allocating Support-Department Costs at Castleford Engineering for 2012

	A	B	C	D	E	F	G
1		<b>SUPPORT DEPARTMENTS</b>			<b>OPERATING DEPARTMENTS</b>		
2		<b>Plant Maintenance</b>	<b>Information Systems</b>		<b>Machining</b>	<b>Assembly</b>	<b>Total</b>
3	Budgeted overhead costs						
4	before any interdepartment cost allocations	\$6,300,000	\$1,452,150		\$4,000,000	\$2,000,000	\$13,752,150
5	Allocation of plant maintenance (3/8, 5/8) <sup>a</sup>	(6,300,000)			2,362,500	3,937,500	
6	Allocation of information systems (8/9, 1/9) <sup>b</sup>		(1,452,150)		1,290,800	161,350	
7							
8	Total budgeted overhead of operating departments	\$ 0	\$ 0		\$7,653,300	\$6,098,850	\$13,752,150
9							
10	<sup>a</sup> Base is (6,000 + 10,000), or 16,000 hours; 6,000 ÷ 16,000 = 3/8; 10,000 ÷ 16,000 = 5/8.						
11	<sup>b</sup> Base is (4,000 + 500), or 4,500 hours; 4,000 ÷ 4,500 = 8/9; 500 ÷ 4,500 = 1/9.						

base used to allocate plant maintenance costs to the operating departments is the budgeted total maintenance labor-hours worked in the operating departments: 6,000 + 10,000 = 16,000 hours. This amount excludes the 4,000 hours of budgeted support time provided by plant maintenance to information systems. Similarly, the base used for allocation of information systems costs to the operating departments is 4,000 + 500 = 4,500 budgeted hours of computer time, which excludes the 500 hours of budgeted support time provided by information systems to plant maintenance.

An equivalent approach to implementing the direct method involves calculating a budgeted rate for each support department's costs. For example, the rate for plant maintenance department costs is \$6,300,000 ÷ 16,000 hours, or \$393.75 per hour. The machining department is then allocated \$2,362,500 (\$393.75 per hour × 6,000 hours) while the assembly department is assigned \$3,937,500 (\$393.75 per hour × 10,000 hours). For ease of explanation throughout this section, we will use the fraction of the support-department services used by other departments, rather than calculate budgeted rates, to allocate support-department costs.

The direct method is widely practiced because of its ease of use. The benefit of the direct method is simplicity. There is no need to predict the usage of support-department services by other support departments. A disadvantage of the direct method is that it ignores information about reciprocal services provided among support departments and can therefore lead to inaccurate estimates of the cost of operating departments. We now examine a second approach, which partially recognizes the services provided among support departments.

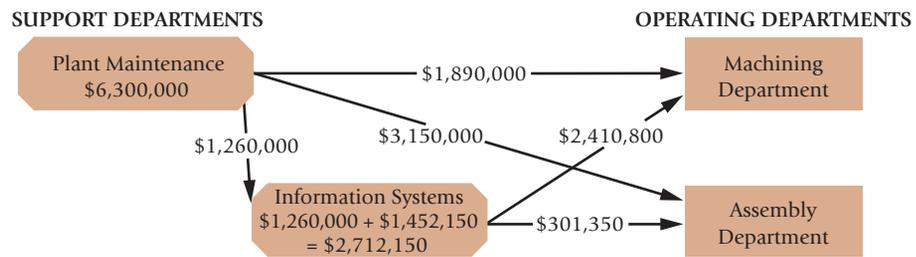
### Step-Down Method

Some organizations use the **step-down method**, also called the **sequential allocation method**, which allocates support-department costs to other support departments and to operating departments in a sequential manner that partially recognizes the mutual services provided among all support departments.

Exhibit 15-4 shows the step-down method. The plant maintenance costs of \$6,300,000 are allocated first. Exhibit 15-2 shows that plant maintenance provides 20% of its services

**Exhibit 15-4**

Step-Down Method of Allocating Support-Department Costs at Castleford Engineering for 2012



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	A	B	C	D	E	F	G
1		<b>SUPPORT DEPARTMENTS</b>			<b>OPERATING DEPARTMENTS</b>		
2		<b>Plant Maintenance</b>	<b>Information Systems</b>		<b>Machining</b>	<b>Assembly</b>	<b>Total</b>
3	Budgeted overhead costs before any						
4	interdepartment cost allocations	\$6,300,000	\$1,452,150		\$4,000,000	\$2,000,000	\$13,752,150
5	Allocation of plant maintenance (2/10, 3/10, 5/10) <sup>a</sup>	(6,300,000)	<u>1,260,000</u>		1,890,000	3,150,000	
6			2,712,150				
7	Allocation of information systems (8/9, 1/9) <sup>b</sup>		<u>(2,712,150)</u>		<u>2,410,800</u>	<u>301,350</u>	
8							
9	Total budgeted overhead of operating departments	<u>\$ 0</u>	<u>\$ 0</u>		<u>\$8,300,800</u>	<u>\$5,451,350</u>	<u>\$13,752,150</u>
10							
11	<sup>a</sup> Base is (4,000 + 6,000 + 10,000), or 20,000 hours; 4,000 ÷ 20,000 = 2/10; 6,000 ÷ 20,000 = 3/10; 10,000 ÷ 20,000 = 5/10.						
12	<sup>b</sup> Base is (4,000 + 500), or 4,500 hours; 4,000 ÷ 4,500 = 8/9; 500 ÷ 4,500 = 1/9.						

to information systems, 30% to machining, and 50% to assembly. Therefore, \$1,260,000 is allocated to information systems (20% of \$6,300,000), \$1,890,000 to machining (30% of \$6,300,000), and \$3,150,000 to assembly (50% of \$6,300,000). The information systems costs now total \$2,712,150: budgeted costs of the information systems department before any interdepartmental cost allocations, \$1,452,150, plus \$1,260,000 from the allocation of plant maintenance costs to the information systems department. The \$2,712,150 is then only allocated between the two operating departments based on the proportion of the information systems department services provided to machining and assembly. From Exhibit 15-2, the information systems department provides 80% of its services to machining and 10% to assembly, so \$2,410,800 ( $8/9 \times \$2,712,150$ ) is allocated to machining and \$301,350 ( $1/9 \times \$2,712,150$ ) is allocated to assembly.

Note that this method requires the support departments to be ranked (sequenced) in the order that the step-down allocation is to proceed. In our example, the costs of the plant maintenance department were allocated first to all other departments, including the information systems department. The costs of the information systems support department were allocated second, but only to the two operating departments. If the information systems department costs had been allocated first and the plant maintenance department costs second, the resulting allocations of support-department costs to operating departments would have been different. A popular step-down sequence begins with the support department that renders the highest percentage of its total services to *other support departments*. The sequence continues with the department that renders the next-highest percentage, and so on, ending with the support department that renders the lowest percentage.<sup>5</sup> In our example, costs of the plant maintenance department were allocated first because it provides 20% of its services to the information systems department, whereas the information systems department provides only 10% of its services to the plant maintenance department (see Exhibit 15-2).

<sup>5</sup> An alternative approach to selecting the sequence of allocations is to begin with the support department that renders the highest dollar amount of services to other support departments. The sequence ends with the allocation of the costs of the department that renders the lowest dollar amount of services to other support departments.

Under the step-down method, once a support department’s costs have been allocated, no subsequent support-department costs are allocated back to it. Once the plant maintenance department costs are allocated, it receives no further allocation from other (lower-ranked) support departments. The result is that the step-down method does not recognize the total services that support departments provide to one another. The reciprocal method fully recognizes all such services, as you will see next.

### Reciprocal Method

The **reciprocal method** allocates support-department costs to operating departments by fully recognizing the mutual services provided among all support departments. For example, the plant maintenance department maintains all the computer equipment in the information systems department. Similarly, information systems provide database support for plant maintenance. The reciprocal method fully incorporates interdepartmental relationships into the support-department cost allocations.

One way to understand the reciprocal method is as an extension of the step-down method. This approach is illustrated in Exhibit 15-5. As in the step-down procedure, plant maintenance costs are first allocated to all other departments, including the information systems support department: information systems, 20%; machining, 30%; assembly, 50%. The costs in the information systems department then total \$2,712,150 (\$1,452,150 + \$1,260,000 from the first-round allocation), as in Exhibit 15-4. Under the step-down method, these costs are allocated directly to the operating departments alone. But the reciprocal method recognizes that a portion of the information systems department costs arises

**Exhibit 15-5** Reciprocal Method of Allocating Support-Department Costs Using Repeated Iterations at Castleford Engineering for 2012

							
	A	B	C	D	E	F	G
1		SUPPORT DEPARTMENTS			OPERATING DEPARTMENTS		
2		Plant Maintenance	Information Systems		Machining	Assembly	Total
3	Budgeted overhead costs before any						
4	interdepartment cost allocations	\$6,300,000	\$1,452,150		\$4,000,000	\$2,000,000	\$13,752,150
5	First allocation of plant maintenance (2/10, 3/10, 5/10) <sup>a</sup>	(6,300,000)	1,260,000		1,890,000	3,150,000	
6			2,712,150				
7	First allocation of information systems (1/10, 8/10, 1/10) <sup>b</sup>	271,215	(2,712,150)		2,169,720	271,215	
8	Second allocation of plant maintenance (2/10, 3/10, 5/10) <sup>a</sup>	(271,215)	54,243		81,364	135,608	
9	Second allocation of information systems (1/10, 8/10, 1/10) <sup>b</sup>	5,424	(54,243)		43,395	5,424	
10	Third allocation of plant maintenance (2/10, 3/10, 5/10) <sup>a</sup>	(5,424)	1,085		1,627	2,712	
11	Third allocation of information systems (1/10, 8/10, 1/10) <sup>b</sup>	109	(1,085)		867	109	
12	Fourth allocation of plant maintenance (2/10, 3/10, 5/10) <sup>a</sup>	(109)	22		33	54	
13	Fourth allocation of information systems (1/10, 8/10, 1/10) <sup>b</sup>	2	(22)		18	2	
14	Fourth allocation of plant maintenance (2/10, 3/10, 5/10) <sup>a</sup>	(2)	0		1	1	
15							
16	Total budgeted overhead of operating departments	\$ 0	\$ 0		\$8,187,025	\$5,565,125	\$13,752,150
17							
18	Total support department amounts allocated and reallocated (the numbers in parentheses in the first two columns):						
19	Plant Maintenance: \$6,300,000 + \$271,215 + \$5,424 + \$109 + \$2 = \$6,576,750						
20	Information Systems: \$2,712,150 + \$54,243 + \$1,085 + \$22 = \$2,767,500						
21							
22	<sup>a</sup> Base is (4,000 + 6,000 + 10,000), or 20,000 hours; 4,000 ÷ 20,000 = 2/10; 6,000 ÷ 20,000 = 3/10; 10,000 ÷ 20,000 = 5/10.						
23	<sup>b</sup> Base is (500 + 4,000 + 500), or 5,000 hours; 500 ÷ 5,000 = 1/10; 4,000 ÷ 5,000 = 8/10; 500 ÷ 5,000 = 1/10.						

