

I don't know how we're supposed to determine the costs of different grades of coal. First, we have back office operations here at headquarters that support our two mines up north. Second, coal from the mines comes in two grades, but the same costs to mine are incurred for both. Finally, we get some revenues from the slurry we sell from the coal that we cannot sell directly. Which product should we credit? It seems to me that there are so many costs being allocated that it is impossible to determine what *anything* costs.

Another question I have is what to do about Information Services, one of our back office operations activities. I have read a lot about companies outsourcing some of these activities to vendors here or in Asia. I would really like to have a way to think about the costs we would save, if any, if we did this. [See the *In Action* item, "Outsourcing Information Services—Managed Service Providers."]

The members of the marketing team at Carlyle Coal Company (CCC) in British Columbia were sitting in the company's conference room at corporate headquarters. CCC

produces two primary products, hi-grade and lo-grade coal. When CCC mines coal, this mixture of hi- and lo-grade coal is produced in fixed proportions. (Coal "quality" is determined by the heating value, ash content, etc.) The company had just received an order for several hundred tons of hi-grade coal. The problem, of course, was that CCC would have to produce lo-grade coal as well and would have to discount it because the company has no room to store it. Somehow, managers had to decide whether the special order was worth accepting and how much cost each product should bear.

Jennifer King, the marketing team member from cost accounting, spoke up. "Cost allocation can be arbitrary, but it is important because of the information it provides. We have two types of allocation problems here. First, what do we do about the support services from the back office operations? Second, how do we treat the joint costs of producing the two grades? Many companies face both of these problems and have developed methods to address them. Give me a day, and I'll have some suggestions."

We have seen how cost allocation is used to develop the costs of products, services, and customers. The cost allocation process has other roles, two of which we explore in this chapter. In our discussion of *two-stage cost allocation*, we took the first-stage allocation process as given and concentrated on allocating the cost pools in the second stage. However, part of the first-stage overhead cost is incurred for departments that do not directly produce the service or product. Instead, these departments provide services to the plants and departments that do. For example, personnel, accounting, and purchasing provide services to production departments. In this chapter we will consider service department cost allocation, which is the process used to allocate the costs of these "service" departments.

Next we consider product costing when multiple products are jointly produced from common inputs in fixed proportions such as the coal at CCC. In our discussions so far, the companies altered the proportions of the outputs by changing the input mix. For some products, especially in foods, chemicals, and mineral industries, the output proportions are fixed by physical characteristics. When a production process results in outputs in fixed proportion, we use a process called *joint cost allocation* to assign costs to the individual products.

service department
Department that provides services to other subunits in the organization.

Service Department Cost Allocation

This section focuses on allocating the costs of a service department to other departments that use the service. **Service departments** provide services to other departments. For example, an information systems department is a service department that provides information systems support to other departments, and a human resources department provides hiring and training services to other departments. **User departments** use the functions of service departments. For example, the production department uses the services provided by the information systems and human resources departments. User departments could be other service departments or production or marketing departments that produce or market the organization's products.

L.O. 1
Explain why service costs are allocated.

user department
Department that uses the functions of service departments.

In Action

Outsourcing Information Services—Managed Service Providers

When we hear about information services being outsourced, we often imagine entire information technology (IT) departments moving outside the firm. Recently, however, the trend has been toward outsourcing more specific functions to companies.

Where outsourcing once meant transferring departments to Bangalore, India, or Riga, Latvia, it now usually involves assigning specific, basic operational tasks like making data backups, running e-mail networks, and maintaining computer servers. As a result, outsourcing has become more attractive to small businesses that in the past might not have had the resources to hire a full tech-support team to do the work.

The vendors supplying this new generation of outsourcing services are called managed service providers, or MSPs. They come in all shapes and sizes, from IBM down. Some operate their own large data centers. They have emerged in unexpected places—American cities like Portland, Oregon; Little Rock, Arkansas; and Madison, Wisconsin, where there is enough skilled labor for the tasks, and the expenses are less than in bigger cities.¹

As they have taken on more business, MSPs now provide support for ensuring data integrity:

... even the smaller corporations are motivated to do a better job with disaster recovery and off-site data protection as a result of the Sarbanes-Oxley law, which set new financial reporting and auditing rules for businesses and other legislation. In the past, only the largest corporate data centers made off-site plans; now it is more common for smaller ones to do so. MSPs have tailored their offerings and sell less expensive solutions for this market.²

An example of a company using an MSP:

Xerox will pay \$100 million over six years to outsource data-center services to HCL Technologies, one of India's largest technology service providers, a Xerox spokesman, Bill McKee, said on Sunday. As part of the deal, HCL will manage disaster-recovery preparation and consolidate Xerox's data centers in North America and Europe . . .³

Sources: ¹D. Strom, *The New York Times*, September 12, 2007.

²Ibid.

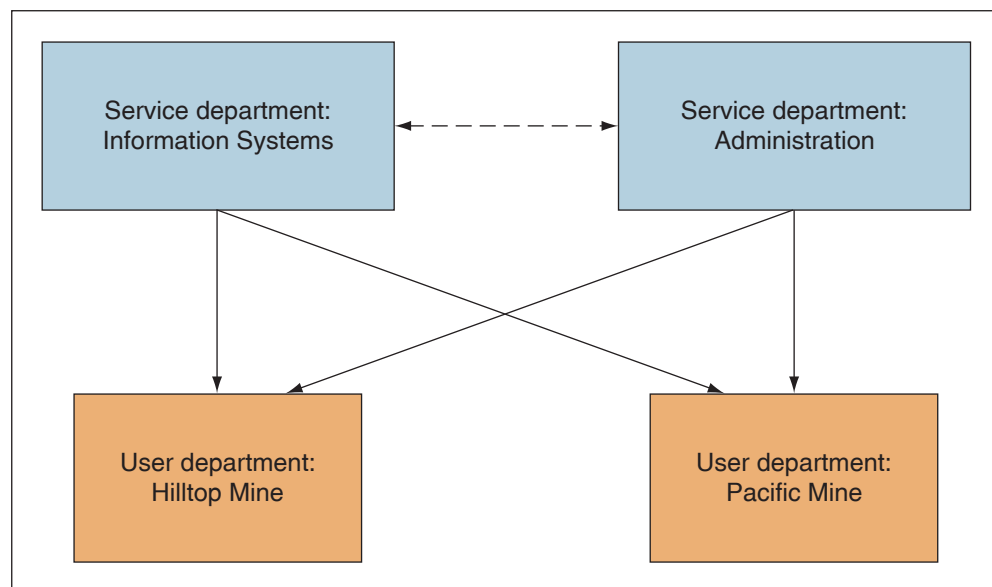
³Reuters, as reported in *The New York Times*, April 6, 2009.

