5

Cost Allocation and Activity-Based Costing Systems

LEARNING OBJECTIVES

After studying this chapter, you will be able to

1. Explain the major purposes for allocating costs.

2. Explain the relationship between activities, resources, costs, and cost drivers.

3. Use recommended guidelines to charge the variable and fixed costs of service departments to other organizational units.

4. Identify methods for allocating the central costs of an organization.

5. Use the direct, step-down, and reciprocal allocation methods to allocate service department costs to user departments.

6. Describe the general approach to allocating costs to products or services.

7. Use the physical units and relative-sales-value methods to allocate joint costs to products.

8. Use activity-based costing to allocate costs to products or services.

9. Identify the steps involved in the design and implementation of activity-based costing systems.

10. Calculate activity-based costs for cost objects.

11. Explain why activity-based costing systems are being adopted.

12. Explain how just-in-time systems can reduce non-value-added activities

A university's computer is used for teaching and for government-funded research. How much of its cost should be assigned to each task? A city creates a special police unit to investigate a series of related assaults. What is the total cost of the effort? A company uses a machine to make two different products. How much of the cost of the machine belongs to each product? These are all problems of cost allocation, the subject of this chapter. University presidents, city managers, corporate executives, and others all face problems of cost allocation.

Cost Accounting System. The techniques used to determine the cost of a product or service by collecting and classifying costs and assigning them to cost objects.

This is the first of three chapters on **cost accounting systems**—the techniques used to determine the cost of a product or service. A cost accounting system collects and classifies costs and assigns them to cost objects. The goal of a cost accounting system is to measure the cost of designing, developing, producing (or purchasing), selling, distributing, and servicing particular products or services. Cost allocation is at the heart of most cost accounting systems.

The first part of this chapter describes general approaches to cost allocation. Although we present some factors to consider in selecting cost-allocation methods, there are no easy answers. Recent attempts to improve cost-allocation methods have focused on activity-based costing, the subject of the last part of this chapter.

COST ALLOCATION IN GENERAL

As Chapter 4 pointed out, cost allocation is fundamentally a problem of linking (1) some cost or groups of costs with (2) one or more *cost objectives*, such as products, departments, and divisions. Ideally, costs should be assigned to the cost objective that *caused* it. In short, cost allocation tries to identify (1) with (2) via some function representing causation.

Cost-Allocation Base. A cost driver when it is used for allocating costs.

Linking costs with cost objectives is accomplished by selecting cost drivers. When used for allocating costs, a cost driver is often called a **cost-allocation base**. Major costs, such as newsprint for a newspaper and direct professional labour for a law firm, may each be allocated to departments, jobs, and projects on an item-by-item basis, using obvious cost drivers such as tonnes of newsprint consumed or direct-labour-hours used. Other costs, taken one at a time, are not important enough to justify being allocated individually. These costs are *pooled* and then allocated together. A **cost pool** is a group of individual costs that is allocated to *cost objectives* using a single cost driver. For example, building rent, utilities cost, and janitorial services may be in the same cost pool because all are allocated on the basis of square metres of space occupied. Or a university could pool all the operating costs of its registrar's office and allocate them to its colleges on the basis of the number of students in each faculty. In summary, all costs in a given cost pool should be caused by the same factor. That factor is the cost driver.

Cost Pool. A group of individual costs that is allocated to cost objectives using a single cost driver.

Many different terms are used by companies to describe cost allocation in practice. You may encounter terms such as *allocate, attribute, reallocate, trace, assign, distribute, redistribute, load, burden, apportion*, and *reapportion*, which can be used interchangeably to describe the allocation of costs to cost objectives.

Three Purposes of Allocation

Managers within an organizational unit should be aware of all the consequences of their decisions, even consequences outside of their unit. Examples are the addition of a new course in a university that causes additional work in the registrar's office,

OBJECTIVE 1

Explain the major purposes for allocating costs.

the addition of a new flight or an additional passenger on an airline that requires reservation and booking services, and the addition of a new specialty in a medical clinic that produces more work for the medical records department.

In each of these situations, it is important to *assign* to the organizational unit the *direct* incremental costs of the decision. Using the distinction noted in Chapter 4, managers assign direct costs without using allocated costs. The allocation of costs is necessary when the linkage between the costs and the cost objective is indirect. In this case, a basis for the allocation, such as direct-labour-hours or tonnes of raw material, is used even though its selection is arbitrary.

A cost allocation base has been described as *incorrigible*, since it is impossible to objectively determine which base perfectly describes the link between the cost and the cost objective. Given this subjectivity in the selection of a cost-allocation base, it has always been difficult for managers to determine "When should costs be allocated?" and "On what basis should costs be allocated?" The answers to these questions depend on the principal purpose or purposes of the cost allocation.

Costs are allocated for three main purposes:

1. *To obtain desired motivation*. Cost allocations are sometimes made to influence management behaviour and thus promote goal congruence and managerial effort. Consequently, in some organizations there is no cost allocation for legal or internal auditing services or internal management consulting services because top management wants to encourage their use. In other organizations there is a cost allocation for such items to spur managers to make sure the benefits of the specified services exceed the costs.
2. *To compute income and asset valuations.* Costs are allocated to products and projects to measure inventory costs and cost of goods sold. These allocations frequently service financial accounting purposes. However, the resulting costs are also often used by managers in planning, performance evaluation, and to motivate managers, as described above.
3. *To justify costs or obtain reimbursement.* Sometimes prices are based directly on costs, or it may be necessary to justify an accepted bid. For example, government contracts often specify a price that includes reimbursement for costs plus some profit margin. In these instances, cost allocations become substitutes for the usual working of the marketplace in setting prices.

The first purpose specifies planning and control uses for allocation. The second and third show how cost allocations may differ for inventory costing (and cost of goods sold) and for setting prices. Moreover, different allocations of costs to products may be made for various purposes. Thus, full costs may guide pricing decisions, manufacturing costs may be appropriate for asset valuations, and some "in-between" costs may be negotiated for a government contract.

Ideally, all three purposes would be served simultaneously by a single cost allocation. But thousands of managers and accountants will testify that for most costs, this ideal is rarely achieved. Instead, cost allocations are often a source of discontent and confusion for the affected parties. Allocating fixed costs usually causes the greatest problems. When all three purposes cannot be attained simultaneously, the manager and the accountant should start attacking a cost allocation problem by trying to identify which of the purposes should dominate in the particular situation at hand.

Often inventory-costing purposes dominate by default because they are externally imposed. When allocated costs are used in decision making and performance

evaluation, managers should consider adjusting the allocations used to satisfy inventory-costing purposes. Often the added benefit of using separate allocations for planning and control and inventory-costing purposes is much greater than the added cost.

Three Types of Allocations

As Exhibit 5-1 shows, there are three basic types of cost allocations:

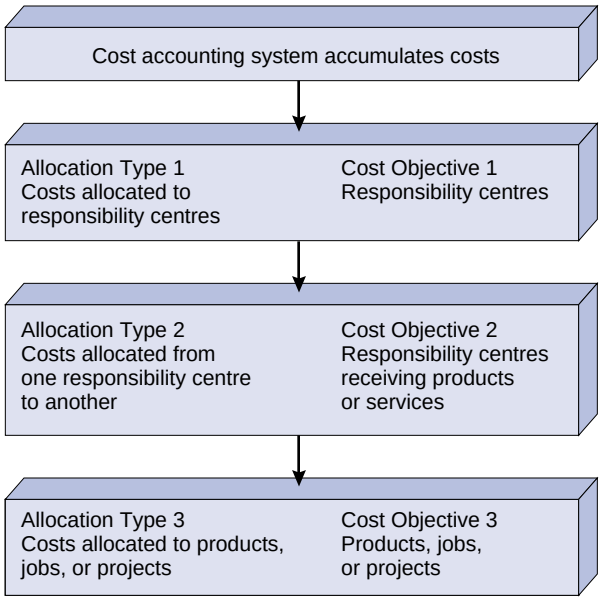
1. *Allocation of joint costs to the appropriate responsibility centres.* Costs that are used jointly by more than one unit are allocated based on cost-driver activity in the units. Examples are allocating rent to departments based on floor space occupied, allocating amortization on jointly used machinery based on machine-hours, and allocating general administrative expense based on total direct cost.
2. *Reallocation of costs from one responsibility centre to another.* When one unit provides products or services to another, the costs are transferred along with the products or services. Some units, called **service departments**, exist only to support other departments, and their costs are totally reallocated. Examples include personnel departments, laundry departments in hospitals, and legal departments in industrial firms.
3. *Allocation of costs of a particular organizational unit to its outputs of products or services.* The paediatrics department of a medical clinic allocates its costs to patient visits, the assembly department of a manufacturing firm to units assembled, and the tax department of a CA firm to clients served. The costs allocated to products or services include those allocated to the organizational unit in allocation types 1 and 2.

Service Departments. Units that exist only to serve other departments.

All three types of allocations are fundamentally similar. Let us look first at how service department costs are allocated to production departments.

EXHIBIT 5-1

Three Types of Cost Allocations



ALLOCATION OF SERVICE DEPARTMENT COSTS

OBJECTIVE 2

Explain the relationship between activities, resources, costs, and cost drivers.

What causes costs? Organizations incur costs to produce goods and services and to provide the support services required for that production. Essentially, costs are caused by the very same activities that are usually chosen as cost objectives. Examples are products produced, patients seen, personnel records processed, and legal advice given. The ultimate *effects* of these activities are various costs. It is important to understand how cost behaviour relates to activities and the consumption of resources. To perform activities, resources are required. These resources have costs. Some costs vary in direct proportion to the consumption of resources. Examples could be materials, labour, energy, and supplies. Other costs do not directly vary (in the short run) with resource usage. Examples of their indirect costs could be amortization, supervisory salaries, and rent. So we say that activities consume resources and the costs of these resources follow various behavioural patterns. Therefore, the manager and the accountant should search for some cost driver that establishes a convincing relationship between the cause (activity being performed) and the effect (consumption of resources and related costs) and that permits *reliable predictions* of how costs will be affected by decisions regarding the activities.