because of the support it provides to plant maintenance. Accordingly, the \$2,712,150 is allocated to all departments supported by the information systems department, including the plant maintenance department: plant maintenance, 10%; machining, 80%; and assembly, 10% (see Exhibit 15-2). The plant maintenance costs that had been brought down to \$0 now have \$271,215 from the information systems department allocation. In the next step, these costs are again reallocated to all other departments, including information systems, in the same ratio that the plant maintenance costs were previously assigned. Now the information systems department costs that had been brought down to \$0 have \$54,243 from the plant maintenance department allocations. These costs are again allocated in the same ratio that the information systems department costs were previously assigned. Successive rounds result in smaller and smaller amounts being allocated to and reallocated from the support departments until eventually all support-department costs are allocated to the operating departments. The final budgeted overhead costs for the operating departments under the reciprocal method are given by the amounts in line 16 of Exhibit 15-5.

An alternative way to implement the reciprocal method is to formulate and solve linear equations. This process requires three steps.

**Step 1: Express Support Department Costs and Reciprocal Relationships in the Form of Linear Equations.** We will use the term *complete reciprocated costs* or *artificial costs* to mean the support department's own costs plus any interdepartmental cost allocations. Let  $PM$  be the *complete reciprocated costs* of plant maintenance and  $IS$  be the *complete reciprocated costs* of information systems. We can then express the data in Exhibit 15-2 as follows:

$$PM = \$6,300,000 + 0.1IS \quad (1)$$

$$IS = \$1,452,150 + 0.2PM \quad (2)$$

The  $0.1IS$  term in equation 1 is the percentage of the information systems services *used by* plant maintenance. The  $0.2PM$  term in equation 2 is the percentage of plant maintenance services *used by* information systems.

**Step 2: Solve the Set of Linear Equations to Obtain the Complete Reciprocated Costs of Each Support Department.** Substituting equation 1 into 2,

$$IS = \$1,452,150 + [0.2(\$6,300,000 + 0.1IS)]$$

$$IS = \$1,452,150 + \$1,260,000 + 0.02IS$$

$$0.98IS = \$2,712,150$$

$$IS = \$2,767,500$$

Substituting this into equation 1,

$$PM = \$6,300,000 + 0.1(\$2,767,500)$$

$$PM = \$6,300,000 + \$276,750 = \$6,576,750$$

The complete reciprocated costs or artificial costs for plant maintenance and information systems are \$6,576,750 and \$2,767,500, respectively. Note that these are the same amounts that appear at the bottom of Exhibit 15-5 (lines 19 and 20) as the total support department costs allocated and reallocated during the iterative process. By setting up the system of simultaneous equations, we are able to solve for these amounts directly. When there are more than two support departments with reciprocal relationships, software such as Excel or Matlab is required to compute the complete reciprocated costs of each support department. Since the calculations involve finding the inverse of a matrix, the reciprocal method is also sometimes referred to as the **matrix method**.<sup>6</sup>

**Step 3: Allocate the Complete Reciprocated Costs of Each Support Department to All Other Departments (Both Support Departments and Operating Departments) on the Basis of the Usage Percentages (Based on Total Units of Service Provided to All Departments).**

<sup>6</sup> If there are  $n$  support departments, then Step 1 will yield  $n$  linear equations. Solving the equations to calculate the complete reciprocated costs then requires finding the inverse of an  $n$ -by- $n$  matrix.

Consider the information systems department. The complete reciprocated costs of \$2,767,500 are allocated as follows:

To plant maintenance (1/10) × \$2,767,500	= \$ 276,750
To machining (8/10) × \$2,767,500	= 2,214,000
To assembly (1/10) × \$2,767,500	= 276,750
<b>Total</b>	<b><u>\$2,767,500</u></b>

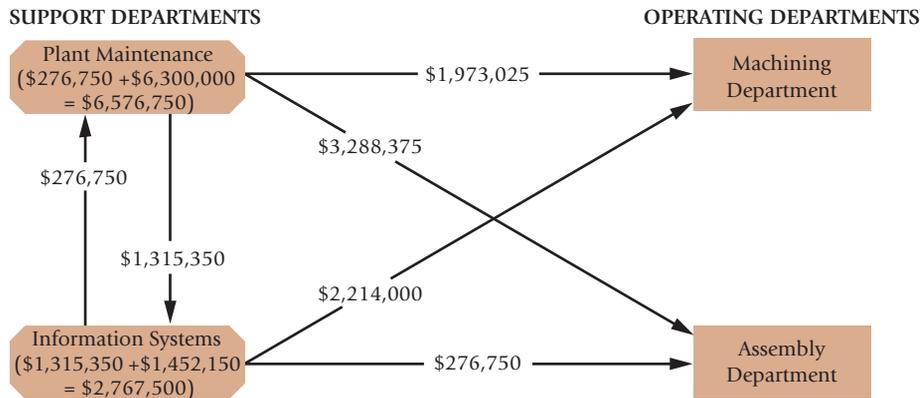
Exhibit 15-6 presents summary data pertaining to the reciprocal method.

Castleford's \$9,344,250 complete reciprocated costs of the support departments exceed the budgeted amount of \$7,752,150.

Support Department	Complete Reciprocated Costs	Budgeted Costs	Difference
Plant maintenance	\$6,576,750	\$6,300,000	\$ 276,750
Information systems	<u>2,767,500</u>	<u>1,452,150</u>	<u>1,315,350</u>
<b>Total</b>	<b><u>\$9,344,250</u></b>	<b><u>\$7,752,150</u></b>	<b><u>\$1,592,100</u></b>

Each support department's complete reciprocated cost is greater than the budgeted amount to take into account that the support costs will be allocated to all departments using its services and not just to operating departments. This step ensures that the reciprocal method fully recognizes all interrelationships among support departments, as well as relationships between support and operating departments. The difference between complete

**Exhibit 15-6** Reciprocal Method of Allocating Support-Department Costs Using Linear Equations at Castleford Engineering for 2012



		SUPPORT DEPARTMENTS		OPERATING DEPARTMENTS			
		Plant Maintenance	Information Systems	Machining	Assembly	Total	
1							
2							
3	Budgeted overhead costs before any						
4	interdepartment cost allocations	\$6,300,000	\$1,452,150	\$4,000,000	\$2,000,000	\$13,752,150	
5	Allocation of plant maintenance (2/10, 3/10, 5/10) <sup>a</sup>	(6,576,750)	1,315,350	1,973,025	3,288,375		
6	Allocation of information systems (1/10, 8/10, 1/10) <sup>b</sup>	276,750	(2,767,500)	2,214,000	276,750		
7							
8	Total budgeted overhead of operating departments	\$ 0	\$ 0	\$8,187,025	\$5,565,125	\$13,752,150	
9							
10	<sup>a</sup> Base is (4,000 + 6,000 + 10,000), or 20,000 hours; 4,000 ÷ 20,000 = 2/10; 6,000 ÷ 20,000 = 3/10; 10,000 ÷ 20,000 = 5/10.						
11	<sup>b</sup> Base is (500 + 4,000 + 500), or 5,000 hours; 500 ÷ 5,000 = 1/10; 4,000 ÷ 5,000 = 8/10; 500 ÷ 5,000 = 1/10.						

reciprocated costs and budgeted costs for each support department reflects the costs allocated among support departments. The total costs allocated to the operating departments under the reciprocal method are still only \$7,752,150.

## Overview of Methods

Assume that Castleford reallocates the total budgeted overhead costs of each operating department in Exhibits 15-3 through 15-6 to individual products on the basis of budgeted machine-hours for the machining department (18,000 hours) and budgeted direct labor-hours for the assembly department (25,000 hours). The budgeted overhead allocation rates (to the nearest dollar) for each operating department by allocation method are as follows:

Support Department Cost-Allocation Method	Total Budgeted Overhead Costs After Allocation of All Support-Department Costs		Budgeted Overhead Rate per Hour for Product- Costing Purposes	
	Machining	Assembly	Machining (18,000 machine-hours)	Assembly (25,000 labor-hours)
Direct	\$7,653,300	\$6,098,850	\$425	\$244
Step-down	8,300,800	5,451,350	461	218
Reciprocal	8,187,025	5,565,125	455	223

These differences in budgeted overhead rates under the three support-department cost-allocation methods can, for example, affect the amount of costs Castleford is reimbursed for engines it manufactures under cost-reimbursement contracts. Consider a cost-reimbursement contract for a project that uses 200 machine-hours in the machining department and 50 direct labor-hours in the assembly department. The overhead costs allocated to this contract under the three methods would be as follows:

Direct:	\$97,200 (\$425 per hour × 200 hours + \$244 per hour × 50 hours)
Step-down:	103,100 (\$461 per hour × 200 hours + \$218 per hour × 50 hours)
Reciprocal:	102,150 (\$455 per hour × 200 hours + \$223 per hour × 50 hours)

The amount of cost reimbursed to Castleford will differ depending on the method used to allocate support-department costs to the contract. Differences among the three methods' allocations increase (1) as the magnitude of the reciprocal allocations increases and (2) as the differences across operating departments' usage of each support department's services increase. Note that while the final allocations under the reciprocal method are in between those under the direct and step-down methods in our example, this is not true in general. To avoid disputes in cost-reimbursement contracts that require allocation of support-department costs, managers should always clarify the method to be used for allocation. For example, Medicare reimbursements and federal contracts with universities that pay for the recovery of indirect costs typically mandate use of the step-down method, with explicit requirements about the costs that can be included in the indirect cost pools.