Although our focus in this chapter is on allocating the costs of service departments to production departments, we also discuss how the allocation process can help managers make decisions about keeping or eliminating the service departments. We return to this issue at the end of our discussion on service department cost allocation.

Carlyle Coal Company (CCC) is a midsize coal mining company with many departments, but for simplicity we assume that it has only four. Two, Information Systems (S1) and Administration (S2), are service departments. The other two, Hilltop Mine (P1) and Pacific Mine (P2), are user departments. See Exhibit 11.1 for the connection among the departments. Both user departments employ both service departments. That

Exhibit 11.1

Service and User Departments—Carlyle Coal Company

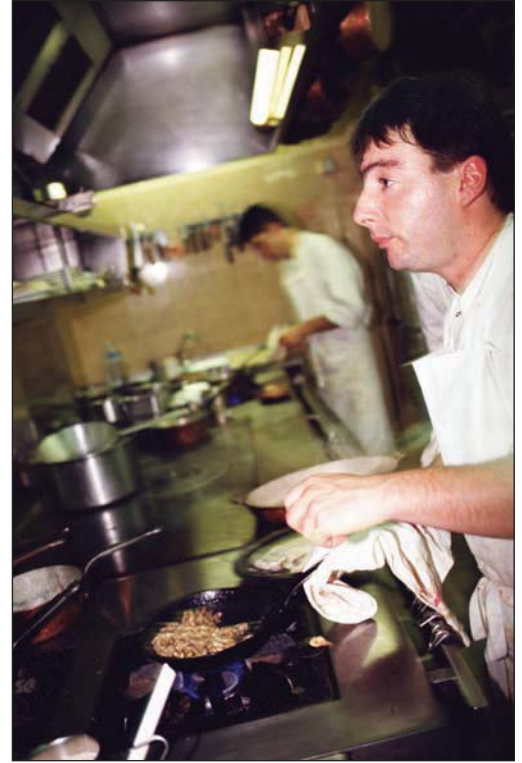


is, Hilltop Mine requires support from Information Systems for the automated systems it uses and it requires support from Administration for most staff functions, such as hiring and training employees. The same is true of the Pacific Mine. Notice that Exhibit 11.1 has a dashed line between the two service departments. This indicates that, depending on the situation, each service department also provides service to the other.

Any cost center whose costs are charged to other departments in the organization is called an **intermediate cost center**. **Final cost centers**, on the other hand, are cost centers whose costs are not allocated to another cost center.

Power companies and cement plants use the company’s products. CCC’s Hilltop Mine and Pacific Mine provide these products. To serve their customers, these two user departments require the assistance of Information Systems (to prepare customer statements, for example) and Administration (to provide employees to work in the mines and produce coal, for example). In Chapter 10, you learned how to compute the cost of a customer. Here, you will consider how to allocate the cost of the service departments (the “back office costs”) to the departments that interact with the customers, such as the power company.

Service organizations, merchandising organizations, and manufacturing organizations all have production or marketing departments and service departments. The following are examples of production or marketing and service departments at various organizations:



Many organizations have a food services department that provides meals to employees. Such departments are service departments.

Organization	Service Department	Production or Marketing Department
Steelcase (office furniture)	Order Entry	Computer Furniture Plant
Marriott Hotels	Reservations	Albuquerque Marriott
Los Angeles Unified School District . . .	Motor Pool	Central High School
City of Grand Rapids	Purchasing	Streets and Sanitation

intermediate cost center
Cost center whose costs are charged to other departments in the organization.

final cost center
Cost center, such as a production or marketing department, whose costs are not allocated to another cost center.

Methods of Allocating Service Department Costs

This section describes three methods used to allocate service department overhead costs: the direct method, the step method, and the reciprocal method. To make each method easier to understand, we use the four departments at CCC as an example.

CCC allocates service department costs to Hilltop and Pacific for two purposes: (1) to determine the cost to produce and market coal and (2) to encourage operating department managers to monitor service department costs, that is, cross-department monitoring. Because all CCC department managers are evaluated, in part, on the costs of their department, they do not view the allocation of cost as a meaningless exercise. (Performance measurement is discussed in more detail in later chapters of the book.) They make operating decisions, such as pricing, based on the costs of their operations. Therefore, to the managers in these departments, the allocated costs are as “real” as the costs of employees and equipment.



Allocation Bases

Each service department is an intermediate cost center whose costs are recorded as incurred and then distributed to other cost centers. We know from our discussion of cost

Exhibit 11.2

Basic Data for Service Department Cost Allocation—Carlyle Coal Company

	A	B	C	D	E
1		Service Department			
2		Information Systems (S1)		Administration (S2)	
3		Usage	Percent	Usage	Percent
4	Departments	(hours)	of Total	(employees)	of Total
5	Administration	100,000	50%	—0—	0%
6	Information Systems	—0—	0	2,000	20
7	Hilltop Mine (P1)	20,000	10	5,000	50
8	Pacific Mine (P2)	80,000	40	3,000	30
9	Total	<u>200,000</u>	<u>100%</u>	<u>10,000</u>	<u>100%</u>
10					

management systems that an important aspect of cost allocation is deciding which allocation base to use. Because we have already spent a great deal of time on the choice of cost allocation bases, we simply specify that CCC has determined that the best allocation base for Information Systems is computer-hours and the best allocation base for Administration is number of employees.

See Exhibit 11.2 for the allocation base for each service department and the proportion of costs allocated to user departments. For example, Information Systems's costs are allocated on the basis of the number of computer-hours used by each other department. During the period, Information Systems provided 100,000 hours of service to Administration, which represents 50 percent of the 200,000 total computer-hours provided. Similar methods are used to derive the percentages for allocating Administration costs.