To illustrate this important principle, we will consider allocation of service department costs. Service departments typically provide a service to a broad range of functions and products within an organization, and thus the allocation of costs becomes more difficult. The preferred guidelines for allocating service department costs are:

1. *Evaluate performance using budgets* for each service (staff) department, just as is done for each production or operating (line) department. The performance of a service department is evaluated by comparing actual costs with a budget, regardless of how the costs are later allocated. From the budget, variable-cost pools and fixed-cost pools can be identified.
2. *Charge variable-and fixed-cost pools separately* (sometimes called the dual method of allocation). Note that one service department (such as a computer department) can contain multiple cost pools if more than one cost driver causes the department's costs. At a minimum, there should be a variable-cost pool and a fixed-cost pool.
3. *Establish part of all of the details regarding cost allocation in advance* of rendering the service, rather than after the fact. This approach establishes the "rules of the game" so that all departments can plan appropriately.

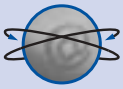
Consider a simplified example of a computer department of a university that serves two major users: the School of Business and the School of Engineering. The computer mainframe was acquired on a five-year lease that is not cancellable unless prohibitive cost penalties are paid.

How should costs be charged to the user departments? Suppose there are two major purposes for the information: (1) predicting economic effects of the use of the computer and (2) motivating departments and individuals to use its capabilities more fully.

To apply the first of the above guidelines, we need to analyze the costs of the computer department in detail. The primary activity performed is computer processing. Resources consumed include processing time, operator time, consulting time, energy, materials, and building space. Suppose cost behaviour analysis has been performed and the budget formula for the forthcoming fiscal year is $100,000 monthly fixed costs plus $200 variable cost per hour of computer time used. We will apply guidelines two and three in the next two sections.

COMPANY STRATEGIES

COST ALLOCATIONS AT BOREAL LABORATORIES LTD.



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Boreal is Canada's largest supplier of science supplies and apparatus to Canadian schools. The product line is diverse and thus product costing is complex.

A recent project included revisiting our inventory costing. In order to determine the inventory cost, many allocations have had to be made.

A combination of all the costing techniques listed in Chapter 13 have been used since there are several different production departments and the production activities vary for each commodity.

In making allocations, three guidelines should be kept in mind.

1. The allocation must be fair.
2. The allocation must be rational and verifiable.
3. The impact on the people who use or work with this information must be known.

These guidelines provide a useful reference since there may be ramifications beyond just the immediate task or project, for which the initially intended allocation calculation was made.

Recently, the Inventory Costing System was revised to reflect current input costs and to reflect the change in operating costs and procedures as a result of moving to a new facility. When this inventory information was updated, the above three guidelines were considered when it came time to make allocations of costs.

This proved to be very beneficial since there have been many other applications of these calculations than those originally made for inventory purposes. Some of the additional uses of this information have been:

- Used to re-calculate selling prices in our catalogue to reflect the fact that our costs have changed.
- Used to calculate a selling price on several special orders that involve different quantities and mixture of products.
- Assisted in determining if Boreal would continue to produce a product in-house or to buy elsewhere.
- Useful for accounting taxation purposes.
- A useful calculation in determining a profit-share amount since each department manager's work is based upon performance.

Based upon the number and varying uses of an allocation, we can see how important allocations are in business. Furthermore, we should be aware that allocations may be used for more than one intended use.

Source: Written by John Richardson, Controller, Boreal Laboratories Ltd.

Variable-Cost Pool

OBJECTIVE 3

Use recommended guidelines to charge the variable and fixed costs of service departments to other organizational units.

The cost driver for the variable-cost pool is *hours of computer time used*. Therefore, variable costs should be assigned as follows:

budgeted unit rate × actual hours of computer time used

The cause-and-effect relationship is direct and clear: the heavier the usage, the higher the total costs. In this example, the rate used would be the budgeted rate of $200 per hour.

The use of *budgeted* cost rates rather than *actual* cost rates for allocating variable costs of service departments protects the using departments from intervening price fluctuations and also often protects them from inefficiencies in the service departments. When an organization allocates *actual* total service department cost, it holds user-department managers responsible for costs beyond their control and provides less incentive for service departments to be efficient. Both effects are undesirable.

Consider the charging of *variable* costs to a department that uses 600 hours of computer time. Suppose inefficiencies in the computer department caused the variable costs to be $140,000 instead of the 600 hours times $200, or $120,000 budgeted. A good cost-accounting scheme would charge only the $120,000 to the consuming departments and would let the $20,000 remain as an unfavourable budget variance of the computer department. This scheme holds computer department managers responsible for the $20,000 variance and reduces the resentment of user managers. User-department managers sometimes complain more vigorously about uncertainty over allocations and the poor management of a service department than about the choice of a cost driver (such as direct-labour dollars or number of employees). Such complaints are less likely if the service department managers have budget responsibility and the user departments are protected from short-run price fluctuations and inefficiencies.

Most consumers prefer to know the total price in advance. They become nervous when an automobile mechanic or contractor undertakes a job without specifying prices. As a minimum, they like to know the hourly rates that they must bear. Therefore, predetermined unit prices (at least) should be used. Where feasible, predetermined total prices should be used for various kinds of work based on budgets and standards.

To illustrate, consider an automobile repair and maintenance department for a provincial government. Agencies who use the department's service should receive firm prices for various services. Imagine the reaction of an agency manager who had an agency automobile repaired and was told, "Normally your repair would have taken five hours, but we had a new employee work on it, and the job took ten hours. Therefore, we must charge you for ten hours of labour time."

Fixed-Cost Pool

The cost driver for the fixed-cost pool is the amount of capacity required when the computer facilities were acquired. Therefore, fixed costs could be allocated as follows:

budgeted fraction of capacity available for use × total budgeted fixed costs

Consider again our example of the university computer department. Suppose the dean had originally predicted the following long-run average monthly usage: Business, 210 hours, and Engineering, 490 hours, for a total of 700 hours. The fixed-cost pool would be allocated as follows:

	BUSINESS	ENGINEERING
Fixed costs per month:		
210/700, or 30% of $100,000	$30,000	
490/700, or 70% of $100,000		$70,000

This predetermined lump-sum approach is based on the long-run capacity *available* to the user, regardless of actual usage from month to month. The reasoning is that the level of fixed costs is affected by long-range planning regarding the overall level of service and the *relative expected* usage, not by *short-run* fluctuations in service levels and relative *actual* usage.

A major strength of using capacity *available* rather than capacity used when allocating *budgeted* fixed costs is that short-run allocations to user departments

are not affected by the *actual* user departments. Such a budgeted lump-sum approach is more likely to have the desired motivational effects with respect to the ordering of services in both the short run and the long run.

In practice, fixed-cost pools are often inappropriately allocated on the basis of capacity used, not capacity available. Suppose the computer department allocated the total actual costs after the fact. At the end of the month, total *actual* would be allocated in proportion to the *actual* hours used by the consuming departments. Compare the costs borne by the two schools when Business uses 200 hours and Engineering 400 hours:

Total costs incurred, $100,000 + 600($200) = $220,000	
Business: 200/600 x $220,000 =	$ 73,333
Engineering: 400/600 x $220,000 =	146,667
Total cost allocated	$220,000

What happens if Business uses only 100 hours during the following month while Engineering still uses 400 hours?

Total costs incurred, $100,000 + 500(200) = $200,000	
Business: 100/500 x $200,000 =	$ 40,000
Engineering: 400/500 x $200,000 =	160,000
Total cost allocated	$200,000

Engineering has done nothing differently, but it must bear higher costs of $13,333, an increase of 9 percent. Its short-run costs depend on what *other* consumers have used, not solely on its own actions. This phenomenon is caused by a faulty allocation method for the *fixed* portion of the total costs, a method whereby the allocations are highly sensitive to fluctuations in the actual volumes used by the various consuming departments. This weakness is avoided by using a predetermined lump-sum allocation of fixed costs, based on budgeted usage.

Consider the automobile repair shop example introduced above. You would not be happy if you came to get your car and were told, "Our daily fixed overhead is $1,000. Yours was the only car in our shop today, so we are charging you the full $1,000. If we had processed 100 cars today, your charge would have been only $10."

Troubles with Using Lump Sums

There are problems with using lump-sum allocations. If fixed costs are allocated on the basis of long-range plans, there is a natural tendency on the part of consumers to underestimate their planned usage and thus obtain a smaller fraction of the cost allocation. Top management can counteract these tendencies by monitoring predictions and by following up and using feedback to keep future predictions more honest.

In some organizations there are even rewards in the form of salary increases for managers who make accurate predictions. Moreover, some cost-allocation methods provide for penalties for underpredictions. For example, suppose a manager predicts usage of 210 hours and then demands 300 hours. The manager either doesn't get the hours or pays a price for every hour beyond 210.

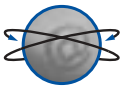
Allocating Central Costs

OBJECTIVE 4

Identify methods for allocating the central costs of an organization.

The need to allocate central costs is a manifestation of a widespread, deep-seated belief that all costs must somehow be fully allocated to the revenue-producing (operating) parts of the organization. Such allocations are neither necessary from an accounting viewpoint nor useful as management information. However, most managers accept them as a fact of life—as long as all managers are treated alike.