The reciprocal method is conceptually the most precise method because it considers the mutual services provided among all support departments. The advantage of the direct and step-down methods is that they are simple to compute and understand relative to the reciprocal method. However, as computing power to perform repeated iterations (as in Exhibit 15-5) or to solve sets of simultaneous equations (as on pp. 554–555) increases, more companies find the reciprocal method easier to implement.

Another advantage of the reciprocal method is that it highlights the complete reciprocated costs of support departments and how these costs differ from budgeted or actual costs of the departments. Knowing the complete reciprocated costs of a support department is a key input for decisions about whether to outsource all the services that the support department provides.

Suppose all of Castleford's support-department costs are variable over the period of a possible outsourcing contract. Consider a third party's bid to provide, say, all the information systems services currently provided by Castleford's information systems department. Do not compare the bid to the \$1,452,150 costs reported for the information systems department. The complete reciprocated costs of the information systems

department, which include the services the plant maintenance department provides the information systems department, are \$2,767,500 to deliver 5,000 hours of computer time to all other departments at Castleford. The complete reciprocated costs for computer time are \$553.50 per hour ( $\$2,767,500 \div 5,000$  hours). Other things being equal, a third party's bid to provide the same information services as Castleford's internal department at less than \$2,767,500, or \$553.50 per hour (even if much greater than \$1,452,150) would improve Castleford's operating income.

To see this point, note that the relevant savings from shutting down the information systems department are \$1,452,150 of information systems department costs *plus* \$1,315,350 of plant maintenance department costs. By closing down the information systems department, Castleford will no longer incur the 20% of reciprocated plant maintenance department costs (equal to \$1,315,350) that were incurred to support the information systems department. Therefore, the total cost savings are \$2,767,500 ( $\$1,452,150 + \$1,315,350$ ).<sup>7</sup> Neither the direct nor the step-down methods can provide this relevant information for outsourcing decisions.

We now consider common costs, another special class of costs for which management accountants have developed specific allocation methods.

## Allocating Common Costs

A **common cost** is a cost of operating a facility, activity, or like cost object that is shared by two or more users. Common costs exist because each user obtains a lower cost by sharing than the separate cost that would result if such a user were an independent entity.

The goal is to allocate common costs to each user in a reasonable way. Consider Jason Stevens, a graduating senior in Seattle who has been invited to a job interview with an employer in Albany. The round-trip Seattle–Albany airfare costs \$1,200. A week later, Stevens is also invited to an interview with an employer in Chicago. The Seattle–Chicago round-trip airfare costs \$800. Stevens decides to combine the two recruiting trips into a Seattle–Albany–Chicago–Seattle trip that will cost \$1,500 in airfare. The \$1,500 is a common cost that benefits both prospective employers. Two methods of allocating this common cost between the two prospective employers are the stand-alone method and the incremental method.

### Stand-Alone Cost-Allocation Method

The **stand-alone cost-allocation method** determines the weights for cost allocation by considering each user of the cost as a separate entity. For the common-cost airfare of \$1,500, information about the separate (stand-alone) round-trip airfares (\$1,200 and \$800) is used to determine the allocation weights:

$$\begin{aligned} \text{Albany employer: } & \frac{\$1,200}{\$1,200 + \$800} \times \$1,500 = 0.60 \times \$1,500 = \$900 \\ \text{Chicago employer: } & \frac{\$800}{\$800 + \$1,200} \times \$1,500 = 0.40 \times \$1,500 = \$600 \end{aligned}$$

Advocates of this method often emphasize the fairness or equity criterion described in Exhibit 14-2 (p. 504). The method is viewed as reasonable because each employer bears a proportionate share of total costs in relation to the individual stand-alone costs.

### Incremental Cost-Allocation Method

The **incremental cost-allocation method** ranks the individual users of a cost object in the order of users most responsible for the common cost and then uses this ranking to allocate cost among those users. The first-ranked user of the cost object is the *primary user* (also called the *primary party*) and is allocated costs up to the costs of the primary user as a stand-alone user. The second-ranked user is the *first-incremental user* (*first-incremental party*) and

<sup>7</sup> Technical issues when using the reciprocal method in outsourcing decisions are discussed in R. S. Kaplan and A. A. Atkinson, *Advanced Management Accounting*, 3rd ed. (Upper Saddle River, NJ: Prentice Hall, 1998), 73–81.

#### Decision Point

What methods can managers use to allocate costs of multiple support departments to operating departments?

#### Learning Objective 4

Allocate common costs using the stand-alone method

... uses cost information of each user as a separate entity to allocate common costs

and the incremental method

... allocates common costs primarily to one user and the remainder to other users

is allocated the additional cost that arises from two users instead of only the primary user. The third-ranked user is the *second-incremental user* (*second-incremental party*) and is allocated the additional cost that arises from three users instead of two users, and so on.

To see how this method works, consider again Jason Stevens and his \$1,500 airfare cost. Assume the Albany employer is viewed as the primary party. Stevens' rationale is that he had already committed to go to Albany before accepting the invitation to interview in Chicago. The cost allocations would be as follows:

Party	Costs Allocated	Cumulative Costs Allocated
Albany (primary)	\$1,200	\$1,200
Chicago (incremental)	300 (\$1,500 – \$1,200)	\$1,500
Total	<u>\$1,500</u>	

The Albany employer is allocated the full Seattle–Albany airfare. The unallocated part of the total airfare is then allocated to the Chicago employer. If the Chicago employer had been chosen as the primary party, the cost allocations would have been Chicago \$800 (the stand-alone round-trip Seattle–Chicago airfare) and Albany \$700 (\$1,500 – \$800). When there are more than two parties, this method requires them to be ranked from first to last (such as by the date on which each employer invited the candidate to interview).

Under the incremental method, the primary party typically receives the highest allocation of the common costs. If the incremental users are newly formed companies or subunits, such as a new product line or a new sales territory, the incremental method may enhance their chances for short-run survival by assigning them a low allocation of the common costs. The difficulty with the method is that, particularly if a large common cost is involved, every user would prefer to be viewed as the incremental party!

One approach to sidestep disputes in such situations is to use the stand-alone cost-allocation method. Another approach is to use the *Shapley value*, which considers each party as first the primary party and then the incremental party. From the calculations shown earlier, the Albany employer is allocated \$1,200 as the primary party and \$700 as the incremental party, for an average of \$950 [(\$1,200 + \$700) ÷ 2]. The Chicago employer is allocated \$800 as the primary party and \$300 as the incremental party, for an average of \$550 [(\$800 + 300) ÷ 2]. The Shapley value method allocates, to each employer, the average of the costs allocated as the primary party and as the incremental party: \$950 to the Albany employer and \$550 to the Chicago employer.<sup>8</sup>

As our discussion suggests, allocating common costs is not clear-cut and can generate disputes. Whenever feasible, the rules for such allocations should be agreed on in advance. If this is not done, then, rather than blindly follow one method or another, managers should exercise judgment when allocating common costs. For instance, Stevens must choose an allocation method for his airfare cost that is acceptable to each prospective employer. He cannot, for example, exceed the maximum reimbursable amount of airfare for either firm. The next section discusses the role of cost data in various types of contracts, another area where disputes about cost allocation frequently arise.

### Decision Point

What methods can managers use to allocate common costs to two or more users?

### Learning Objective 5

Explain the importance of explicit agreement between contracting parties when the reimbursement amount is based on costs incurred

... to avoid disputes regarding allowable cost items and how indirect costs should be allocated

## Cost Allocations and Contract Disputes

Many commercial contracts include clauses based on cost accounting information. Examples include the following:

- A contract between the Department of Defense and a company designing and assembling a new fighter plane specifies that the price paid for the plane is to be based on the contractor's direct and overhead costs plus a fixed fee.
- A contract between an energy-consulting firm and a hospital specifies that the consulting firm receive a fixed fee plus a share of the energy-cost savings that arise from implementing the consulting firm's recommendations.

<sup>8</sup> For further discussion of the Shapley value, see J. Demski, "Cost Allocation Games," in *Joint Cost Allocations*, ed. S. Moriarity (University of Oklahoma Center for Economic and Management Research, 1981); L. Kruz and P. Bronisz, "Cooperative Game Solution Concepts to a Cost Allocation Problem," *European Journal of Operations Research* 122 (2000): 258–271.

Contract disputes often arise with respect to cost allocation. The areas of dispute between the contracting parties can be reduced by making the “rules of the game” explicit and in writing at the time the contract is signed. Such rules of the game include the definition of allowable cost items; the definitions of terms used, such as what constitutes direct labor; the permissible cost-allocation bases; and how to account for differences between budgeted and actual costs.

## Contracting with the U.S. Government

The U.S. government reimburses most contractors in one of two main ways:

1. **The contractor is paid a set price without analysis of actual contract cost data.** This approach is used, for example, when there is competitive bidding, when there is adequate price competition, or when there is an established catalog with prices quoted for items sold in substantial quantities to the general public.
2. **The contractor is paid after analysis of actual contract cost data.** In some cases, the contract will explicitly state that the reimbursement amount is based on actual allowable costs plus a fixed fee.<sup>9</sup> This arrangement is called a *cost-plus contract*.

All contracts with U.S. government agencies must comply with cost accounting standards issued by the **Cost Accounting Standards Board (CASB)**. For government contracts, the CASB has the exclusive authority to make, put into effect, amend, and rescind cost accounting standards and interpretations. The standards are designed to achieve *uniformity and consistency* in regard to measurement, assignment, and allocation of costs to government contracts within the United States.<sup>10</sup>

In government contracting, there is a complex interplay of political considerations and accounting principles. Terms such as “fairness” and “equity,” as well as cause and effect and benefits received, are often used in government contracts.

## Fairness of Pricing

In many defense contracts, there is great uncertainty about the final cost to produce a new weapon or equipment. Such contracts are rarely subject to competitive bidding. The reason is that no contractor is willing to assume all the risk of receiving a fixed price for the contract and subsequently incurring high costs to fulfill it. Hence, setting a market-based fixed price for the contract fails to attract contractors, or requires a contract price that is too high from the government’s standpoint. To address this issue, the government typically assumes a major share of the risk of the potentially high costs of completing the contract. Rather than relying on selling prices as ordinarily set by suppliers in the marketplace, the government negotiates contracts on the basis of *costs plus a fixed fee*. In costs-plus-fixed-fee contracts, which often involve billions of dollars, the allocation of a specific cost may be difficult to defend on the basis of any cause-and-effect reasoning. Nonetheless, the contracting parties may still view it as a “reasonable” or “fair” means to help establish a contract amount.