L.O. 2

Allocate service department costs using the direct method.

direct method

Cost allocation method that charges costs of service departments to user departments without making allocations between or among service departments.

Direct Method

The **direct method** allocates costs directly to the final user of a service (e.g., Hilltop Mine), ignoring intermediate users (e.g., Administration). The direct method makes no allocations among service departments. Thus, Information Systems's costs attributable to the Administration Department are not allocated to Administration. Instead, the service department costs are allocated "directly" to the user departments—hence, the name *direct method*.

The use of the direct method of cost allocation at CCC is discussed here (see Exhibit 11.3). Assume that the accounting records show that costs of \$800,000 and \$5,000,000 are recorded in each service department, Information Systems (S1) and Administration (S2), respectively. Costs are allocated directly to Hilltop Mine (P1) and Pacific Mine (P2).

Note that these are direct costs of service departments that become overhead costs of the user departments. Exhibit 11.4 is the cost flow diagram that illustrates the direct method.

Allocate Information Systems Department Costs Information Systems' costs of \$800,000 are allocated to Hilltop Mine and Pacific Mine based on the number of computer-hours used by each. According to the facts in Exhibit 11.3, Hilltop Mine (P1) used 20 percent and Pacific Mine (P2) used 80 percent of the total Information Systems computer-hours consumed by user departments. Remember that these are *relative* usages that ignore the use of Information Systems services by Administration. Of the total of 200,000 computer-hours used, Administration uses 100,000. This means that the two user departments (Hilltop and Pacific Mines) used 100,000 computer-hours. Hilltop uses 20,000 hours (or 20 percent) of the 100,000, and Pacific Mine uses 80,000 (or 80 percent) of the 100,000. Applying these percentages in exactly the same way in which we have made all of our cost

Exhibit 11.3 Service Department Cost Allocation Computations: Direct Method—Carlyle Coal Company

	A	B	C	D	E	F
1		Service Department				
2		Information Systems (S1)		Administration (S2)		
3		Usage of S1	Percent	Usage of S2	Percent	
4	Departments	services (hours)	of Total	services (employees)	of Total	
5	Administration	100,000	50%	—0—	0%	
6	Information Systems	—0—	0	2,000	20	
7	Hilltop Mine (P1)	20,000	10	5,000	50	
8	Pacific Mine (P2)	<u>80,000</u>	<u>40</u>	<u>3,000</u>	<u>30</u>	
9	Total usage	<u>200,000</u>	<u>100%</u>	<u>10,000</u>	<u>100%</u>	
10						
11						
12	Direct Method:		Percent Allocable to			
13		Department	Hilltop Mine		Pacific Mine	
14		Direct Cost	(P1)		(P2)	
15	Service Department					
16	Information Systems (S1)	\$ 800,000	20.0%	=[B7/(B7+B8)]	80.0%	=[B8/(B7+B8)]
17	Administration (S2)	5,000,000	62.5%	=[D7/(D7+D8)]	37.5%	=[D8/(D7+D8)]
18						
19						
20			Amount Allocable to			
21			Hilltop Mine		Pacific Mine	
22			(P1)		(P2)	
23	Service Department					
24	Information Systems (S1)	\$ 800,000	\$ 160,000	=(B24*C16)	\$ 640,000	=(B24*E16)
25	Administration (S2)	<u>5,000,000</u>	<u>3,125,000</u>	=(B25*C17)	<u>1,875,000</u>	=(B25*E17)
26		<u>\$ 5,800,000</u>	<u>\$ 3,285,000</u>		<u>\$ 2,515,000</u>	
27						

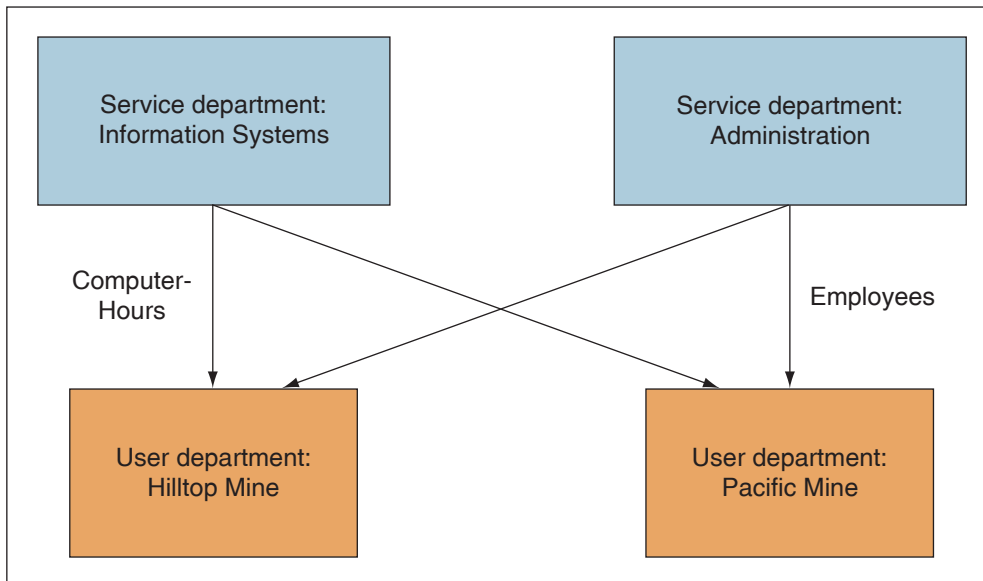


Exhibit 11.4 Cost Flow Diagram: Direct Method—Carlyle Coal Company

allocation computations, we find that the \$800,000 is allocated to the two cost objects (user departments) as follows:

Hilltop Mine (P1)	20% × \$800,000 =	\$160,000
Pacific Mine (P2)	80% × \$800,000 =	640,000
Total	100% × \$800,000 =	<u>\$800,000</u>