Whenever possible, the preferred cost driver for central services is usage, either actual or estimated. But the costs of such services as public relations, top corporate-management overhead, real estate departments, and corporate-planning departments are the least likely to be allocated on the basis of usage. Data processing, advertising, and operations research are the most likely to choose usage as a cost driver.



J.C. Penney
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***Business Week* Online**
www.businessweek.com

Companies that allocate central costs by usage tend to generate less resentment. Consider the experience of J.C. Penney Co. as reported in *Business Week*:

> The controller's office wanted subsidiaries such as Thrift Drug Co. and the insurance operations to base their share of corporate personnel, legal, and auditing costs on their revenues. The subsidiaries contended that they maintained their own personnel and legal departments, and should be assessed far less.
>
> The subcommittee addressed the issue by asking the corporate departments to approximate the time and costs involved in servicing the subsidiaries. The final allocation plan, based on these studies, cost the divisions less than they were initially assessed but more than they had wanted to pay. Nonetheless, the plan was implemented easily.

Usage is not always an economically viable way to allocate central costs, however. Also, many central costs, such as the president's salary and related expenses, public relations, legal services, income tax planning, company-wide advertising, and basic research, are difficult to allocate on the basis of cause and effect. As a result, some companies use cost drivers such as the revenue of each division, the cost of goods sold by each division, the total assets of each division, or the total costs of each division (before allocation of the central costs) to allocate central costs.

The use of the foregoing cost drivers might provide a *rough* indication of cause-and-effect relationship. Basically, however, they represent an "ability to bear" philosophy of cost allocation. For example, the costs of company-wide advertising, such as the goodwill sponsorship of a program on a non-commercial television station, might be allocated to all products and divisions on the basis of the dollar sales in each. But such costs precede sales. They are discretionary costs as determined by management policies, not by sales results. Although 60 percent of the companies in a large survey treat sales revenue as a cost driver for cost allocation purposes, it is not truly a cost driver in the sense of being an activity that *causes* the costs.

If the costs of central services are to be allocated based on sales even though the costs do not vary in proportion to sales, the use of *budgeted* sales is preferable to the use of *actual* sales. At least this method means that the short-run costs of a given consuming department will not be affected by the fortunes of other consuming departments.

For example, suppose $100 of fixed central advertising costs were allocated on the basis of potential sales in two territories:

	TERRITORIES			
	A	B	TOTAL	PERCENT
Budgeted sales	$500	$500	$1,000	100%
Central advertising allocated	$ 50	$ 50	$ 100	10%

Consider the possible differences in allocations when actual sales become known:

	TERRITORIES	
	A	B
Actual Sales	$300	$600
Central advertising:		
1. Allocated on basis of budgeted sales	$ 50	$ 50
or		
2. Allocated on basis of actual sales	$ 33	$ 67

Compare allocation 1 with 2. Allocation 1 is preferable. It indicates a low ratio of sales to advertising in territory A. It directs attention where it is deserved. In contrast, allocation 2 soaks territory B with more advertising cost because of the *achieved* results and relieves territory A despite its lower success. This is another example of the analytical confusion that can arise when cost allocations to one consuming department depend on the activity of other consuming departments.

Reciprocal Services

Service departments often support other service departments as well as supporting producing departments. Consider a manufacturing company with two producing departments—moulding and finishing—and two service departments, facilities management (rent, heat, light, janitorial services, etc.) and personnel. All costs in a given service department are assumed to be caused by, and therefore vary in proportion to, a single cost driver. The company has decided that the best cost driver for facilities management costs is square metres occupied and the best cost drivers for personnel is the number of employees. Exhibit 5-2 shows the direct costs, square metres occupied, and number of employees for each department. Note that facilities management provides services for the personnel department in addition to providing services for the producing departments, and that personnel aids employees in facilities management as well as those in production departments.

EXHIBIT 5-2

Cost Drivers

	SERVICE DEPARTMENTS		PRODUCTION DEPARTMENTS	
	FACILITIES MANAGEMENT	PERSONNEL	MOULDING	FINISHING
Direct department costs	$126,000	$24,000	$100,000	$160,000
Square metres	3,000	9,000	15,000	3,000
Number of employees	20	30	80	320
Direct labour hours			2,100	10,000
Machine-hours			30,000	5,400

OBJECTIVE 5

Use the direct, step-down, and reciprocal allocation methods to allocate service department costs to user departments.

There are three popular methods for allocating service department costs in such cases: the direct method, the step-down method, and the reciprocal allocation method.

Direct Method

Direct Method. Ignores other service departments when any given service department's costs are allocated to the revenue-producing departments.

As its name implies, the **direct method** ignores other service departments when any given service department's costs are allocated to the revenue-producing (operating) departments. In other words, the fact that facilities management provides services for personnel is ignored, as is the support that personnel provides to facilities management. Facilities management costs are allocated based on the relative square metres *occupied by the production departments only*:

- Total square metres in production departments: 15,000 + 3,000 = 18,000
- Facilities management cost allocated to moulding = (15,000 ÷ 18,000) × $126,000 = $105,000
- Facilities management cost allocated to finishing = (3,000 ÷ 18,000) × $126,000 = $21,000

Likewise, personnel department costs are allocated *only to the production departments* on the basis of the relative number of employees in the production departments:

- Total employees in production departments = 80 + 320 = 400
- Personnel costs allocated to moulding = (80 ÷ 400) × $24,000 = $4,800
- Personnel costs allocated to finishing = (320 ÷ 400) × $24,000 = $19,200

Step-Down Method

Step-Down Method. Recognizes that some service depçer service departments as well as those in production departments.

The **step-down method** recognizes that some service departments support the activities in other service departments as well as those in production departments. A sequence of allocations is chosen, usually by starting with the service department that renders the greatest service (as measured by costs) to the greatest number of other service departments. The last service department in the sequence is the one that renders the least service to the least number of other service departments. Once a department's costs are allocated to other departments, no subsequent service department costs are allocated back to it.

In our example, facilities management costs are allocated first. Why? Because facilities management renders more support to personnel than personnel provides for facilities management.[1] Examine Exhibit 5-3. After facilities management costs are allocated, no costs are allocated back to facilities management, even though personnel does provide some services for facilities management. The personnel costs to be allocated to the production departments include the amount allocated to personnel from facilities management ($42,000) in addition to the direct personnel department costs of $24,000.

[1] How should we determine which of the two service departments provides the most service to the other? One way is to carry out step one of the step-down method with facilities management allocated first, and then repeat it assuming personnel is allocated first. With facilities management allocated first, $42,000 is allocated to personnel, as shown in Exhibit 5-3. If personnel had been allocated first, (20/420) × $24,000 = $1,143 would have been allocated to facilities management. Because $1,143 is smaller than $42,000, facilities management is allocated first.

EXHIBIT 5-3

Step-Down Allocation

	FACILITIES MANAGEMENT	PERSONNEL	MOULDING	FINISHING	TOTAL
Direct department costs before allocation	$126,000	$24,000	$100,000	$160,000	$410,000
Step 1:					
Facilities management	$(126,000)	(9 ÷ 27) x $126,000 = $42,000	(15 ÷ 27) x $126,000 = $70,000	(3 ÷ 27) x $126,000 = $14,000	0
Step 2:					
Personnel		$(66,000)	(80 ÷ 400) x $66,000 = $13,200	(320 ÷ 400) x $66,000 = $52,800	0
Total cost after allocation	$ 0	$ 0	$183,200	$226,800	$410,000

EXHIBIT 5-4

Reciprocal Allocation Method

	FACILITIES MANAGEMENT	PERSONNEL	MOULDING	FINISHING	TOTAL
Direct department costs before allocation	$126,000	$24,000	$100,000	$160,000	$410,000
Allocation of facilities management	$(129,220)	(9 ÷ 27) x $129,220 = $43,073	(15 ÷ 27) x $129,220 = $71,789	(3 ÷ 27) x $129,220 = $14,358	0
Allocation of personnel	(20 ÷ 420) x $67,030 = $3,192	$(67,030)	(80 ÷ 450) x $67,030 = $12,768	(320 ÷ 450) x $67,030 = $51,070	0
Total cost after allocation	$(28)*	$ 43*	$184,557	$225,428	$410,000

* due rounding

EXHIBIT 5-5

Direct versus Step-Down Method

	MOULDING			FINISHING		
	DIRECT	STEP-DOWN	RECIPROCAL	DIRECT	STEP-DOWN	RECIPROCAL
Direct department costs	$100,000	$100,000	$100,000	$160,000	$160,000	$160,000
Allocated from facilities management	105,000	70,000	71,789	21,000	14,000	14,358
Allocated from personnel	4,800	13,200	12,768	19,200	52,800	51,070
Total costs	$209,800	$183,200	$184,557	$200,200	$226,800	$225,428

Examine the last column of Exhibit 5-3. Before allocation, the four departments incurred costs of $410,000. In step 1, $126,000 was deducted from facilities management and added to the other three departments. There was no net effect on the total cost. In step 2, $66,000 was deducted from personnel and added to the remaining two departments. Again, total cost was unaffected. After allocation, all $410,000 remains, but it is all in moulding and finishing. None was left in facilities management or personnel.

Reciprocal Allocation Method

Reciprocal Allocation Method. Allocates costs by recognizing that the service departments provide services to each other as well as to the production departments.

The **reciprocal allocation method** allocates costs by recognizing that the service departments provide services to each other as well as to the production departments. This method is generally viewed as being the most theoretically correct as it enables us to cost the interdepartmental relationships fully into the service department cost allocations. In our example, the facilities management cost is allocated to the personnel department and the personnel cost is allocated to the facilities management department before the costs of the service departments are allocated to the production departments.