Some costs are “allowable;” others are “unallowable.” An **allowable cost** is a cost that the contract parties agree to include in the costs to be reimbursed. Some contracts specify how allowable costs are to be determined. For example, only economy-class airfares are allowable in many U.S. government contracts. Other contracts identify cost categories that are unallowable. For example, the costs of lobbying activities and alcoholic beverages are not allowable costs in U.S. government contracts. However, the set of allowable costs is not always clear-cut. Contract disputes and allegations about overcharging the government arise from time to time (see Concepts in Action, p. 560).

<sup>9</sup> The Federal Acquisition Regulation (FAR), issued in March 2005 (see <https://www.acquisition.gov/far/current/pdf/FAR.pdf>) includes the following definition of “allocability” (in FAR 31.201-4): “A cost is allocable if it is assignable or chargeable to one or more cost objectives on the basis of relative benefits received or other equitable relationship. Subject to the foregoing, a cost is allocable to a Government contract if it:

- (a) Is incurred specifically for the contract;
- (b) Benefits both the contract and other work, and can be distributed to them in reasonable proportion to the benefits received; or
- (c) Is necessary to the overall operation of the business, although a direct relationship to any particular cost objective cannot be shown.”

<sup>10</sup> Details on the Cost Accounting Standards Board are available at [www.whitehouse.gov/omb/procurement/casb.html](http://www.whitehouse.gov/omb/procurement/casb.html). The CASB is part of the Office of Federal Procurement Policy, U.S. Office of Management and Budget.

**Decision Point**

How can contract disputes over reimbursement amounts based on costs be reduced?

## Concepts in Action

### Contract Disputes over Reimbursable Costs for the U.S. Department of Defense



For 2011, United States combat activities in Afghanistan are budgeted to cost \$159 billion. As in prior years, a portion of this money is allocated to private companies to carry out specific contracted services for the U.S. Department of Defense. In recent years, the U.S. government has pursued cases against several contractors for overcharging for services provided in the combat zone. The following four examples are from cases pursued by the U.S. Department of Justice's Civil Division, who did so on behalf of the federal government. These recent examples illustrate several types of cost disputes that arise in practice.

1. Eagle Global Logistics agreed to pay \$4 million to settle allegations of allegedly inflating invoices for military cargo shipments to Iraq. The complaint alleged that a company executive added an extra 50 cents per kilogram "war risk surcharge" to invoices for flights between Dubai and Iraq. This bogus surcharge, which was not part of Eagle's U.S. Department of Defense contract, was applied 379 times between 2003 and 2004.
2. In another shipping case, APL Limited paid the federal government \$26.3 million to resolve claims of knowingly overcharging and double-billing the U.S. Department of Defense to transport thousands of containers to destinations in Afghanistan and Iraq. APL was accused of inflating invoices in several ways: marking up electricity costs for containers with perishable cargo, billing in excess of the contractual rate to maintain the operation of refrigerated containers in the port of Karachi, Pakistan, and billing for non-reimbursable services performed by an APL subcontractor at a Kuwaiti port.
3. L-3 communications, a leading defense contractor, paid \$4 million to settle a complaint that it overbilled for hours worked by the firm's employees on a contract supporting military operations by the United States in Iraq. The company allegedly submitted false time records and inflated claims for personnel hours as part of an ongoing contract with the U.S. Army to provide helicopter maintenance services at Camp Taji, Iraq.
4. In late 2009, Public Warehousing Company—a principal food supplier for the U.S. military in Iraq, Kuwait, and Jordan since 2003—was sued by the U.S. government for presenting false claims for payment under the company's multibillion dollar contract with the Defense Logistics Agency. The complaint alleged that the company overcharged the U.S. for locally available fresh fruits and vegetables and failed to disclose pass through rebates and discounts it obtained from U.S.-based suppliers, as required by its contracts.

Source: Press releases from the United States Department of Justice, Civil Division (2006–2009).

## Learning Objective 6

Understand how bundling of products

... two or more products sold for a single-price

gives rise to revenue allocation issues

... allocating revenues to each product in the bundle to evaluate managers of individual products

and the methods for doing so

... using the stand-alone method or the incremental method

## Bundled Products and Revenue Allocation Methods

Allocation issues can also arise when revenues from multiple products (for example, different software programs or cable and internet packages) are bundled together and sold at a single price. The methods for revenue allocation parallel those described for common-cost allocations.

### Bundling and Revenue Allocation

*Revenues* are inflows of assets (almost always cash or accounts receivable) received for products or services provided to customers. Similar to cost allocation, **revenue allocation** occurs when revenues are related to a particular *revenue object* but cannot be traced to it in an economically feasible (cost-effective) way. A **revenue object** is anything for which a separate measurement of revenue is desired. Examples of revenue objects include products, customers, and divisions. We illustrate revenue-allocation issues for Dynamic Software Corporation, which develops, sells, and supports three software programs:

1. WordMaster, a word-processing program, released 36 months ago
2. DataMaster, a spreadsheet program, released 18 months ago
3. FinanceMaster, a budgeting and cash-management program, released six months ago with a lot of favorable media attention

Dynamic Software sells these three products individually as well as together as bundled products.

A **bundled product** is a package of two or more products (or services) that is sold for a single price but whose individual components may be sold as separate items at their own “stand-alone” prices. The price of a bundled product is typically less than the sum of the prices of the individual products sold separately. For example, banks often provide individual customers with a bundle of services from different departments (checking, safety-deposit box, and investment advisory) for a single fee. A resort hotel may offer, for a single amount per customer, a weekend package that includes services from its lodging (the room), food (the restaurant), and recreational (golf and tennis) departments. When department managers have revenue or profit responsibilities for individual products, the bundled revenue must be allocated among the individual products in the bundle.

Dynamic Software allocates revenues from its bundled product sales (called “suite sales”) to individual products. Individual-product profitability is used to compensate software engineers, outside developers, and product managers responsible for developing and managing each product.

How should Dynamic Software allocate suite revenues to individual products? Consider information pertaining to the three “stand-alone” and “suite” products in 2012:

	Selling Price	Manufacturing Cost per Unit
Stand-alone		
WordMaster	\$125	\$18
DataMaster	150	20
FinanceMaster	225	25
Suite		
Word + Data	\$220	
Word + Finance	280	
Finance + Data	305	
Word + Finance + Data	380	

Just as we saw in the section on common-cost allocations, the two main revenue-allocation methods are the stand-alone method and the incremental method.

## Stand-Alone Revenue-Allocation Method

The **stand-alone revenue-allocation method** uses product-specific information on the products in the bundle as weights for allocating the bundled revenues to the individual products. The term *stand-alone* refers to the product as a separate (nonsuite) item. Consider the Word + Finance suite, which sells for \$280. Three types of weights for the stand-alone method are as follows:

1. **Selling prices.** Using the individual selling prices of \$125 for WordMaster and \$225 for FinanceMaster, the weights for allocating the \$280 suite revenues between the products are as follows:

$$\text{WordMaster: } \frac{\$125}{\$125 + \$225} \times \$280 = 0.357 \times \$280 = \$100$$

$$\text{FinanceMaster: } \frac{\$225}{\$125 + \$225} \times \$280 = 0.643 \times \$280 = \$180$$

2. **Unit costs.** This method uses the costs of the individual products (in this case, manufacturing cost per unit) to determine the weights for the revenue allocations.

$$\text{WordMaster: } \frac{\$18}{\$18 + \$25} \times \$280 = 0.419 \times \$280 = \$117$$

$$\text{FinanceMaster: } \frac{\$25}{\$18 + \$25} \times \$280 = 0.581 \times \$280 = \$163$$

3. **Physical units.** This method gives each product unit in the suite the same weight when allocating suite revenue to individual products. Therefore, with two products in the Word + Finance suite, each product is allocated 50% of the suite revenues.

$$\text{WordMaster: } \frac{1}{1+1} \times \$280 = 0.50 \times \$280 = \$140$$

$$\text{FinanceMaster: } \frac{1}{1+1} \times \$280 = 0.50 \times \$280 = \$140$$

These three approaches to determining weights for the stand-alone method result in very different revenue allocations to the individual products:

Revenue-Allocation Weights	WordMaster	FinanceMaster
Selling prices	\$100	\$180
Unit costs	117	163
Physical units	140	140

Which method is preferred? The selling prices method is best, because the weights explicitly consider the prices customers are willing to pay for the individual products. Weighting approaches that use revenue information better capture “benefits received” by customers than unit costs or physical units.<sup>11</sup> The physical-units revenue-allocation method is used when any of the other methods cannot be used (such as when selling prices are unstable or unit costs are difficult to calculate for individual products).

### Incremental Revenue-Allocation Method

The **incremental revenue-allocation method** ranks individual products in a bundle according to criteria determined by management—such as the product in the bundle with the most sales—and then uses this ranking to allocate bundled revenues to individual products. The first-ranked product is the *primary product* in the bundle. The second-ranked product is the *first-incremental product*, the third-ranked product is the *second-incremental product*, and so on.

How do companies decide on product rankings under the incremental revenue-allocation method? Some organizations survey customers about the importance of each of the individual products to their purchase decision. Others use data on the recent stand-alone sales performance of the individual products in the bundle. A third approach is for top managers to use their knowledge or intuition to decide the rankings.

Consider again the Word + Finance suite. Assume WordMaster is designated as the primary product. If the suite selling price exceeds the stand-alone price of the primary product, the primary product is allocated 100% of its *stand-alone* revenue. Because the suite price of \$280 exceeds the stand-alone price of \$125 for WordMaster, WordMaster is allocated revenues of \$125, with the remaining revenue of \$155 (\$280 – \$125) allocated to FinanceMaster:

Product	Revenue Allocated	Cumulative Revenue Allocated
WordMaster	\$125	\$125
FinanceMaster	155 (\$280 – \$125)	\$280
Total	<u>\$280</u>	

If the suite price is less than or equal to the stand-alone price of the primary product, the primary product is allocated 100% of the *suite* revenue. All other products in the suite receive no allocation of revenue.