Allocate Administration Department Costs Administration costs of \$5,000,000 are allocated to Hilltop and Pacific Mines based on the number of employees in the two mines. According to the facts in Exhibit 11.3, Hilltop Mines (P1) has 62.5 percent and Pacific Mine (P2) has 37.5 percent of the employees in the two user departments. Of the total of 10,000 employees shown in cell D9 of Exhibit 11.2, Information Systems employs 2,000. That means the two user departments (Hilltop and Pacific Mines) employ 8,000. Hilltop uses 5,000 (or 62.5 percent) of the 8,000 and Pacific Mine uses 3,000 (or 37.5 percent) of the 8,000. Using the same approach, the \$5,000,000 Administration cost is allocated to the two cost objects (user departments) as follows:

Hilltop Mine (P1)	62.5% × \$5,000,000 =	\$3,125,000
Pacific Mine (P2)	37.5% × \$5,000,000 =	1,875,000
Total	100% × \$5,000,000 =	<u>\$5,000,000</u>

Adding the allocated costs of the service departments in each of the two user departments assigns the following costs to Hilltop Mine and Pacific Mine:

	Hilltop Mine	Pacific Mine	Total
Information Systems (S1)	\$ 160,000	\$ 640,000	\$ 800,000
Administration (S2)	3,125,000	1,875,000	5,000,000
Total	<u>\$3,285,000</u>	<u>\$2,515,000</u>	<u>\$5,800,000</u>

See Exhibit 11.5 for the flow of costs and the allocations to be recognized by CCC’s departments when the direct method is used. The direct costs of service departments are first recorded in those service departments. These costs are shown on the debit side of the service department accounts. Then service department costs are allocated to the user departments.

The user departments also have direct costs such as the department manager’s salary. These costs are indicated as the *direct overhead costs of Pacific Mine* in Exhibit 11.5. These costs do not have to be allocated to the user departments because they are debited to the department accounts when incurred.

Exhibit 11.5 Flow of Cost Allocations: Direct Method—Carlyle Coal Company

Service Departments		User Departments	
Information Systems (S1)		Hilltop Mine (P1)	
Direct costs of Information Systems 800,000	Allocated to 160,000 (S1 → P1) 640,000 (S1 → P2)	Direct overhead costs of Hilltop Mine Allocated costs from: (S1 → P1) 160,000 (S2 → P1) 3,125,000	
Administration (S2)		Pacific Mine (P2)	
Direct costs of Administration 5,000,000	Allocated to 3,125,000 (S2 → P1) 1,875,000 (S2 → P2)	Direct overhead costs of Pacific Mine Allocated costs from: (S1 → P2) 640,000 (S2 → P2) 1,875,000	

Limitations of the Direct Method Some people have criticized the direct method because it ignores services provided by one service department to another. If one purpose of cost allocation is to encourage cross-departmental monitoring, the direct method falls short because it ignores the costs that service departments themselves incur when they use other service departments. This criticism has led some companies to use other methods of service department cost allocation, which we describe next.

Self-Study Question

1. Modoc Bank is a small retail bank with two branches, Downtown and Mall. It has three service departments: Personnel, Finance, and Building Occupancy. The service departments provide support to both branches as well as to the other service departments. However, the branches are considered the only two profit centers, and the branch managers are evaluated on branch profits after allocation of service department costs.
During the current period, the direct costs incurred in each of the departments follow:

Department	Direct Cost
Personnel	\$ 202,500
Finance	126,000
Building Occupancy	150,000
Downtown	950,000
Mall	425,000
Total	<u>\$1,853,500</u>

Personnel costs are allocated on the basis of number of employees. Finance costs are allocated on the basis of billable transactions. Building Occupancy costs are allocated on the basis of the number of

square feet in each user department. For the current period, the following table summarizes the usage of services by other service cost centers and other departments:

Departments	Service Department		
	Personnel (employees)	Finance (transactions)	Building Occupancy (square feet)
Personnel	—0—	13,000	15,000
Finance	30	—0—	10,000
Building Occupancy	15	1,000	—0—
Downtown	60	60,000	30,000
Mall	30	24,000	45,000
Total	<u>135</u>	<u>98,000</u>	<u>100,000</u>

Using the direct method for service cost allocations, what is the total cost for each branch that will be used for determining branch profits?

The solution to this question is at the end of the chapter on page 435.

Step Method

The **step method** recognizes that one service department can provide services to others and allocates some service department costs to other service departments. Allocations usually are made first from the service department that has provided the largest proportion of its total services to other service departments. Once an allocation is made from a service department, no further allocations are made back to that department. Hence, a service department that provides services to, and receives services from, another service department has only one of these two relationships recognized.

Choosing the allocation order that we just suggested minimizes the percentage of service costs ignored in the allocation process. (Sometimes, the allocation begins from the service department with the largest cost. We explore this possibility in Self-Study Question 2.) When CCC uses the step method, it allocates costs from Information Systems to Administration but not vice versa.

An analysis of service usage among CCC’s service departments indicates that Information Systems supplies 50 percent of its services to the other service department, Administration. Administration supplies 20 percent of its services to the other service

L.O. 3

Allocate service department costs using the step method.

step method

Method of service department cost allocation that allocates some service department costs to other service departments.

Exhibit 11.6 Service Department Cost Allocation Computations: Step Method—Carlyle Coal Company

	A	B	C	D	E	F	G	
1		Service Department						
2		Information Systems (S1)		Administration (S2)				
3		Usage	Percent	Usage	Percent			
4	Departments	(hours)	of Total	(employees)	of Total			
5	Administration	100,000	50%	–0–	0%			
6	Information Systems	–0–	0	2,000	20			
7	Hilltop Mine (P1)	20,000	10	5,000	50			
8	Pacific Mine (P2)	80,000	40	3,000	30			
9	Total usage	<u>200,000</u>	<u>100%</u>	<u>10,000</u>	<u>100%</u>			
10								
11								
12	Step Method:	Percent Allocable to						
13		Department	Information		Hilltop	Pacific		
14		Direct Cost	Systems	Administration	Mine	Mine	Total	
15	Service Department							
16	Information Systems (S1)	\$ 800,000	0.0%	50.0%	10.0%	40.0%	100.0%	
17	Administration (S2)	<u>5,000,000</u>	0.0%	0.0%	62.5%	37.5%	100.0%	
18		<u>\$ 5,800,000</u>						
19								
20		Amount Allocable to						
21			Information		Hilltop	Pacific		
22			Systems	Administration	Mine	Mine		
23	From							
24	Direct department costs		\$ 800,000	\$ 5,000,000	\$ –0–	\$ –0–		
25	Information Systems (S1)		(800,000)	400,000	80,000	320,000		
26	Administration (S2)		–0–	(5,400,000)	3,375,000	2,025,000		
27	Total		<u>\$ –0–</u>	<u>\$ –0–</u>	<u>\$ 3,455,000</u>	<u>\$ 2,345,000</u>		
28								

department, Information Systems (see Exhibit 11.2). Based on services provided to other service departments, the rank ordering for step allocation is as follows:

Order	Service Department
1	Information Systems (S1)
2	Administration (S2)

Allocating Service Department Costs Information Systems's costs are allocated to Administration, but remember that under the step method, once a service department's costs have been allocated to other departments, no costs can be allocated back to it. Therefore, no Administration costs will be allocated to Information Systems. See Exhibit 11.6 for the computation of Information Systems' costs allocated to the other service department at CCC.

Notice that in Exhibit 11.6, the Administration costs that are allocated include both the \$5,000,000 costs directly incurred by Administration and the \$400,000 costs allocated from Information Systems. The effect of using the step method is that Hilltop Mine is allocated more costs than it is with the direct method. The reason is that Hilltop uses a larger proportion of Administration resources, and Administration uses half of the Information Systems resources. See Exhibit 11.7 for the cost flow diagram for the step method. The flow of costs through the accounts is shown in Exhibit 11.8.

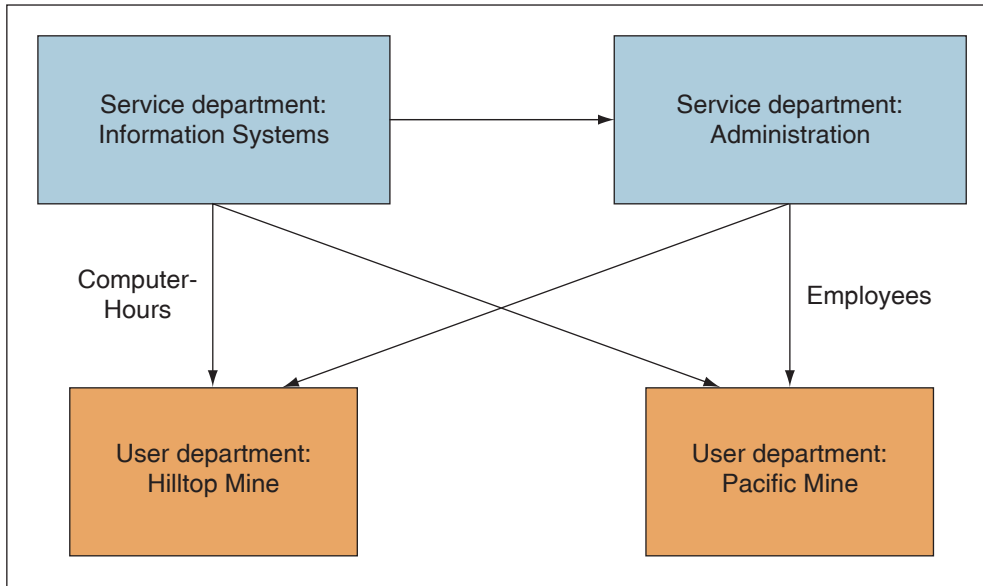


Exhibit 11.7
Cost Flow Diagram: Step Method—Carlyle Coal Company

Exhibit 11.8 Flow of Cost Allocations: Step Method—Carlyle Coal Company

Service Departments		User Departments	
Information Systems (S1)		Hilltop Mine (P1)	
Direct costs of Information Systems 800,000	Allocated to: Administration 400,000 (S1 → S2) 80,000 (S1 → P1) 320,000 (S1 → P2)	Direct overhead costs of Hilltop Mine Allocated costs from: (S1 → P1) 80,000 (S2 → P1) 3,375,000	
Administration (S2)		Pacific Mine (P2)	
Direct costs of Administration 5,000,000 + Allocated costs from (S1 → S2) 400,000	Allocated to: 3,375,000 (S2 → P1) 2,025,000 (S2 → P2)	Direct overhead costs of Pacific Mine Allocated costs from: (S1 → P2) 320,000 (S2 → P2) 2,025,000	

Limitations of the Step Method The step method can result in more reasonable allocations than the direct method because it recognizes that some service departments use other service departments. However, it does not recognize reciprocal services, for example, that Information Systems also uses Administration services. The step method is not necessarily better than the direct method when both the costs and benefits of using cost allocation are considered. A company that already uses the direct method could find it uneconomical to switch methods.

Another limitation of the step method, which is illustrated in Self-Study Question 2, is that the results generally depend on the order in which the allocation is done. Although there are common practices (such as the one followed here) that suggest an order, there is no “right” approach.

In Action

Step Method at Stanford University

S It is the policy of the federal government to reimburse universities, such as Stanford University, for the full costs of conducting federally sponsored research. The reimbursement is calculated by using an indirect cost rate, which is determined (analogous to an overhead rate) as follows:

$$\text{Indirect cost rate} = \frac{\text{Total indirect costs attributable to sponsored research}}{\text{Modified total direct cost of sponsored research}}$$

This rate, which is expressed as a percentage, is typically negotiated a year in advance. During that year, when a researcher at Stanford submits a funding proposal to any federal government agency, the proposal asks the agency to pay for the direct costs of the project, such as salaries, benefits, supplies, and capital equipment. In addition, the proposal asks for the agency to provide an additional amount of funding to reimburse Stanford for a share of the indirect costs of doing research, such as those related to library expenses, depreciation charges, and so on. This amount is computed by multiplying a modified version of the direct costs (typically excluding capital equipment) by the predetermined indirect cost rate.