First, we must allocate the costs of the services provided between the two service departments. We do this using the following two equations in which the facilities management costs are defined as FM and the personnel costs as P.

FM = $126,000 + 20/420 P = $126,000 + .048 P

P = $24,000 + 9/27 FM = $24,000 + .333 FM

Then we solve the two simultaneous equations to determine the total amount of costs for each service department.

FM = $126,000 + (.048 [$24,000 + .333 FM])

FM = $126,000 + $1,152 + .016 FM

.984 FM = $127,152

FM = $129,220

P = $24,000 + .333 ($129,220)

P = $24,000 + $43,030

P = $67,030

Thus, the total costs to be allocated for facilities management is $129,220 and for personnel is $67,030. Exhibit 5-4 provides the details of the allocations of the costs for these two service departments to the two production department. Note that the total of the costs allocated is still $410,000 (after minor adjustments due to rounding errors).

Compare the costs of the production departments under direct, step-down and reciprocal allocation methods as shown in Exhibit 5-5.

Note that the method of allocation can greatly affect the costs. Moulding appears to be a much more expensive operation to a manager using the direct method than to one using the step-down or reciprocal allocation method. Conversely, finishing seems more expensive to a manager using the non-direct method.

Which method is better? It is sometimes difficult to say. An advantage of the step-down method is that it recognizes the effects of the most significant support provided by service departments to other service departments. In our example, the direct method does not make any assumptions about the following possible cause-effect link: if the cost of facilities management is caused by the space used, then the space used by personnel causes $42,000 of facilities management costs. If the space used in personnel is caused by the number of production-department employees supported, then the number of production-department employees, not the square metres, causes $42,000 of the facilities management cost. The producing department with the most employees, not the one with the most square metres, should bear this cost.

The greatest virtue of the direct method is its simplicity. If the three methods do not produce significantly different results, many companies opt for the direct method because it is easier for managers to understand.

ALLOCATING COSTS TO OUTPUTS

Cost Application. The allocation of total departmental costs to the revenue-producing products or services.

Up to this point, we have concentrated on cost allocation to divisions, departments, and similar segments of a company. Cost allocation is often carried one step further—to the outputs of these departments, however defined. Examples are *products*, such as automobiles, furniture, and newspapers, and *services*, such as banking, health care, and education. Sometimes the allocation of total departmental costs to the revenue-producing products or services is called **cost application** or *cost attribution*.

General Approach

OBJECTIVE 6

Describe the general approach to allocating costs to products or services.

The general approach to allocating costs to final products or services is as follows:

1. Allocate production-related costs to the operating (line), production, or revenue-producing departments. This includes allocating service department costs to the production departments following the guidelines listed on page 182. The production departments then contain all the costs: their direct department costs and the service department costs.
2. Select one or more cost drivers in each production department. Historically, most companies have used only one cost driver per department. Recently, a large number of companies have started using multiple costs pools and multiple cost drivers within a department. For example, a portion of the departmental costs may be allocated on the basis of direct-labour hours, another portion on the basis of machine hours, and the remainder on the basis of the number of machine setups.
3. Allocate (assign) the total costs accumulated in step 1 to products or services that are the outputs of the operating departments using the cost drivers specified in step 2. If only one cost driver is used, two cost pools should be maintained, one for variable costs and one for fixed costs. Variable costs should be assigned on the basis of actual cost driver activity. Fixed costs should either remain unallocated or be allocated on the basis of budgeted cost driver activity.

Consider our manufacturing example, and assume that the step-down method was used to allocate service department costs. Exhibit 5-3 shows total costs of $183,200 accumulated in moulding and $226,800 in finishing. Note that all $410,000 total manufacturing costs reside in the production departments. To allocate these costs to the products produced, cost drivers must be selected for each department. We will use a single cost driver for each department and assume that all costs are caused by that cost driver. Suppose machine hours is the best measure of what causes costs in the moulding department, and direct-labour hours measures causation in finishing. Exhibit 5-2 showed 30,000 total machine-hours used in moulding and 10,000 direct labour hours in finishing. Therefore, costs are allocated to products as follows:

Moulding: $183,200 ÷ 30,000 machine-hours = $6.11 per machine-hour
Finishing: $226,800 ÷ 10,000 direct labour hours = $22.68 per direct labour hours

A product that takes four machine-hours in moulding and two direct labour hours in finishing would have a cost of

$$(4 \times \$6.11) + (2 \times \$22.68) = \$24.44 + \$45.36 = \$69.80$$

PERSPECTIVES ON PODM DECISION-MAKING

Phone Carriers Battle Over Accounting Methods

Bell Canada
www.bell.ca

Unitel
www.unitelcom.com

Canadian Radio-television and Telecommunications Commission
www.crtc.gc.ca

The battle between **Bell Canada** and long-distance rival **Unitel Communications Inc.** moved into the accounting field yesterday on the issue of how monthly phone rates break down.

The Canadian Radio-television and Telecommunications Commission will hold hearings in May on the so-called "split rate base" — the separation of a phone company's costs for long-distance competitive services from local monopoly services.

Competitors charge that Bell and others misallocate costs of providing competitive services to the monopoly costs. That allows for lower long-distance rates and hurts rival companies that have to beat those prices, driving up the subsidy competitors pay to the local business.

Both sides will be offering their versions of "benchmarks" — the per-minute cost comparisons between Canadian and U.S. carriers. Unitel has charged that the Canadian carriers' costs are 40 percent to 50 percent lower than U.S. counterparts in the most competitive market in the world.

Bell said Andersen Consulting Canada undertook a cost comparison study on behalf of provincial telephone companies.

It found Bell's costs were 2.8¢ lower per minute than U.S. giant AT&T. The difference was attributed to AT&T's higher marketing and customer service costs, and higher corporate operations.

Unitel said that using CRTC Phase III accounting methods, long-distance costs for U.S. carriers are 12.3¢ per minute, while costs for Canadian carriers average about 8.1¢ — a 52 percent difference.

One of the problems is that telephone companies often make use of the same personnel and equipment for both local and long-distance business. Unitel cites customer billing as an example of when both monopoly and competitive services are charged on the same bill, jointly incurring the costs.

Source: Joanne Chianello, "Phone carriers battle over accounting methods," *The Financial Post*, (February 1, 1995), p. 7.

ALLOCATING JOINT COSTS AND BY-PRODUCT COSTS

OBJECTIVE 7

Use the physical units and relative-sales-value methods to allocate joint costs to products.

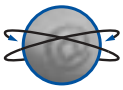
Joint costs and by-product costs create especially difficult cost allocation problems. By definition, such costs relate to more than one product but cannot be separately identified with an individual product.

Joint Costs

Joint Costs. Costs of inputs added to a process before individual products are separated.

So far we have assumed that cost drivers could be identified with an individual product. For example, if costs are being allocated to products or services on the basis of machine hours, we have assumed that each machine hour is used on a single final product or service. However, sometimes inputs are added to the production process before individual products are separately identifiable (that is, before the *split-off point*). Such costs are called **joint costs**. Joint costs include all inputs of material, labour, and overhead costs that are incurred before the split-off point.

Suppose a department has more than one product and some costs are joint costs. How should such joint costs be allocated to the products? Allocation of joint costs should not affect decisions about the individual products. Nevertheless, joint product costs are routinely allocated to products for purposes of *inventory valuation* and *income determination*.



Dow Chemical
www.dow.com

Assume a department in Dow Chemical Company produces two chemicals, X and Y. The joint cost is $100,000, and production is 1,000,000 litres of X and 500,000 litres of Y. Product X can be sold for $.09 per litre and Y for $.06 per litre. Ordinarily, some part of the $100,000 joint cost will be allocated to the inventory of X and the rest to the inventory of Y. Such allocations are useful for inventory purposes only. Joint cost allocations should be ignored for decisions such as selling a joint product or processing it further.

Two conventional ways of allocating joint costs to products are widely used: *physical units* and *relative sales values*. If physical units were used, the joint costs would be allocated as follows:

	LITRES	WEIGHTING	ALLOCATION OF JOINT COSTS	SALES VALUE AT SPLIT-OFF
X	1,000,000	10/15 x $100,000	$ 66,667	$ 90,000
Y	500,000	5/15 x $100,000	33,333	30,000
	1,500,000		$100,000	$120,000

This approach shows that the $33,333 joint cost of producing Y exceeds its $30,000 sales value at split-off, which seems to indicate that Y should not be produced. However, such an allocation is not helpful in making production decisions. Neither of the two products could be produced separately.

A decision to produce Y must be a decision to produce X *and* Y. Because total revenue of $120,000 exceeds the total joint cost of $100,000, both will be produced. The allocation was not useful for this decision.

The physical units method requires a common physical unit for measuring the output of each product. For example, board feet is a common unit for a

variety of products in the lumber industry. However, sometimes such a common denominator is lacking. Consider the production of meat and hides from butchering a steer. You might use kilograms as a common denominator, but kilograms is not a good measure of the output of hides. As an alternative, many companies use the r*elative sales value method* for allocating joint costs. The following allocation results from applying the relative sales value method to the Dow Chemical department:

	RELATIVE SALES VALUE AT SPLIT-OFF	WEIGHTING	ALLOCATION OF JOINT COSTS
X	$ 90,000	90/120 x $100,000	$ 75,000
Y	30,000	30/120 x $100,000	25,000
	$120,000		$100,000

The weighting is based on the sales values of the individual products. Because the sales value of X at split-off is $90,000 and total sales value at split-off is $120,000, X is allocated 90/120 of the joint cost.