<sup>11</sup>Revenue-allocation issues also arise in external reporting. The AICPA’s Statement of Position 97-2 (Software Revenue Recognition) states that with bundled products, revenue allocation “based on vendor-specific objective evidence (VSOE) of fair value” is required. The “price charged when the element is sold separately” is said to be “objective evidence of fair value” (see “Statement of Position 97-2,” Jersey City, NJ: AICPA, 1998). In September 2009, the FASB ratified Emerging Issues Task Force (EITF) Issue 08-1, specifying that with no VSOE or third-party evidence of selling price for all units of accounting in an arrangement, the consideration received for the arrangement should be allocated to the separate units based upon their relative selling prices.

Now suppose FinanceMaster is designated as the primary product and WordMaster as the first-incremental product. Then, the incremental revenue-allocation method allocates revenues of the Word + Finance suite as follows:

Product	Revenue Allocated	Cumulative Revenue Allocated
FinanceMaster	\$225	\$225
WordMaster	55 (\$280 – \$225)	\$280
Total	<u>\$280</u>	

If Dynamic Software sells equal quantities of WordMaster and FinanceMaster, then the Shapley value method allocates to each product the average of the revenues allocated as the primary and first-incremental products:

WordMaster:	$(\$125 + \$55) \div 2 = \$180 \div 2 = \$90$
FinanceMaster:	$(\$225 + \$155) \div 2 = \$380 \div 2 = \underline{190}$
Total	<u>\$280</u>

But what if, in the most recent quarter, the firm sells 80,000 units of WordMaster and 20,000 units of FinanceMaster. Because Dynamic Software sells four times as many units of WordMaster, its managers believe that the sales of the Word + Finance suite are four times more likely to be driven by WordMaster as the primary product. The *weighted Shapley value method* takes this fact into account. It assigns four times as much weight to the revenue allocations when WordMaster is the primary product as when FinanceMaster is the primary product, resulting in the following allocations:

WordMaster:	$(\$125 \times 4 + \$55 \times 1) \div (4 + 1) = \$555 \div 5 = \$111$
FinanceMaster:	$(\$225 \times 1 + \$155 \times 4) \div (4 + 1) = \$845 \div 5 = \underline{169}$
Total	<u>\$280</u>

When there are more than two products in the suite, the incremental revenue-allocation method allocates suite revenues sequentially. Assume WordMaster is the primary product in Dynamic Software’s three-product suite (Word + Finance + Data). FinanceMaster is the first-incremental product, and DataMaster is the second-incremental product. This suite sells for \$380. The allocation of the \$380 suite revenues proceeds as follows:

Product	Revenue Allocated	Cumulative Revenue Allocated
WordMaster	\$125	\$125
FinanceMaster	155 (\$280 – \$125)	\$280 (price of Word + Finance suite)
DataMaster	100 (\$380 – \$280)	\$380 (price of Word + Finance + Data suite)
Total	<u>\$380</u>	

Now suppose WordMaster is the primary product, DataMaster is the first-incremental product, and FinanceMaster is the second-incremental product.

Product	Revenue Allocated	Cumulative Revenue Allocated
WordMaster	\$125	\$125
DataMaster	95 (\$220 – \$125)	\$220 (price of Word + Data suite)
FinanceMaster	160 (\$380 – \$220)	\$380 (price of Word + Data + Finance suite)
Total	<u>\$380</u>	

The ranking of the individual products in the suite determines the revenues allocated to them. Product managers at Dynamic Software likely would differ on how they believe their individual products contribute to sales of the suite products. In fact, each product manager would claim to be responsible for the primary product in the Word + Finance + Data suite!<sup>12</sup>

<sup>12</sup>Calculating the Shapley value mitigates this problem because each product is considered as a primary, first-incremental, and second-incremental product. Assuming equal weights on all products, the revenue allocated to each product is an average of the revenues calculated for the product under these different assumptions. In the preceding example, the interested reader can verify that this will result in the following revenue assignments: FinanceMaster, \$180; WordMaster, \$87.50; and DataMaster, \$112.50.

**Decision Point**

What is product bundling and how can managers allocate revenues of a bundled product to individual products in the package?

Because the stand-alone revenue-allocation method does not require rankings of individual products in the suite, this method is less likely to cause debates among product managers.

## Problem for Self-Study

This problem illustrates how costs of two corporate support departments are allocated to operating divisions using the dual-rate method. Fixed costs are allocated using budgeted costs and budgeted hours used by other departments. Variable costs are allocated using actual costs and actual hours used by other departments.

Computer Horizons budgets the following amounts for its two central corporate support departments (legal and personnel) in supporting each other and the two manufacturing divisions, the laptop division (LTD) and the work station division (WSD):

							
	A	B	C	D	E	F	G
1		<b>SUPPORT</b>			<b>OPERATING</b>		
2		Legal Department	Personnel Department		LTD	WSD	Total
3	<b>BUDGETED USAGE</b>						
4	Legal (hours)	—	250		1,500	750	2,500
5	(Percentages)	—	10%		60%	30%	100%
6	Personnel (hours)	2,500	—		22,500	25,000	50,000
7	(Percentages)	5%	—		45%	50%	100%
8							
9	<b>ACTUAL USAGE</b>						
10	Legal (hours)	—	400		400	1,200	2,000
11	(Percentages)	—	20%		20%	60%	100%
12	Personnel (hours)	2,000	—		26,600	11,400	40,000
13	(Percentages)	5%	—		66.50%	28.5%	100%
14	Budgeted fixed overhead costs before any						
15	interdepartment cost allocations	\$360,000	\$475,000		—	—	\$835,000
16	Actual variable overhead costs before any						
17	interdepartment cost allocations	\$200,000	\$600,000		—	—	\$800,000

**Required** What amount of support-department costs for legal and personnel will be allocated to LTD and WSD using (a) the direct method, (b) the step-down method (allocating the legal department costs first), and (c) the reciprocal method using linear equations?

### Solution

Exhibit 15-7 presents the computations for allocating the fixed and variable support-department costs. A summary of these costs follows:

	Laptop Division (LTD)	Work Station Division (WSD)
<b>(a) Direct Method</b>		
Fixed costs	\$465,000	\$370,000
Variable costs	470,000	330,000
	<u>\$935,000</u>	<u>\$700,000</u>
<b>(b) Step-Down Method</b>		
Fixed costs	\$458,053	\$376,947
Variable costs	488,000	312,000
	<u>\$946,053</u>	<u>\$688,947</u>
<b>(c) Reciprocal Method</b>		
Fixed costs	\$462,513	\$372,487
Variable costs	476,364	323,636
	<u>\$938,877</u>	<u>\$696,123</u>

**Exhibit 15-7**

Alternative Methods of Allocating Corporate Support-Department Costs to Operating Divisions of Computer Horizons: Dual-Rate Method



	A	B	C	D	E	F	G	
20		<b>CORPORATE SUPPORT DEPARTMENTS</b>			<b>OPERATING DIVISIONS</b>			
21	<b>Allocation Method</b>	<b>Legal Department</b>	<b>Personnel Department</b>		<b>LTD</b>	<b>WSD</b>	<b>Total</b>	
22	<b>A. DIRECT METHOD</b>							
23	Fixed costs	\$360,000	\$475,000					
24	Legal (1,500 ÷ 2,250; 750 ÷ 2,250)	(360,000)			\$240,000	\$120,000		
25	Personnel (22,500 ÷ 47,500; 25,000 ÷ 47,500)		(475,000)		225,000	250,000		
26	Fixed support dept. cost allocated to operating divisions	\$ 0	0		\$465,000	\$370,000	\$835,000	
27	Variable costs	\$200,000	\$600,000					
28	Legal (400 ÷ 1,600; 1,200 ÷ 1,600)	(200,000)			\$ 50,000	\$150,000		
29	Personnel (26,600 ÷ 38,000; 11,400 ÷ 38,000)		(600,000)		420,000	180,000		
30	Variable support dept. cost allocated to operating divisions	\$ 0	0		\$470,000	\$330,000	\$800,000	
31	<b>B. STEP-DOWN METHOD</b>							
32	(Legal department first)							
33	Fixed costs	\$360,000	\$475,000					
34	Legal (250 ÷ 2,500; 1,500 ÷ 2,500; 750 ÷ 2,500)	(360,000)	36,000		\$216,000	\$108,000		
35	Personnel (22,500 ÷ 47,500; 25,000 ÷ 47,500)		(511,000)		242,053	268,947		
36	Fixed support dept. cost allocated to operating divisions	\$ 0	0		\$458,053	\$376,947	\$835,000	
37	Variable costs	\$200,000	\$600,000					
38	Legal (400 ÷ 2,000; 400 ÷ 2,000; 1,200 ÷ 2,000)	(200,000)	40,000		\$ 40,000	\$120,000		
39	Personnel (26,600 ÷ 38,000; 11,400 ÷ 38,000)		(640,000)		448,000	192,000		
40	Variable support dept. cost allocated to operating divisions	\$ 0	0		\$488,000	\$312,000	\$800,000	
41	<b>C. RECIPROCAL METHOD</b>							
42	Fixed costs	\$360,000	\$475,000					
43	Legal (250 ÷ 2,500; 1,500 ÷ 2,500; 750 ÷ 2,500 )	(385,678) <sup>a</sup>	38,568		\$231,407	\$115,703		
44	Personnel (2,500 ÷ 50,000; 22,500 ÷ 50,000; 25,000 ÷ 50,000)	25,678	(513,568) <sup>a</sup>		231,106	256,784		
45	Fixed support dept. cost allocated to operating divisions	\$ 0	\$ 0		\$462,513	\$372,487	\$835,000	
46	Variable costs	\$200,000	\$600,000					
47	Legal (400 ÷ 2,000; 400 ÷ 2,000; 1,200 ÷ 2,000)	(232,323) <sup>b</sup>	46,465		\$ 46,465	\$139,393		
48	Personnel (2,000 ÷ 40,000; 26,600 ÷ 40,000; 11,400 ÷ 40,000)	32,323	(646,465) <sup>b</sup>		429,899	184,243		
49	Variable support dept. cost allocated to operating divisions	\$ 0	\$ 0		\$476,364	\$323,636	\$800,000	
50								
51	<sup>a</sup> FIXED COSTS	<sup>b</sup> VARIABLE COSTS						
52	Letting <i>LF</i> = Legal department fixed costs, and <i>PF</i> = Personnel department fixed costs, the simultaneous equations for the reciprocal method for fixed costs are	Letting <i>LV</i> = Legal department variable costs, and <i>PV</i> = Personnel department variable costs, the simultaneous equations for the reciprocal method for variable costs are						
53	$LF = \$360,000 + 0.05 PF$	$LV = \$200,000 + 0.05 PV$						
54	$PF = \$475,000 + 0.10 LF$	$PV = \$600,000 + 0.20 LV$						
55	$LF = \$360,000 + 0.05 (\$475,000 + 0.10 LF)$	$LV = \$200,000 + 0.05 (\$600,000 + 0.20 LV)$						
56	$LF = \$385,678$	$LV = \$232,323$						
57	$PF = \$475,000 + 0.10 (\$385,678) = \$513,568$	$PV = \$600,000 + 0.20 (\$232,323) = \$466,465$						

## 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. When should managers use the dual-rate method over the single-rate method?
2. What factors should managers consider when deciding between allocation based on budgeted and actual rates, and budgeted and actual usage?
3. What methods can managers use to allocate costs of multiple support departments to operating departments?
4. What methods can managers use to allocate common costs to two or more users?
5. How can contract disputes over reimbursement amounts based on costs be reduced?
6. What is product bundling and how can managers allocate revenues of a bundled product to individual products in the package?