Not all indirect costs are allocable to sponsored research. Costs that are allowable, based on the federal government's guidelines, are subdivided into functions, such as Plant Operations and Maintenance or Administrative Expense, and then assigned to indirect cost pools. The final cost objectives include categories such as Sponsored Instruction, Patient Care, Stanford University Hospital, and so on, as well as the primary category of interest, Organized Research. The costs from the indirect cost pools are allocated to the final cost objectives using a *step* allocation process. Each indirect cost pool has its own basis of allocation. For instance, depreciation on buildings is allocated according to the square footage of space occupied by each cost objective within the building. The depreciation cost pool is then emptied and no costs are allocated back to it, in accordance with the step process. Once all of the indirect cost pools have been emptied in sequence, the total amount that has been allocated to the Organized Research cost objective is then used as the numerator in the calculation of the indirect cost rate.

Source: S. Huddart and R. Sarkar, "Stanford University (A): Indirect Cost Recovery," #A155A, Stanford University.

Self-Study Question

2. Some firms choose the order of allocation based on the costs in the individual service departments. Consider the case of CCC where Administration is the service department with the higher direct costs. Compute the service cost allocated to each mine (Hilltop and Pacific) using the step method. Start by allocating Administra-

tion costs first. Recall that Administration's direct cost is \$5,000,000 and Information Systems' is \$800,000. See Exhibit 11.2 for service department use data.

The solution to this question is at the end of the chapter on pages 435–436.

L.O. 4

Allocate service department costs using the reciprocal method.

reciprocal method

Method to allocate service department costs that recognizes all services provided by any service department, including services provided to other service departments.

Reciprocal Method

The reciprocal method addresses a limitation of the step method by making a reciprocal cost allocation when service departments provide reciprocal services (that is, when they provide services to each other). The **reciprocal method** recognizes all services provided by any department, including those provided to other service departments. This method is identical to the actual process by which services are exchanged among departments within the organization.

With the reciprocal method, the costs of each service department are written in equation form:

$$\text{Total service department costs} = \text{Direct costs of the service department} + \text{Cost allocated to the service department}$$

A single equation for each service department and a single unknown (the total cost of the service department) for each service department in the organization are used. The system of equations is then solved simultaneously using matrix algebra. Solving all equations simultaneously yields all service department allocations, including services provided by service departments to each other. This method is called the *reciprocal method* because it accounts for cost flows in both directions among service departments that provide services to each other. It is also known as the *simultaneous solution method* because it solves a system of equations simultaneously.

Allocating Service Department Costs We illustrate the use of computer spreadsheets such as Microsoft Excel® for solving reciprocal cost allocation problems in the Appendix to this chapter. However, when there are only two service departments, as in the case of CCC, simple algebra can be used to solve the allocation problem.

From the data in Exhibit 11.2, we can write the equations describing the costs in the two service departments as follows:

$$\begin{array}{rclcl} \text{Total service} & = & \text{Direct costs of the} & + & \text{Cost allocated to the} \\ \text{department costs} & & \text{service department} & & \text{service department} \\ \\ \text{S1 (Information Systems)} & = & \$ 800,000 & + & 0.20 \text{ S2} \\ \text{S2 (Administration)} & = & \$ 5,000,000 & + & 0.50 \text{ S1} \end{array}$$

Substituting the first equation into the second yields

$$\begin{aligned} \text{S2} &= \$5,000,000 + 0.50 (\$800,000 + 0.20 \text{ S2}) \\ \text{S2} &= \$5,000,000 + \$400,000 + 0.10 \text{ S2} \\ 0.9 \text{ S2} &= \$5,400,000 \\ \text{S2} &= \$6,000,000 \end{aligned}$$

Substituting the value of S2 back into the first equation gives

$$\begin{aligned} \text{S1} &= \$800,000 + 0.20 (\$6,000,000) \\ \text{S1} &= \$2,000,000 \end{aligned}$$

Thus, costs are simultaneously allocated between the two service departments. The values for S1 (\$2,000,000) and S2 (\$6,000,000) are then used as the total costs of the service departments that are to be allocated to the production departments. See Exhibit 11.9 for the allocations.

The total cost allocated to the production departments (the two mines) amounts to \$5,800,000 (= \$3,200,000 + \$2,600,000), which equals the costs to be allocated from the service departments (\$800,000 + \$5,000,000 = \$5,800,000). See Exhibit 11.10 for the cost flow diagram for the reciprocal method.

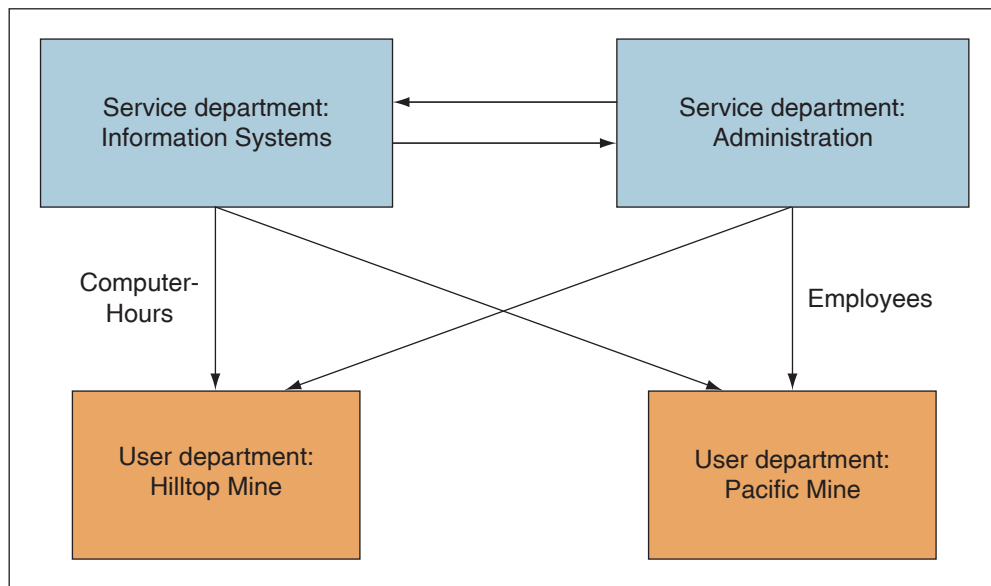
Compare Exhibits 11.8 and 11.11 to identify the key difference between the step and reciprocal methods. Note that the reciprocal method accounts for the reciprocal services between the Information Systems and Administration departments. The step method accounted for only one direction of services, from Information Systems to Administration.