Now each product would be assigned a joint cost portion that is less than its sales value at split-off. Note how the allocation of a cost to a particular product such as Y depends not only on the sales value of Y but also on the sales value of X. For example, suppose you were the product manager for Y. You planned to sell your 500,000 litres for $30,000, achieving a profit of $30,000 – $25,000 = $5,000. Everything went as expected except that the price of X fell to $.07 per litre for revenue of $70,000 rather than $90,000. Instead of 30/120 of the joint cost, Y received 30/100 × $100,000 = $30,000 and had a profit of $0. Despite the fact that Y operations were exactly as planned, the cost-allocation method caused the profit on Y to be $5,000 below plan.

The relative sales value method can also be used when one or more of the joint products cannot be sold at the split-off point. To apply the method, we approximate the sales value at split-off as follows:

sales value at split-off = final sales value – separate costs

For example, suppose the 500,000 litres of Y requires $20,000 of processing beyond the split-off point, after which it can be sold for $.10 per litre. The sales value at split-off would be $.10 × 500,000 – $20,000 = $50,000 – $20,000 = $30,000.

By-Product Costs

By-Product. A product that, like a joint product, is not individually identifiable until manufacturing reaches a split-off point, but has relatively insignificant total sales value.

By-products are similar to joint products. A **by-product** is a product that, like a joint product, is not individually identifiable until manufacturing reaches a split-off point. By-products differ from joint products because they have relatively insignificant total sales value in comparison with the other products emerging at split-off. Joint products have relatively significant total sales values at split-off in comparison with the other jointly produced items. Examples of by-products are glycerine from soap-making and mill ends of cloth and carpets.

If an item is accounted for as a by-product, only separable costs are assigned to it. All joint costs are allocated to main products. Any revenues from by-products, less their separable costs, are deducted from the cost of the main products.

Consider a lumber company that sells sawdust generated in the production of lumber to companies making particle board. Suppose the company regards the sawdust as a by-product. In 2001, sales of sawdust totalled $30,000, and the cost of loading and shipping the sawdust (that is, costs incurred beyond the split-off point) was $20,000. The inventory cost of the sawdust would consist of only the $20,000 separable cost. None of the joint cost of producing lumber and sawdust would be allocated to the sawdust. The difference between the revenue and separable cost, $30,000 – $20,000 = $10,000, would be deducted from the cost of the lumber produced.

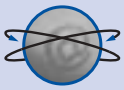
ACTIVITY-BASED COSTING (ABC)

OBJECTIVE 8

Use activity-based costing to allocate costs to products or services.

In the past, the vast majority of departments used direct labour hours as the only cost driver for applying costs to products. But direct labour hours is not a very good measure of the cause of costs in modern, highly automated departments. Labour-related costs in an automated system may be only 5 percent to 10 percent of the total manufacturing costs and often are not related to the causes of most manufacturing overhead costs. Therefore, many companies are beginning to use machine-hours as their cost-allocation base. However, some managers in modern manufacturing firms and automated service companies believe it is inappropriate to allocate all costs based on measures of volume. Using direct labour hours or cost—or even machine hours—as the only cost driver seldom meets the cause/effect criterion desired in cost allocation. If many costs are caused by non-volume-based cost drivers, **Activity-Based Costing (ABC)** should be considered.

COMPANY STRATEGIES



J.M. Schneider
www.jmschneider.com

ACTIVITY-BASED COSTING AT J. M. SCHNEIDER INC.

Schneider Corporation is one of Canada's largest producers of premium-quality food products. The company's mission statement, which provides a common focus to all activities within the corporation, is:

To generate profitable growth by providing high-quality food products of superior value in specific market segments while maintaining our status as a financially secure, well-managed, ethical company.

The majority of the Corporation's meat processing is done through its subsidiary, J. M. Schneider Inc.

In the late 1980s the Canadian meat-packing industry, in which the company's core business operated, was in critical condition. Red meat consumption levels were declining at an alarming rate, as consumers adopted changing lifestyles and eating habits. Meat producers and food retailers rationalized into a handful of participants engaged in intense price competition. This development resulted in a sharp decline in profitability for Schneider.

In the absence of significant market growth opportunities, Schneider launched an initiative to internally generate efficiencies and cost reductions in order to improve profit margins. The vehicle chosen to drive these improvements was the implementation of a broadly based continuous improvement program.[2]

This program, in order to be successful, required the support of a more up-to-date and relevant cost system. Up until this time, Schneider had used a standard cost system to meet the requirements of measuring the success of its labour and materials yield productivity program. This program measured productivity gains by comparing actual results to costs in the standard cost system.[3]

Continued

There were a number of shortcomings with the company's conventional standard cost system, however:

1. The focus was on minimizing costs within each department. Consequently, actions would be taken in one department that would reduce their costs, but would create additional costs in downstream departments.
2. Targets were limited to material yield and direct labour productivity. Opportunities to better control and manage a number of other manufacturing costs and overheads were not measured.
3. Comparisons were made to standards that incorporated allowances for waste and non-value-added activity. Although meeting the standard costs satisfied management, it resulted in "satisfactory" costs rather than "minimum" costs.

Schneider realized that the primary emphasis of its cost system should be to provide relevant and reliable information for management decision making rather than focusing only on financial reporting requirements.

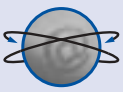
Under continuous improvement, the focus on minimizing costs broadened from control of yields and direct labour productivity to better understanding and managing the entire business cycle. Continuous improvement initiatives were launched to address just-in-time, productive maintenance, total quality control, quick changeover techniques, cycle time, identification and elimination of non-value-added activities. The standard cost system was unable to accurately measure and report the true costs of these activities, and was in need of an overhaul.

In order to better measure and, in turn, understand production cost behaviour, Schneider decided to implement Activity-Based Costing (ABC). ABC systems are designed on the premise that products require "activities" and that these activities, in turn, consume "resources," i.e., incur costs. Non-value- added activities and waste are more clearly highlighted and therefore better managed. Non-financial measures have also been recognized as key yardsticks in measuring operational performance (i.e., tonnage throughput, machine downtime hours, process cycle time, etc.).

The information generated by this updated management accounting system will be supportive of the firm's continuous improvement and cost reduction programs, providing relevant and reliable decision-making information.

[2] Dodds, Douglas W., "MAKING IT BETTER....and better," *CMA MAGAZINE*, February 1992, pp. 16–21.
[3] For a more complete discussion of the standard cost system, see Armitage, H.M., and A. A. Atkinson, "The Choice of Productivity Measures in Organizations: A Field Study of Practice in Seven Canadian Firms." Society of Management Accountants of Canada, Hamilton, Ontario, 1990.

Source: Written by John Carney, Manager Accounting Services and Larry Wozniak, Senior Cost Analyst, J. M. Schneider Inc.



CMA Magazine
www.cma-canada.org

Activity-Based Costing

Activity-Based Costing (ABC). A system that first accumulates overhead costs for each of the activities of an organization, and then assigns the costs of activities to the products, services, or other cost objects that caused that activity.

Activity-based costing (ABC) systems first accumulate overhead costs for each of the activities of an organization, and then assign the costs of activities to the products, services, or other cost objects that caused that activity. To establish a cause-effect relationship between an activity and a cost object, cost drivers are identified for each activity. Consider the following activities and *cost drivers* for the Belmont manufacturing plant department of a major appliance producer:

ACTIVITY	COST DRIVER
Production set-up	Number of production runs
Production control	Number of production process changes
Engineering	Number of engineering change orders
Maintenance	Number of machine hours
Power	Number of kilowatt hours

Outsourcing

Most organizations are now realizing that to succeed they must focus on a few core competencies, things they uniquely do very well. For example, Compaq defines itself as a "platform integrator" developing and marketing products whose components are largely manufactured by others. Such organizations realize that they should not seek to do activities for which they do not have competitive advantage.

Traditionally, outsourcing started with narrow, low-risk activities such as payroll processing, data centre management, and catering. Now much more strategic activities are starting to be outsourced, including financial management, human resource management, supply chain management and even customer management processes. Also, the scope of the outsourcing relationships is much broader; for example, outsourcing of accounting used to consist primarily of accounts receivable collection and payroll. Now, organizations are outsourcing their entire financial transaction processing, recognizing that their own competencies are in the use of financial information, not its creation.

An important change in the outsourcing environment is the rapid emergence of e-business, which is making it far more possible, and necessary, for organizations to implement new business models, with extensive outsourcing of processes to third parties. Organizations such as Cisco have demonstrated that they can dominate the value chain while outsourcing many processes, including manufacturing, to other organizations.

Future outlook

The outsourcing market will change quite dramatically over the next few years towards a new relationship characterized by the following factors:

- a broadening of the scope of outsourcing relationships;
- significant investment by the service provider, particularly in information technology infrastructure to support service delivery;
- use of e-business to implement new and highly innovative outsourcing relationships; and
- sharing of risks and rewards associated with the outsourcing.

The outsourcing market move towards highly strategic partnering arrangements addresses such broad processes as: financial transaction processing; human resource administration; supply chain management; document and print management; and customer service.

Several of the most progressive global organizations will seek outsourcing partnerships that focus on enhancing shareholder value and enabling organizations to be more focused and flexible.

Global research findings

PricewaterhouseCoopers commissioned a study of outsourcing trends amongst 300 of the largest global companies, including 26 large Canadian organizations. The research, conducted by an independent market research organization, highlighted some interesting issues and trends amongst the Canadian participants.

- Seventy-three percent of the organizations have outsourced at least one activity or process. The main reasons for outsourcing are: to enable a focus on core competencies; enhance profitability and share-holder value; and avoid the investment in technology required to enhance efficiency.
- The most commonly outsourced activities and those most likely to be outsourced in the near future are: benefits administration payroll pro cessing; logistics; real estate man agement, and internal audits.
- About half of the respondents believe outsourcing to be more important to their organizations then was the case three years ago, ninety-five percent were somewhat or very satisfied with their outsourc ing to date, while sixty three percent achieved at least the cost savings expected from outsourcing.