### Guidelines

The single-rate method aggregates fixed and variable costs and allocates them to objects using a single allocation base and rate. Under the dual-rate method, costs are grouped into separate variable cost and fixed cost pools; each pool uses a different cost-allocation base and rate. If costs can be easily separated into variable and fixed costs, the dual-rate method should be used because it provides better information for making decisions.

The use of budgeted rates enables managers of user departments to have certainty about the costs allocated to them, and insulates users from inefficiencies in the supplier department. Charging budgeted variable cost rates to users based on actual usage is causally appropriate and promotes control of resource consumption. Charging fixed cost rates on the basis of budgeted usage helps user divisions with planning, and leads to goal congruence when considering outsourcing decisions.

The three methods managers can use are the direct, the step-down, and the reciprocal methods. The direct method allocates each support department's costs to operating departments without allocating a support department's costs to other support departments. The step-down method allocates support-department costs to other support departments and to operating departments in a sequential manner that partially recognizes the mutual services provided among all support departments. The reciprocal method fully recognizes mutual services provided among all support departments.

Common costs are the costs of a cost object (such as operating a facility or performing an activity) that are shared by two or more users. The stand-alone cost-allocation method uses information pertaining to each user of the cost object to determine cost-allocation weights. The incremental cost-allocation method ranks individual users of the cost object and allocates common costs first to the primary user and then to the other incremental users. The Shapley value method considers each user, in turn, as the primary and the incremental user.

Disputes can be reduced by making the cost-allocation rules as explicit as possible and in writing at the time the contract is signed. These rules should include details such as the allowable cost items, the acceptable cost-allocation bases, and how differences between budgeted and actual costs are to be accounted for.

Bundling occurs when a package of two or more products (or services) is sold for a single price. Revenue allocation of the bundled price is required when managers of the individual products in the bundle are evaluated on product revenue or product operating income. Revenues can be allocated for a bundled product using the stand-alone method, the incremental method, or the Shapley value method.

## Terms to Learn

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

allowable cost (p. 559)

artificial costs (p. 554)

bundled product (p. 561)

common cost (p. 557)

complete reciprocated costs (p. 554)

Cost Accounting Standards Board  
(CASB) (p. 559)

direct method (p. 550)

dual-rate method (p. 544)	production department (p. 543)	stand-alone cost-allocation method (p. 557)
incremental cost-allocation method (p. 557)	reciprocal method (p. 553)	stand-alone revenue-allocation method (p. 561)
incremental revenue-allocation method (p. 562)	revenue allocation (p. 561)	step-down method (p. 552)
matrix method (p. 554)	revenue object (p. 561)	support department (p. 543)
operating department (p. 543)	service department (p. 543)	
	single-rate method (p. 544)	
	sequential allocation method (p. 552)	

## Assignment Material

### Questions



- 15-1** Distinguish between the single-rate and the dual-rate methods.
- 15-2** Describe how the dual-rate method is useful to division managers in decision making.
- 15-3** How do budgeted cost rates motivate the support-department manager to improve efficiency?
- 15-4** Give examples of allocation bases used to allocate support-department cost pools to operating departments.
- 15-5** Why might a manager prefer that budgeted rather than actual cost-allocation rates be used for costs being allocated to his or her department from another department?
- 15-6** “To ensure unbiased cost allocations, fixed costs should be allocated on the basis of estimated long-run use by user-department managers.” Do you agree? Why?
- 15-7** Distinguish among the three methods of allocating the costs of support departments to operating departments.
- 15-8** What is conceptually the most defensible method for allocating support-department costs? Why?
- 15-9** Distinguish between two methods of allocating common costs.
- 15-10** What role does the Cost Accounting Standards Board play when companies contract with the U.S. government?
- 15-11** What is one key way to reduce cost-allocation disputes that arise with government contracts?
- 15-12** Describe how companies are increasingly facing revenue-allocation decisions.
- 15-13** Distinguish between the stand-alone and the incremental revenue-allocation methods.
- 15-14** Identify and discuss arguments that individual product managers may put forward to support their preferred revenue-allocation method.
- 15-15** How might a dispute over the allocation of revenues of a bundled product be resolved?

### Exercises



**15-16 Single-rate versus dual-rate methods, support department.** The Chicago power plant that services all manufacturing departments of MidWest Engineering has a budget for the coming year. This budget has been expressed in the following monthly terms:

Manufacturing Department	Needed at Practical Capacity Production Level (Kilowatt-Hours)	Average Expected Monthly Usage (Kilowatt-Hours)
Rockford	10,000	8,000
Peoria	20,000	9,000
Hammond	12,000	7,000
Kankakee	<u>8,000</u>	<u>6,000</u>
Total	<u>50,000</u>	<u>30,000</u>

The expected monthly costs for operating the power plant during the budget year are \$15,000: \$6,000 variable and \$9,000 fixed.

- Assume that a single cost pool is used for the power plant costs. What budgeted amounts will be allocated to each manufacturing department if (a) the rate is calculated based on practical capacity and costs are allocated based on practical capacity, and (b) the rate is calculated based on expected monthly usage and costs are allocated based on expected monthly usage?
- Assume the dual-rate method is used with separate cost pools for the variable and fixed costs. Variable costs are allocated on the basis of expected monthly usage. Fixed costs are allocated on the basis of practical capacity. What budgeted amounts will be allocated to each manufacturing department? Why might you prefer the dual-rate method?

**Required**

**15-17 Single-rate method, budgeted versus actual costs and quantities.** Chocolat Inc. is a producer of premium chocolate based in Palo Alto. The company has a separate division for each of its two products: dark chocolate and milk chocolate. Chocolat purchases ingredients from Wisconsin for its dark chocolate division and from Louisiana for its milk chocolate division. Both locations are the same distance from Chocolat's Palo Alto plant.

Chocolat Inc. operates a fleet of trucks as a cost center that charges the divisions for variable costs (drivers and fuel) and fixed costs (vehicle depreciation, insurance, and registration fees) of operating the fleet. Each division is evaluated on the basis of its operating income. For 2012, the trucking fleet had a practical capacity of 50 round-trips between the Palo Alto plant and the two suppliers. It recorded the following information:

 Home   Insert   Page Layout   Formulas   Data   Review   View			
	A	B	C
1		<b>Budgeted</b>	<b>Actual</b>
2	Costs of truck fleet	\$115,000	\$96,750
3	Number of round-trips for dark chocolate division (Palo Alto plant—Wisconsin)	30	30
4	Number of round-trips for milk chocolate division (Palo Alto plant—Louisiana)	20	15

**Required**

- Using the single-rate method, allocate costs to the dark chocolate division and the milk chocolate division in these three ways.
  - Calculate the budgeted rate per round-trip and allocate costs based on round-trips budgeted for each division.
  - Calculate the budgeted rate per round-trip and allocate costs based on actual round-trips used by each division.
  - Calculate the actual rate per round-trip and allocate costs based on actual round-trips used by each division.
- Describe the advantages and disadvantages of using each of the three methods in requirement 1. Would you encourage Chocolat Inc. to use one of these methods? Explain and indicate any assumptions you made.

**15-18 Dual-rate method, budgeted versus actual costs and quantities (continuation of 15-17).** Chocolat Inc. decides to examine the effect of using the dual-rate method for allocating truck costs to each round-trip. At the start of 2012, the budgeted costs were as follows:

Variable cost per round-trip	\$ 1,350
Fixed costs	\$47,500

The actual results for the 45 round-trips made in 2012 were as follows:

Variable costs	\$58,500
Fixed costs	<u>38,250</u>
	<u>\$96,750</u>

Assume all other information to be the same as in Exercise 15-17.

**Required**

- Using the dual-rate method, what are the costs allocated to the dark chocolate division and the milk chocolate division when (a) variable costs are allocated using the budgeted rate per round-trip and actual round-trips used by each division and when (b) fixed costs are allocated based on the budgeted rate per round-trip and round-trips budgeted for each division?
- From the viewpoint of the dark chocolate division, what are the effects of using the dual-rate method rather than the single-rate methods?

**15-19 Support-department cost allocation; direct and step-down methods.** Phoenix Partners provides management consulting services to government and corporate clients. Phoenix has two support departments—administrative services (AS) and information systems (IS)—and two operating departments—government consulting (GOVT) and corporate consulting (CORP). For the first quarter of 2012, Phoenix's cost records indicate the following:

							
	A	B	C	D	E	F	G
1		SUPPORT			OPERATING		
2		AS	IS		GOVT	CORP	Total
3	Budgeted overhead costs before any						
4	interdepartment cost allocations	\$600,000	\$2,400,000		\$8,756,000	\$12,452,000	\$24,208,000
5	Support work supplied by AS (budgeted head count)	—	25%		40%	35%	100%
6	Support work supplied by IS (budgeted computer time)	10%	—		30%	60%	100%

- Allocate the two support departments' costs to the two operating departments using the following methods:
  - Direct method
  - Step-down method (allocate AS first)
  - Step-down method (allocate IS first)
- Compare and explain differences in the support-department costs allocated to each operating department.
- What approaches might be used to decide the sequence in which to allocate support departments when using the step-down method?