Both the step method and the direct method could understate the cost of running service departments. These methods omit costs of certain services consumed by one service department that were provided by other service departments. For example, only the reciprocal method considers services provided by Administration and Information Systems to each other.

Exhibit 11.9 Service Department Cost Allocation Computations: Reciprocal Method—Carlyle Coal Company

	A	B	C	D	E	F	G	
1		Service Department						
2		Information Systems (S1)		Administration (S2)				
3		Usage	Percent	Usage	Percent			
4	Departments	(hours)	of Total	(employees)	of Total			
5	Administration	100,000	50%	-0-	0%			
6	Information Systems	-0-	0	2,000	20			
7	Hilltop Mine (P1)	20,000	10	5,000	50			
8	Pacific Mine (P2)	80,000	40	3,000	30			
9	Total usage	200,000	100%	10,000	100%			
10								
11								
12	Reciprocal Method:	Percent Allocable to						
13		Department	Information		Hilltop	Pacific		
14		Total Cost	Systems	Administration	Mine	Mine	Total	
15	Service Department							
16	Information Systems (S1)	\$ 2,000,000	0.0%	50.0%	10.0%	40.0%	100.0%	
17	Administration (S2)	6,000,000	20.0%	0.0%	50.0%	30.0%	100.0%	
18		\$ 8,000,000						
19								
20		Amount Allocable to						
21			Information		Hilltop	Pacific		
22			Systems	Administration	Mine	Mine		
23	From							
24	Direct department costs		\$ 800,000	\$ 5,000,000	\$ -0-	\$ -0-		
25	Information Systems (S1)		(2,000,000)	1,000,000	200,000	800,000		
26	Administration (S2)		1,200,000	(6,000,000)	3,000,000	1,800,000		
27	Total		\$ -0-	\$ -0-	\$ 3,200,000	\$ 2,600,000		
28								

Exhibit 11.10
Cost Flow Diagram: The Reciprocal Method—Carlyle Coal Company



Comparison of Direct, Step, and Reciprocal Methods

These three service department allocation methods can be compared in two ways. The first is to examine how each allocates costs to departments receiving services. Returning

Exhibit 11.11 Flow of Cost Allocations: Reciprocal Method—Carlyle Coal Company

Service Departments		Operating Departments	
Information Systems (S1)		Hilltop Mine (P1)	
Direct costs of Information Systems 800,000 (S2 → S1) 1,200,000	Allocated to: 1,000,000 (S1 → S2) 200,000 (S1 → P1) 800,000 (S1 → P2)	Direct overhead costs of Hilltop Mine Allocated costs from: (S1 → P1) 200,000 (S2 → P1) 3,000,000	
Administration (S2)		Pacific Mine (P2)	
Direct costs of Administration 5,000,000 (S1 → S2) 1,000,000	Allocated to: 1,200,000 (S2 → S1) 3,000,000 (S2 → P1) 1,800,000 (S2 → P2)	Direct overhead costs of Pacific Mine Allocated costs from: (S1 → P2) 800,000 (S2 → P2) 1,800,000	

Self-Study Question

3. Williston Machining is a small manufacturing firm with two production departments, Finishing and Assembly. Its two service departments, Maintenance and the Cafeteria, serve both production departments.

During the current period, the direct costs incurred in each department follow:

Department	Direct Cost
Maintenance	\$ 100,000
Cafeteria	17,600
Finishing	1,200,000
Assembly	640,000
Total	<u>\$1,957,600</u>

Maintenance costs are allocated on the basis of repair-hours. Cafeteria costs are allocated on the basis of the number of employees in each department. For the current period, the following table summarizes

the usage of services by other service cost centers and other departments:

Departments	Service Department	
	Maintenance (S1) (repair-hours)	Cafeteria (S2) (employees)
Maintenance	—0—	30
Cafeteria	3,000	—0—
Finishing (P1)	7,500	20
Assembly (P2).	<u>4,500</u>	<u>50</u>
Total	<u>15,000</u>	<u>100</u>

Using the reciprocal method for service cost allocations, what are the total costs in each of the two production departments, Finishing (P1) and Assembly (P2)?

The solution to this question is at the end of the chapter on page 436.

to the CCC example (see Exhibit 11.12), only the reciprocal method allocates costs to all departments receiving services from other departments.

The second way to compare these three methods is to examine the costs that each ultimately allocates to the production departments, Hilltop Mine and Pacific Mine (see Exhibit 11.13). Each method allocates the same total cost for CCC—\$5,800,000—but the amounts allocated to the two mines differ by as much as 10 percent. The other thing to notice

Exhibit 11.12 Comparison of Services Provided and Costs Charged Using Each Service Department Cost Allocation Method—Carlyle Coal Company

Service Department	Services Provided to	Departments Receiving Allocated Costs under the		
		Direct Method	Step Method	Reciprocal Method
Information Systems (S1)	Administration		Administration	Administration
	Hilltop Mine	Hilltop Mine	Hilltop Mine	Hilltop Mine
	Pacific Mine	Pacific Mine	Pacific Mine	Pacific Mine
Administration (S2)	Information Systems			Information Systems
	Hilltop Mine	Hilltop Mine	Hilltop Mine	Hilltop Mine
	Pacific Mine	Pacific Mine	Pacific Mine	Pacific Mine

Exhibit 11.13
Summary of Results:
Service Department Cost
Allocations—Carlyle Coal
Company

Method	Cost Allocated to		
	Hilltop Mine	Pacific Mine	Total
Direct	\$3,285,000	\$2,515,000	\$5,800,000
Step (S1 first)	3,455,000	2,345,000	5,800,000
Reciprocal	3,200,000	2,600,000	5,800,000



The allocation of service department costs in a hospital can have a major impact on revenues if rates are related to reported costs.

about the different methods summarized in Exhibit 11.13 is that the direct method results are closer to the reciprocal cost method results than they are to the results using the step method.

This example demonstrates that these methods are not ordered in any sense. That is, the step method does not necessarily result in allocations that are closer to the reciprocal method than does the direct method.