Source: John Simke, "Emerging Trends in Outsourcing", *CMA Management*, February 2000, pp. 26–27.

Cost-driver activity is measured by the number of transactions involved in the activity. For example, in this case, engineering costs are caused by change orders (a document detailing a production change that requires the attention of the engineering department). Therefore, engineering costs are assigned to products in proportion to the number of engineering change orders issued for each product. If the production of microwave ovens caused 18 percent of the engineering change orders, then the ovens should bear 18 percent of the costs of engineering. Because transactions are often used for assigning costs of activities to cost objects, activity-based costing is also called **transaction-based accounting** or **transaction costing**.

Transaction-Based Accounting (Transaction Costing). See **Activity-Based Costing.**

Consider the Belmont manufacturing plant of a major appliance producer. Exhibit 5-6 contrasts the traditional costing system with an ABC system. In the traditional cost system, the portion of total overhead allocated to a product depends on the proportion of total direct labour hours consumed in making the product. In the ABC system, significant overhead activities (machining, assembly, quality inspection, etc.) and related resources are separately identified and traced to products using cost drivers—machine hours, number of parts, number of inspections, etc. In the ABC system, the amount of overhead costs allocated to a product depends on the proportion of total machine hours, total parts, total inspections, etc. consumed in making the product. One large overhead cost pool has been broken into several pools, each associated with a key activity. We now consider a more in-depth illustration of the design of an ABC system.

EXHIBIT 5-6

Traditional and Activity-Based Cost Systems

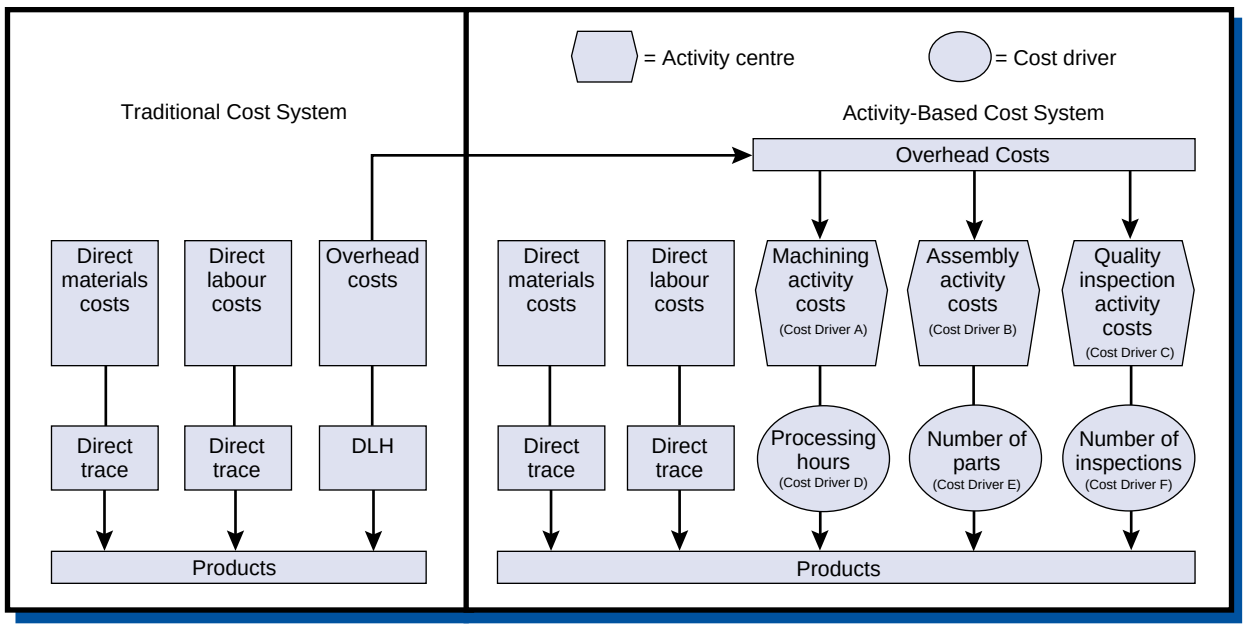


Illustration of Activity-Based Costing[4]

Consider the Billing Department at Pacific Power Company (PPC), an electric utility. The Billing Department (BD) at PPC provides account inquiry and bill printing services for two major classes of customers—residential and commercial. Currently, the Billing Department services 120,000 residential and 20,000 commercial customer accounts.

Two factors are having a significant impact on PPC's profitability. First, deregulation of the power industry has led to increased competition and lower rates, so PPC must find ways of reducing its operating costs. Second, the demand for power in PPC's area will increase due to the addition of a large housing development and a shopping centre. The marketing department estimates that residential demand will increase by almost 50 percent and commercial demand will increase by 10 percent during the next year. Since the BD is currently operating at full capacity, it needs to find ways to create capacity to service the expected increase in demand. A local service bureau has offered to take over the BD functions at an attractive lower cost (compared to the current cost). The service bureau's proposal is to provide all the functions of the BD at $3.50 per residential account and $8.50 per commercial account.

Exhibit 5-7 depicts the residential and commercial customer classes (cost objects) and the resources used to support the BD. The costs associated with the BD are all indirect—they cannot be identified specifically and exclusively with either customer class in an economically feasible way. The BD used a traditional costing system that allocated all support costs based on the number of account inquiries of the two customer classes. Exhibit 5-7 shows that the cost of the resources used in the BD last month was $565,340. BC received 23,000 account inquiries during the month, so the indirect cost per inquiry was $565,340 ÷ 23,000 = $24.58. There were 18,000 residential account inquiries, about 78 percent of the total. Thus, residential accounts were charged with 78 percent of the support costs while commercial accounts were charged with 22 percent. The resulting cost per account is $3.69 and $6.15 for residential and commercial accounts, respectively.

Based on the costs provided by the traditional cost system, the BD management would be motivated to accept the service bureau's proposal to service all residential accounts because of the apparent savings of $.19 ($3.69 2 $3.50) per account. The BD would continue to service its commercial accounts because its costs are $2.35 ($8.50 2 $6.15), less than the service bureau's bid.

However, management believed that the actual consumption of support resources was much greater than 22 percent for commercial accounts because of their complexity. For example, commercial accounts average 50 lines per bill compared with only 12 for residential accounts. Management was also concerned about activities such as correspondence (and supporting labour) resulting from customer inquiries because these activities are costly but do not add value to PPC's services from the customer's perspective. However, management wanted a more thorough understanding of key BD activities and their interrelationships

[4] Much of the discussion in this section is based on an illustration used in Implementing Activity-Based Costing—The Model Approach, a workshop sponsored by the Institute of Management Accounting and Sapling Corporation.

OBJECTIVE 9

Step 1. Determine cost objectives, key activities centres, resources, and related cost drivers.
Step 2. Develop a process-based map representing the flow of activities, resources, and their interrelationships.
Step 3. Collect relevant data concerning costs and the physical flow of cost-driver units among activities.
Step 4. Calculate and interpret the new activity-based information.

before making important decisions that would affect PPC's profitability. The company decided to perform a study of the BD, using activity-based costing. The following is a description of the study and its results.

The activity-based-costing study was performed by a team of managers from the BD and the chief financial officer from PPC. The team followed a four-step procedure to conduct the study.

Step 1. *Determine cost objectives, key activities centres, resources, and related cost drivers.* Management had set the objective for the study—determine the BD cost per account for each customer class. The team identified the following activities, resources, and related cost drivers for the BD through interviews with appropriate personnel.

ACTIVITY CENTRES	COST DRIVERS
Account Billing	Number of Lines
Account Verification	Number of Accounts
Account Inquiry	Number of Labour Hours
Correspondence	Number of Letters

The four key BD activity centres are account billing, bill verification, account inquiry, and correspondence. The resources shown in Exhibit 5-7 support these major activity centres. Cost drivers were selected based on two criteria.

1. There had to be a reasonable assumption of a cause-effect relationship between the driver unit and the consumption of resources and/or the occurrence of supporting activities.
2. Data on the cost-driver units had to be available.

Step 2. *Develop a process-based map representing the flow of activities, resources, and their interrelationships.* An important phase of any activity-based analysis is identifying the interrelationships between key activities and the resources consumed. This is typically done by interviewing key personnel. Once the linkage between activities and resources is identified, a process map is drawn that provides a visual representation of the operations of the BD.

Exhibit 5-8 is a process map that depicts the flow of activities and resources at the BD.[5] Note that there are no costs on Exhibit 5-8. BD first focused on understanding business processes. Costs were not considered until Step 3, after the key interrelationships of the business are understood.