**Required**

**15-20 Support-department cost allocation, reciprocal method (continuation of 15-19).** Refer to the data given in Exercise 15-19.

- Allocate the two support departments' costs to the two operating departments using the reciprocal method. Use (a) linear equations and (b) repeated iterations.
- Compare and explain differences in requirement 1 with those in requirement 1 of Exercise 15-19. Which method do you prefer? Why?

**Required**

**15-21 Direct and step-down allocation.** E-books, an online book retailer, has two operating departments—corporate sales and consumer sales—and two support departments—human resources and information systems. Each sales department conducts merchandising and marketing operations independently. E-books uses number of employees to allocate human resources costs and processing time to allocate information systems costs. The following data are available for September 2012:

						
	A	B	C	D	E	F
1		SUPPORT DEPARTMENTS			OPERATING DEPARTMENTS	
2		Human Resources	Information Systems		Corporate Sales	Consumer Sales
3	Budgeted costs incurred before any					
4	interdepartment cost allocations	\$72,700	\$234,400		\$998,270	\$489,860
5	Support work supplied by human resources department					
6	Budgeted number of employees	—	21		42	28
7	Support work supplied by information systems department					
8	Budgeted processing time (in minutes)	320	—		1,920	1,600

- Allocate the support departments' costs to the operating departments using the direct method.
- Rank the support departments based on the percentage of their services provided to other support departments. Use this ranking to allocate the support departments' costs to the operating departments based on the step-down method.
- How could you have ranked the support departments differently?

**Required**

**15-22 Reciprocal cost allocation (continuation of 15-21).** Consider E-books again. The controller of E-books reads a widely used textbook that states that "the reciprocal method is conceptually the most defensible." He seeks your assistance.

**Required**

1. Describe the key features of the reciprocal method.
2. Allocate the support departments' costs (human resources and information systems) to the two operating departments using the reciprocal method.
3. In the case presented in this exercise, which method (direct, step-down, or reciprocal) would you recommend? Why?

**15-23 Allocation of common costs.** Ben and Gary are students at Berkeley College. They share an apartment that is owned by Gary. Gary is considering subscribing to an Internet provider that has the following packages available:

Package	Per Month
A. Internet access	\$60
B. Phone services	15
C. Internet access + phone services	65

Ben spends most of his time on the Internet ("everything can be found online now"). Gary prefers to spend his time talking on the phone rather than using the Internet ("going online is a waste of time"). They agree that the purchase of the \$65 total package is a "win-win" situation.

**Required**

1. Allocate the \$65 between Ben and Gary using (a) the stand-alone cost-allocation method, (b) the incremental cost-allocation method, and (c) the Shapley value method.
2. Which method would you recommend they use and why?

**15-24 Allocation of common costs.** Sunny Gunn, a self-employed consultant near Sacramento, received an invitation to visit a prospective client in Baltimore. A few days later, she received an invitation to make a presentation to a prospective client in Chicago. She decided to combine her visits, traveling from Sacramento to Baltimore, Baltimore to Chicago, and Chicago to Sacramento.

Gunn received offers for her consulting services from both companies. Upon her return, she decided to accept the engagement in Chicago. She is puzzled over how to allocate her travel costs between the two clients. She has collected the following data for regular round-trip fares with no stopovers:

Sacramento to Baltimore	\$1,200
Sacramento to Chicago	\$ 800

Gunn paid \$1,600 for her three-leg flight (Sacramento–Baltimore, Baltimore–Chicago, Chicago–Sacramento). In addition, she paid \$40 each way for limousines from her home to Sacramento Airport and back when she returned.

**Required**

1. How should Gunn allocate the \$1,600 airfare between the clients in Baltimore and Chicago using (a) the stand-alone cost-allocation method, (b) the incremental cost-allocation method, and (c) the Shapley value method?
2. Which method would you recommend Gunn use and why?
3. How should Gunn allocate the \$80 limousine charges between the clients in Baltimore and Chicago?

**15-25 Revenue allocation, bundled products.** Yves Parfum Company blends and sells designer fragrances. It has a Men's Fragrances Division and a Women's Fragrances Division, each with different sales strategies, distribution channels, and product offerings. Yves is now considering the sale of a bundled product consisting of a men's cologne and a women's perfume. For the most recent year, Yves reported the following:

	A	B
1	<b>Product</b>	<b>Retail Price</b>
2	Monaco (men's cologne)	\$ 48
3	Innocence (women's perfume)	112
4	L'Amour (Monaco + Innocence)	130

**Required**

1. Allocate revenue from the sale of each unit of L'Amour to Monaco and Innocence using the following:
  - a. The stand-alone revenue-allocation method based on selling price of each product
  - b. The incremental revenue-allocation method, with Monaco ranked as the primary product
  - c. The incremental revenue-allocation method, with Innocence ranked as the primary product
  - d. The Shapley value method, assuming equal unit sales of Monaco and Innocence
2. Of the four methods in requirement 1, which one would you recommend for allocating L'Amour's revenues to Monaco and Innocence? Explain.

**15-26 Allocation of common costs.** Jim Dandy Auto Sales uses all types of media to advertise its products (television, radio, newspaper, etc.). At the end of 2011, the company president, Jim Dandridge, decided that all advertising costs would be incurred by corporate headquarters and allocated to each of the company's three sales locations based on number of vehicles sold. Jim was confident that his corporate purchasing manager could negotiate better advertising contracts on a corporate-wide basis than each of the sales managers could on their own. Dandridge budgeted total advertising cost for 2012 to be \$1.8 million. He introduced the new plan to his sales managers just before the New Year.

The manager of the east sales location, Tony Snider, was not happy. He complained that the new allocation method was unfair and would increase his advertising costs significantly over the prior year. The east location sold high volumes of low-priced used cars and most of the corporate advertising budget was related to new car sales.

Following Tony's complaint, Jim decided to take another hard look at what each of the divisions were paying for advertising before the new allocation plan. The results were as follows:

Sales Location	Actual Number of Cars Sold in 2011	Actual Advertising Cost Incurred in 2011
East	3,150	\$ 324,000
West	1,080	432,000
North	2,250	648,000
South	<u>2,520</u>	<u>756,000</u>
	<u>9,000</u>	<u>\$2,160,000</u>

- Using 2011 data as the cost bases, show the amount of the 2012 advertising cost (\$1,800,000) that would be allocated to each of the divisions under the following criteria:
  - Dandridge's allocation method based on number of cars sold
  - The stand-alone method
  - The incremental-allocation method, with divisions ranked on the basis of dollars spent on advertising in 2011
- Which method do you think is most equitable to the divisional sales managers? What other options might President Jim Dandridge have for allocating the advertising costs?

**Required**

## Problems



**15-27 Single-rate, dual-rate, and practical capacity allocation.** Perfection Department Store has a new promotional program that offers a free gift-wrapping service for its customers. Perfection's customer-service department has practical capacity to wrap 7,000 gifts at a budgeted fixed cost of \$6,650 each month. The budgeted variable cost to gift wrap an item is \$0.40. Although the service is free to customers, a gift-wrapping service cost allocation is made to the department where the item was purchased. The customer-service department reported the following for the most recent month:

	A	B	C	D
1	Department	Actual Number of Gifts Wrapped	Budgeted Number of Gifts to Be Wrapped	Practical Capacity Available for Gift-Wrapping
2	Women's face wash	2,020	2,470	2,640
3	Men's face wash	730	825	945
4	Fragrances	1,560	1,805	1,970
5	Body wash	545	430	650
6	Hair products	<u>1,495</u>	<u>1,120</u>	<u>795</u>
7	Total	<u>6,350</u>	<u>6,650</u>	<u>7,000</u>

- Using the single-rate method, allocate gift-wrapping costs to different departments in these three ways.
  - Calculate the budgeted rate based on the budgeted number of gifts to be wrapped and allocate costs based on the budgeted use (of gift-wrapping services).
  - Calculate the budgeted rate based on the budgeted number of gifts to be wrapped and allocate costs based on actual usage.
  - Calculate the budgeted rate based on the practical gift-wrapping capacity available and allocate costs based on actual usage.

**Required**

- Using the dual-rate method, compute the amount allocated to each department when (a) the fixed-cost rate is calculated using budgeted costs and the practical gift-wrapping capacity, (b) fixed costs are allocated based on budgeted usage of gift-wrapping services, and (c) variable costs are allocated using the budgeted variable-cost rate and actual usage.
- Comment on your results in requirements 1 and 2. Discuss the advantages of the dual-rate method.

**15-28 Revenue allocation.** Lee Shu-yu Inc. produces and sells DVDs to business people and students who are planning extended stays in China. It has been very successful with two DVDs: Beginning Mandarin and Conversational Mandarin. It is introducing a third DVD, Reading Chinese Characters. It has decided to market its new DVD in two different packages grouping the Reading Chinese Characters DVD with each of the other two language DVDs. Information about the separate DVDs and the packages follow.

DVD	Selling Price
Beginning Mandarin (BegM)	\$ 50
Conversational Mandarin (ConM)	\$ 90
Reading Chinese Characters (RCC)	\$ 30
BegM + RCC	\$ 60
ConM + RCC	\$100

**Required**

- Using the selling prices, allocate revenues from the BegM + RCC package to each DVD in that package using (a) the stand-alone method; (b) the incremental method, in either order; and (c) the Shapley value method.
- Using the selling prices, allocate revenues from the ConM + RCC package to each DVD in that package using (a) the stand-alone method; (b) the incremental method, in either order; and (c) the Shapley value method.
- Which method is most appropriate for allocating revenues among the DVDs? Why?