In this section we have considered three approaches to allocating service department costs. We have chosen to present all three, rather than just the reciprocal method, for two reasons. First, the direct and step methods are still in use. Second, the three methods represent an intuitive progression. It is important to remember that all three allocation methods are arbitrary in the following sense. If a production department (Hilltop Mine, for example) stops using the services of a service department (Information Systems, for example), the costs saved by the firm are unlikely to be equal to the costs allocated by any one of these methods.

The Reciprocal Method and Decision Making

In the previous sections, we allocated service department costs to determine the costs of the production departments. The primary purpose of that exercise was to obtain the manufacturing costs for each of the production departments for product costing purposes. Throughout the text, however, we have stressed the importance of developing cost information to assist managers in making decisions.

One decision that Jennifer King is considering is outsourcing some or all of the activities of the Information Services department. Using the methods of Chapter 4, the cost savings will depend on how much an outside vendor will charge and how much cost in Information Services can be eliminated, if Jennifer selects the outsourcing option.

If there are no reciprocal services among the service departments, estimating the cost savings from eliminating a particular department is reasonably straightforward. It is the cost of the service department that is avoidable. This would generally be the variable costs plus any avoidable fixed costs. Examples of fixed costs that could be avoided might include employees that could be used in other activities, leases for space, equipment costs,

L.O. 5

Use the reciprocal method for decisions.

and so on. Examples of fixed costs that would not be avoided might include allocated overhead costs, for example, corporate costs, or space costs in buildings that would not be sold or used in another capacity.

If there are reciprocal services, however, the manager has to consider the effect of eliminating one of the service departments on the service requirements of the remaining service departments. In the case where the service usage follows a step pattern we can use the step method applied to variable costs to determine the costs we will avoid. We can do so because no service department both uses services from another department and provides services to that same department.

Rather than consider all these cases, however, we will illustrate the decision process when there are reciprocal services. Even if there are not, we can still use the method below to help with the decision.

Consider the situation at CCC, where Jennifer is deciding whether to outsource Information Services. Information Services uses some of the services of Administration. If Jennifer eliminates Information Services, not only will the avoidable costs of Information Services be saved, but the resource demands, and the costs associated with these demands on Administration, will be reduced as well. Similarly, if she were to eliminate Administration, the resource demands on Information Services would be reduced.

How can these additional savings be estimated? Fortunately, the reciprocal method provides a way to do this. Because this method explicitly recognizes the use of one service department by another, it provides an estimate of the costs of Information Services when reciprocal service costs are included. We have to modify the results of the reciprocal method allocation above slightly, because if we eliminate Information Services, some of the costs of services of Administration will be lower. The savings in Administration, however, will only be the costs that vary with the output of Administration: the variable costs.

Suppose that the variable cost in Information Services (S1) is \$200,000 (out of the total of \$800,000) and the variable cost in Administration (S2) is \$3,500,000 (out of \$5,000,000). We now repeat the reciprocal cost analysis from above substituting the variable costs for the total costs:

$$\begin{array}{rclcl}
 \text{Total service} & = & \text{Direct costs of the} & + & \text{Cost allocated to the} \\
 \text{department costs} & & \text{service department} & & \text{service department} \\
 \\
 \text{S1 (Information Systems)} & = & \$ 200,000 & + & 0.20 \text{ S2} \\
 \text{S2 (Administration)} & = & \$3,500,000 & + & 0.50 \text{ S1}
 \end{array}$$

Substituting the first equation into the second yields

$$\begin{aligned}
 \text{S2} &= \$3,500,000 + 0.50 (\$200,000 + 0.20 \text{ S2}) \\
 \text{S2} &= \$3,500,000 + 100,000 + 0.10 \text{ S2} \\
 0.9 \text{ S2} &= \$3,600,000 \\
 \text{S2} &= \$4,000,000
 \end{aligned}$$

Substituting the value of S2 back into the first equation gives:

$$\begin{aligned}
 \text{S1} &= \$200,000 + 0.20 (\$4,000,000) \\
 \text{S1} &= \$1,000,000
 \end{aligned}$$

The total variable cost of Information Services, when you consider the use of Administration by Information Services, is \$1,000,000. (Recall that 50 percent of Administration is used by Information Services.)

The total cost savings that would result from eliminating Information Services are the \$1,000,000 in variable costs determined by the reciprocal method plus any of the fixed costs of \$600,000 (= \$800,000 total cost in Information Services – \$200,000 variable costs) that can be avoided.

For example, suppose that Jennifer determines that \$400,000 of the fixed costs in Information Services is avoidable. When she evaluates bids from outside vendors, she can compare the avoidable costs from eliminating Information Services, \$1,400,000 (= \$1,000,000 variable costs + \$400,000 avoidable fixed costs in Information Services) to the bid by the outside vendor.

Allocation of Joint Costs

joint cost

Cost of a manufacturing process with two or more outputs.

joint products

Outputs from a common input and common production process.

split-off point

Stage of processing that separates two or more products.

A **joint cost** is a cost of a manufacturing process with several different outputs. For example, coal of different quality can come from the same mine. The cost of mining the coal is a joint cost of these **joint products**. The problem in such cases is whether and how to allocate the joint cost of the input (for example, the cost of the mine) to the joint products (for example, hi-grade and lo-grade coal).

Joint Costing Defined

See Exhibit 11.14 for a diagram of the flow of costs incurred to mine coal for a month at CCC’s Hilltop Mine. These costs include materials, labor, and manufacturing overhead (including allocated service department overhead). As the coal is mined, two products, hi-grade and lo-grade, emerge. (We ignore any other possible products for now.) The stage of processing at which the two products are separated is called the **split-off point**. Processing costs incurred prior to the split-off point are the *joint costs*.

Managers often are interested in another issue. Should a product be sold at the split-off point or processed further? Rather than selling lo-grade coal at the split-off point, should CCC process it further to produce a higher quality of coal (mid-grade coal)? The higher-quality coal requires additional processing costs, but the sales price for mid-grade coal is higher than that for lo-grade coal sold at the split-off point.

L.O. 6

Explain why joint costs are allocated.

Reasons for Allocating Joint Costs

Joint costs are allocated for many reasons. Cost allocations are often used to determine departmental or division costs for evaluating executive performance. Many companies

Exhibit 11.14

Diagram of Joint Cost Flows—Carlyle Coal Company