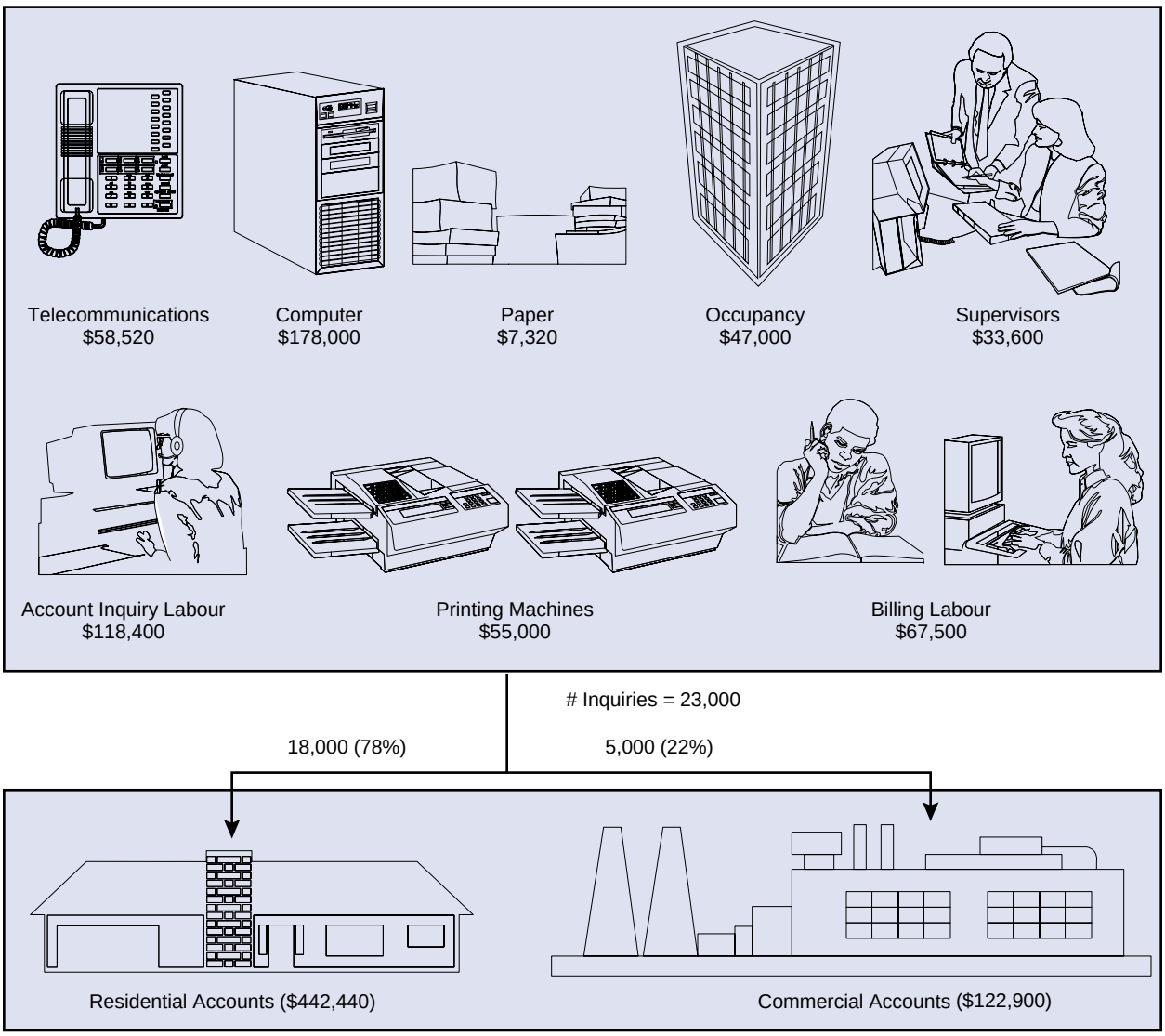
Consider residential accounts. Three key activities support these accounts—account billing, account inquiry, and correspondence. Bill printing activity consumes printing machine time, paper, computer transaction time, billing labour time, and supervisory time. This activity also takes up significant occupancy space. Account inquiry activity consumes labour time and requires correspondence for some inquiries. Account inquiry labour, in turn, uses the telecommunication, computer, supervisory resources, and also occupies a significant amount of occupancy space. Finally, the correspondence activity requires supervision and inquiry labour. The costs of each of the resources consumed were determined during Step 3—data collection.

[5] This example illustrates the process-based modelling approach to activity-based costing. For a more detailed description of the process modelling approach, see Raef A. Lawson, "Beyond ABC: Process-Based Costing," *Journal of Cost Management*, Volume 8, No. 3 (Fall 1994), pp. 33–43. Also, for a discussion of how one major firm used process-based costing to implement ABC in its billing centre, see T. Hobdy, J. Thomson, and P. Sharman, "Activity-Based Management at AT&T," *Management Accounting* (April 1994), pp. 35–39.

EXHIBIT 5-7

Pacific Power Company—Billing Department

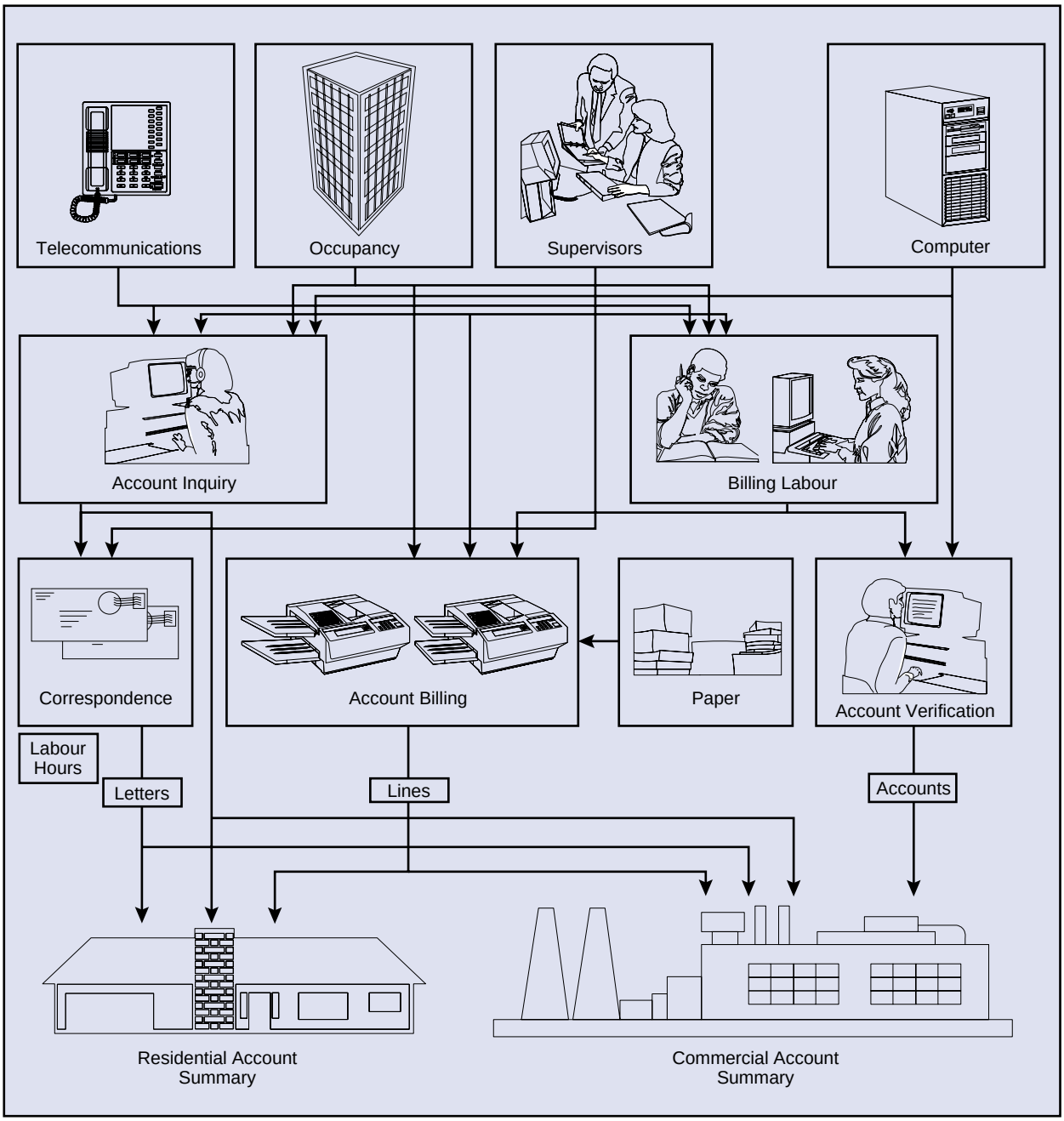
Current Costing Based on One Overall Rate
Total Indirect Cost: $565,340



	Cost/Inquiry $565,340/23,000 (1)	#Inquiries (2)	#Accounts (3)	Cost/Account (1)X(2)/(3)
Residential	$24.58	18,000	120,000	$3.69
Commercial	$24.58	5,000	20,000	$6.15