**15-29 Fixed cost allocation.** State University completed construction of its newest administrative building at the end of 2011. The University's first employees moved into the building on January 1, 2012. The building consists of office space, common meeting rooms (including a conference center), a cafeteria and even a workout room for its exercise enthusiasts. The total 2012 building space of 125,000 square feet was utilized as follows:

Usage of Space	% of Total Building Space
Office space (occupied)	52%
Vacant office space	8%
Common meeting space	25%
Workout room	5%
Cafeteria	10%

The new building cost the university \$30 million and was depreciated using the straight-line method over 20 years. At the end of 2012 three departments occupied the building: executive offices of the president, accounting, and human resources. Each department's usage of its assigned space was as follows:

Department	Actual Office Space Used (sq. ft.)	Planned Office Space Used (sq. ft.)	Practical Capacity Office Space (sq. ft.)
Executive	16,250	12,400	18,000
Accounting	26,000	26,040	33,000
Human resources	22,750	23,560	24,000

**Required**

- How much of the total building cost will be allocated in 2012 to each of the departments, if allocated on the basis of the following?
  - Actual usage
  - Planned usage
  - Practical capacity
- Assume that State University allocates the total annual building cost in the following manner:
  - All vacant office space is absorbed by the university and is not allocated to the departments.
  - All occupied office space costs are allocated on the basis of actual square footage used.
  - All common costs are allocated on the basis of a department's practical capacity.
 Calculate the cost allocated to each department in 2012 under this plan. Do you think the allocation method used here is appropriate? Explain.

**15-30 Allocating costs of support departments; step-down and direct methods.** The Central Valley Company has prepared department overhead budgets for budgeted-volume levels before allocations as follows:

Support departments:			
Building and grounds	\$10,000		
Personnel	1,000		
General plant administration	26,090		
Cafeteria: operating loss	1,640		
Storeroom	<u>2,670</u>	\$ 41,400	
Operating departments:			
Machining	\$34,700		
Assembly	<u>48,900</u>		83,600
Total for support and operating departments			<u>\$125,000</u>

Management has decided that the most appropriate inventory costs are achieved by using individual-department overhead rates. These rates are developed after support-department costs are allocated to operating departments.

Bases for allocation are to be selected from the following:

Department	Direct	Number of Employees	Square Feet of	Manufacturing Labor-Hours	Number of Requisitions
	Manufacturing Labor-Hours		Floor Space Occupied		
Building and grounds	0	0	0	0	0
Personnel <sup>a</sup>	0	0	2,000	0	0
General plant administration	0	35	7,000	0	0
Cafeteria: operating loss	0	10	4,000	1,000	0
Storeroom	0	5	7,000	1,000	0
Machining	5,000	50	30,000	8,000	2,000
Assembly	<u>15,000</u>	<u>100</u>	<u>50,000</u>	<u>17,000</u>	<u>1,000</u>
Total	<u>20,000</u>	<u>200</u>	<u>100,000</u>	<u>27,000</u>	<u>3,000</u>

<sup>a</sup>Basis used is number of employees.

- Using the step-down method, allocate support-department costs. Develop overhead rates per direct manufacturing labor-hour for machining and assembly. Allocate the costs of the support departments in the order given in this problem. Use the allocation base for each support department you think is most appropriate.
- Using the direct method, rework requirement 1.
- Based on the following information about two jobs, determine the total overhead costs for each job by using rates developed in (a) requirement 1 and (b) requirement 2.

**Required**

	Direct Manufacturing Labor-Hours	
	Machining	Assembly
Job 88	18	2
Job 89	3	17

- The company evaluates the performance of the operating department managers on the basis of how well they managed their total costs, including allocated costs. As the manager of the machining department, which allocation method would you prefer from the results obtained in requirements 1 and 2? Explain.

**15-31 Support-department cost allocations; single-department cost pools; direct, step-down, and reciprocal methods.** The Manes Company has two products. Product 1 is manufactured entirely in department X. Product 2 is manufactured entirely in department Y. To produce these two products, the Manes Company has two support departments: A (a materials-handling department) and B (a power-generating department).

An analysis of the work done by departments A and B in a typical period follows:

Supplied By	Used By			
	A	B	X	Y
A	—	100	250	150
B	500	—	100	400

The work done in department A is measured by the direct labor-hours of materials-handling time. The work done in department B is measured by the kilowatt-hours of power. The budgeted costs of the support departments for the coming year are as follows:

	Department A (Materials Handling)	Department B (Power Generation)
Variable indirect labor and indirect materials costs	\$ 70,000	\$10,000
Supervision	10,000	10,000
Depreciation	<u>20,000</u>	<u>20,000</u>
	<u>\$100,000</u>	<u>\$40,000</u>
	+Power costs	+Materials-handling costs

The budgeted costs of the operating departments for the coming year are \$1,500,000 for department X and \$800,000 for department Y.

Supervision costs are salary costs. Depreciation in department B is the straight-line depreciation of power-generation equipment in its 19th year of an estimated 25-year useful life; it is old, but well-maintained, equipment.

**Required**

1. What are the allocations of costs of support departments A and B to operating departments X and Y using (a) the direct method, (b) the step-down method (allocate department A first), (c) the step-down method (allocate department B first), and (d) the reciprocal method?
2. An outside company has offered to supply all the power needed by the Manes Company and to provide all the services of the present power department. The cost of this service will be \$40 per kilowatt-hour of power. Should Manes accept? Explain.

**15-32 Common costs.** Wright Inc. and Brown Inc. are two small clothing companies that are considering leasing a dyeing machine together. The companies estimated that in order to meet production, Wright needs the machine for 800 hours and Brown needs it for 200 hours. If each company rents the machine on its own, the fee will be \$50 per hour of usage. If they rent the machine together, the fee will decrease to \$42 per hour of usage.

**Required**

1. Calculate Wright's and Brown's respective share of fees under the stand-alone cost-allocation method.
2. Calculate Wright's and Brown's respective share of fees using the incremental cost-allocation method. Assume Wright to be the primary party.
3. Calculate Wright's and Brown's respective share of fees using the Shapley value method.
4. Which method would you recommend Wright and Brown use to share the fees?

**15-33 Stand-alone revenue allocation.** MaxSystems, Inc., sells computer hardware to end consumers. Its most popular model, the CX30 is sold as a "bundle," which includes three hardware products: a personal computer (PC) tower, a 23-inch monitor, and a color laser printer. Each of these products is made in a separate manufacturing division of MaxSystems and can be purchased individually, as well as in a bundle. The individual selling prices and per unit costs are as follows:

Computer Component	Individual Selling Price per Unit	Cost per Unit
PC tower	\$ 840	\$300
Monitor	\$ 280	\$180
Color laser printer	\$ 480	\$270
Computer bundle purchase price	\$1,200	

**Required**

1. Allocate the revenue from the computer bundle purchase to each of the hardware products using the stand-alone method based on the individual selling price per unit.
2. Allocate the revenue from the computer bundle purchase to each of the hardware products using the stand-alone method based on cost per unit.
3. Allocate the revenue from the computer bundle purchase to each of the hardware products using the stand-alone method based on physical units (that is, the number of individual units of product sold per bundle).
4. Which basis of allocation makes the most sense in this situation? Explain your answer.

**15-34 Support-department cost allocations; single-department cost pools; direct, step-down, and reciprocal methods.** Spirit Training, Inc., manufactures athletic shoes and athletic clothing for both amateur and professional athletes. The company has two product lines (clothing and shoes), which are produced in separate manufacturing facilities; however, both manufacturing facilities share the same support services for information technology and human resources. The following shows total costs for each manufacturing facility and for each support department.

	Variable Costs	Fixed Costs	Total Costs by Department (in thousands)
Information technology (IT)	\$ 500	\$ 1,500	\$ 2,000
Human resources (HR)	\$ 100	\$ 900	\$ 1,000
Clothing	\$3,000	\$ 7,000	\$10,000
Shoes	\$2,500	\$ 5,500	\$ 8,000
Total costs	\$7,100	\$16,900	\$24,000

The total costs of the support departments (IT and HR) are allocated to the production departments (clothing and shoes) using a single rate based on the following:

Information technology:	Number of IT labor hours worked by department
Human resources:	Number of employees supported by department

Data on the bases, by department, are given as follows:

Department	IT Hours Used	Number of Employees
Clothing	5,000	120
Shoes	3,000	40
Information technology	-	40
Human resources	2,000	-

1. What are the total costs of the production departments (clothing and shoes) **after** the support department costs of information technology and human resources have been allocated using (a) the direct method, (b) the step-down method (allocate information technology first), (c) the step-down method (allocate human resources first), and (d) the reciprocal method?
2. Assume that all of the work of the IT department could be outsourced to an independent company for \$97.50 per hour. If Spirit Training no longer operated its own IT department, 30% of the fixed costs of the IT department could be eliminated. Should Spirit outsource its IT services?

**Required**

### Collaborative Learning Problem

**15-35 Revenue allocation, bundled products.** Exclusive Resorts (ER) operates a five-star hotel with a championship golf course. ER has a decentralized management structure, with three divisions:

- Lodging (rooms, conference facilities)
- Food (restaurants and in-room service)
- Recreation (golf course, tennis courts, swimming pool, etc.)

Starting next month, ER will offer a two-day, two-person “getaway package” for \$1,000.

This deal includes the following:

	As Priced Separately
Two nights’ stay for two in an ocean-view room	\$ 800 (\$400 per night)
Two rounds of golf (can be used by either guest)	\$ 375 (\$187.50 per round)
Candlelight dinner for two at ER’s finest restaurant	\$ 200 (\$100 per person)
Total package value	\$1,375

Jenny Lee, president of the recreation division, recently asked the CEO of ER how her division would share in the \$1,000 revenue from the getaway package. The golf course was operating at 100% capacity. Currently, anyone booking the package was guaranteed access to the golf course. Lee noted that every “getaway” booking would displace \$375 of other golf bookings not related to the package. She emphasized that the high demand reflected the devotion of her team to keeping the golf course rated one of the “Best 10 Courses in the World” by *Golf Monthly*. As an aside, she also noted that the lodging and food divisions had to turn away customers during only “peak-season events such as the New Year’s period.”

1. Using selling prices, allocate the \$1,000 getaway-package revenue to the three divisions using:
  - a. The stand-alone revenue-allocation method
  - b. The incremental revenue-allocation method (with recreation first, then lodging, and then food)
2. What are the pros and cons of the two methods in requirement 1?
3. Because the recreation division is able to book the golf course at 100% capacity, the company CEO has decided to revise the getaway package to only include the lodging and food offerings shown previously. The new package will sell for \$900. Allocate the revenue to the lodging and food divisions using the following:
  - a. The Shapley value method.
  - b. The weighted Shapley value method, assuming that lodging is three times as likely to sell as the food.

**Required**