EXHIBIT 5-8

Process Map of Billing Department Activities



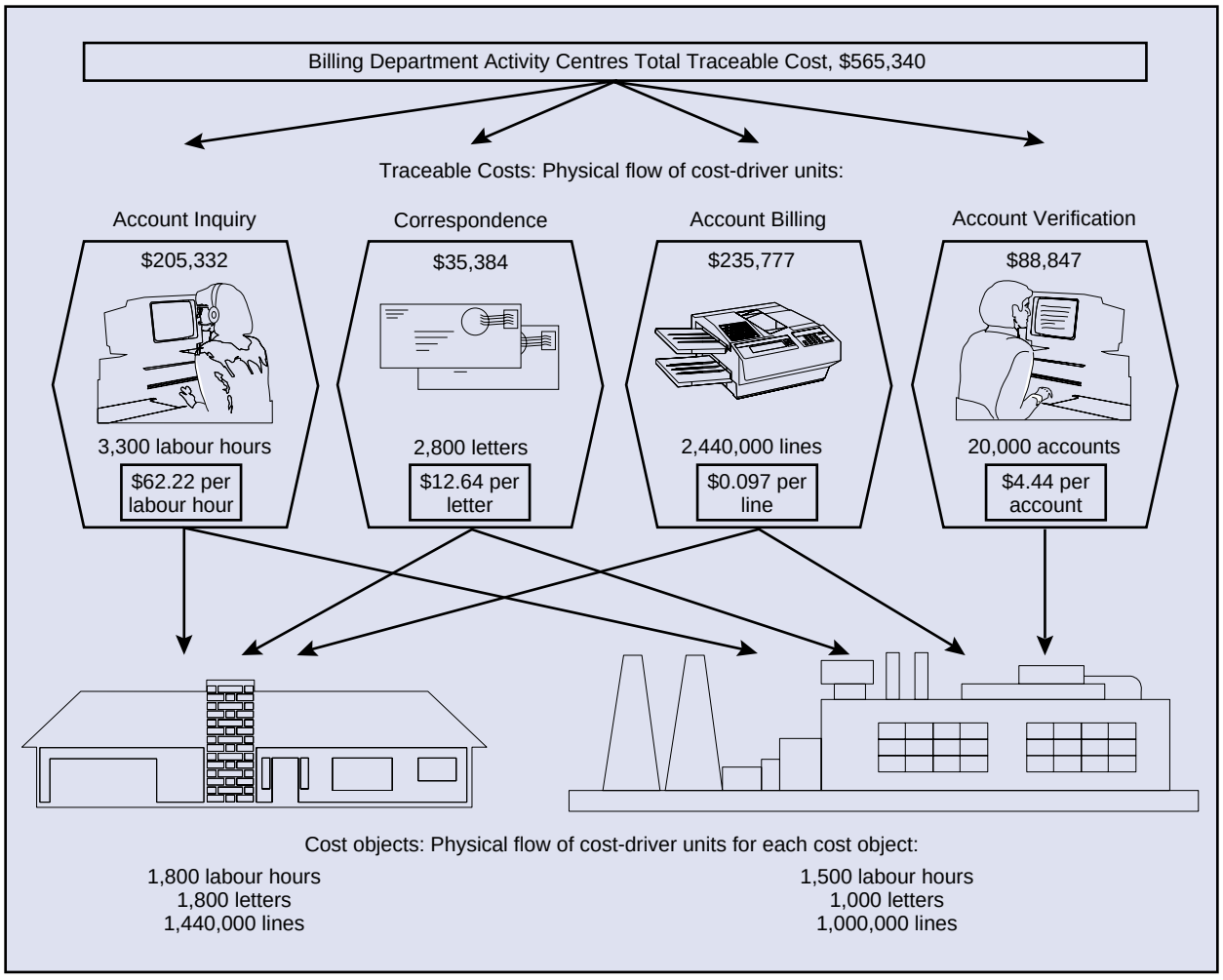
Step 3. *Collect relevant data concerning costs and the physical flow of cost-driver units among resources and activities*. Using the process map as a guide, BD accountants collected the required cost and operational data by further interviews with relevant personnel. Sources of data include the accounting records, special studies, and sometimes "best estimates of managers."

Exhibit 5-9 is a graphical representation of the data collected for the four activity centres identified in Step 1. For each activity centre, data collected included traceable costs and the physical flow of cost-driver units. For example, Exhibit 5-9 shows traceable costs of $235,777 for the account billing activity. Traceable costs include the costs of the printing machines ($55,000 from Exhibit 5-7) plus portions of the costs of all other resources that support the billing activity (paper, occupancy, computer, and billing labour). Notice that the total traceable costs of $205,332 + $35,384 + $235,777 + $88,847 = $565,340 in Exhibit 5-9 equals the total indirect costs in Exhibit 5-7. Next, the physical flow of cost-driver units was determined for each activity or cost object. For each activity centre, the traceable costs were divided by the sum of the physical flows to establish a cost per cost-driver unit.

Step 4. *Calculate and interpret the new activity-based information.* The activity-based cost per account for each customer class can be determined from the data in Step 3. Exhibit 5-10 shows the computations.

EXHIBIT 5-9

ABC System



OBJECTIVE 10

Calculate activity-based costs for cost objects.

Examine the last two items in Exhibit 5-10. Notice that traditional costing indicated higher costs for the high-volume residential accounts and substantially lower costs for the low-volume commercial accounts. The ABC cost per account for residential accounts is $2.28, which is $1.41 less than the $3.69 cost generated by the traditional costing system. The cost per account for commercial accounts is $14.57, which is $8.42 more than the $6.15 cost from the traditional cost system. Management's belief that traditional costing was undercosting commercial accounts was supported. PPC's management now has the cost information that they think is preferred for planning and decision-making purposes.

These results are common when companies perform activity-based costing studies—high-volume cost objects with simple processes are overcosted when only one volume-based cost driver is used. In the BD, this volume-based cost-driver was the number of inquiries. Which system makes more sense—the traditional allocation system that "spreads" all support costs to customer classes based solely on the number of inquiries, or the activity-based-costing system that identifies key activities and assigns costs based on the consumption of units of cost drivers chosen for each key activity? For PPC, the probable benefits of the new activity-based-costing system may outweigh the costs of implementing and maintaining the new cost system. However, the cost-benefit balance must be assessed on a case-by-case basis.

PERSPECTIVES ON DECISION-MAKING

The ABCs of Profitability

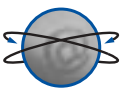
Today, many organizations are using Activity Based Costing (ABC) to make strategy changes and to cut costs, and the process may end up affecting a broad range of operations: simple ones, like the way a truck delivery is unloaded at a store, or major ones, such as whether to outsource direct store deliveries. ABC shows the individual impact of each decision, and the impact of one decision on another. A company may even discover that changing the way deliveries are processed makes outsourcing them uneconomical.

ABC can produce results. Here are some examples:

• A mining company needed to reduce logistics costs and to assess the bottom-line impact of some proposed capital investments. It conducted an ABC pilot project which focused on customer service and distribution. The study found enough "quick hit" improvements to pay for the cost of the pilot project. Management used the model to justify several strategic initiatives, which led to even greater bottom-line improvements. ABC was then rolled out to the mining and milling processes. Today, strategic planning, budgeting, and performance measurement have all been upgraded.

• A food processor and wholesale distribution company needed to understand the economics of its processing and logistics activities. Management suspected that some customer groups, products, and delivery routes were losing money. As it turned out, all products contributed to the bottom line, but some customers were indeed unprofitable. The improvement opportunities that ABC discovered amounted to ten times the cost of the pilot project.

Source: Henry Kolisnik, "The ABCs of Profitability," *Canadian Transportation Logistics*, March 1995, p. 50.



Activity-Based Costing
www.abctech.com

Summary of Activity-Based Costing

Activity-based accounting systems can turn many indirect manufacturing overhead costs into direct costs—costs identified specifically with given cost objectives. Appropriate selection of activities and cost drivers allows managers to trace many manufacturing overhead costs to cost objectives just as specifically as they have traced direct material and direct labour costs. Because activity-based accounting systems classify more costs as direct than do traditional systems, managers have greater confidence in the costs of products and services reported by activity-based systems.

Because activity-based accounting systems are more complex and costly than traditional systems, not all companies use them. But more and more organizations in both manufacturing and non-manufacturing industries are adopting activity-based systems for a variety of reasons:

OBJECTIVE 11

Explain why activity-based costing systems are being adopted.

- Fierce competitive pressure has resulted in shrinking margins. Companies may know their overall margin, but they often do not believe in the accuracy of the margins for *individual* products or services.
- Business complexity has increased, which results in greater diversity in the types of products and services as well as customer classes. Therefore, the consumption of a company's shared resources also varies substantially across products and customers.
- New production techniques have increased the proportion of indirect costs—that is, indirect costs are far more important in today's world-class manufacturing environment. In many industries direct labour is being replaced by automated equipment. Indirect costs are sometimes over 50 percent of total cost.
- The rapid pace of technology change has shortened product life-cycles. Hence, companies do not have time to make price or cost adjustments once errors are discovered.
- Computer technology has reduced the costs of developing and operating cost systems that track many activities.

EXHIBIT 5-10

Key Results of Activity-Based Costing Study

DRIVER COSTS

Activity/Resource (Driver Units)	Traceable Costs (From Exhibit 5-9) (1)	Total Physical Flow of Driver Units (From Exhibit 5-9) (2)	Cost Per Driver Unit (1)4 (2)
Account Inquiry (Labour Hours)	$205,332	3,300 Hours	$62.22
Correspondence (Letters)	$ 35,384	2,800 Letters	$12.64
Account Billing (Lines)	$235,777	2,440,000 Lines	$ 0.097
Account Verification (Accounts)	$ 88,847	20,000 Accounts	$ 4.44

COST PER CUSTOMER CLASS

	Cost Per Driver Unit	Residential		Commercial	
		Physical Flow of Driver Units	Cost	Physical Flow of Driver Units	Cost
Account Inquiry	$62.22	1,800 Hrs.	$111,999	1,500 Hrs.	$ 93,333
Correspondence	$12.64	1,800 Ltrs.	$ 22,747	1,000 Ltrs.	$ 12,638
Account Billing	$0.097	1,440,000 Lines	$139,147	1,000,000 Lines	$ 96,629
Account Verification	$4.44	0	$ 0	20,000 Accts.	$ 88,847
Total Cost			$273,893		$291,447
Number of Accounts			120,000		20,000
Cost per Account			$ 2.28		$ 14.57
Cost per Account (Traditional System)			$ 3.69		$ 6.15

Note: Some differences may exist due to rounding.

PERSPECTIVES ON DECISION-MAKING

Identifying Activities, Resources, and Cost Drivers

Arkansas Blue Cross Blue Shield (ABCBS) is the largest health insurer in Arkansas with annual revenue of more than $450 million. Recently, ABCBS implemented activity-based management. The identification of key activities, resources, and cost drivers was one of the early steps performed.

• A pilot study was performed on one area of the firm—information management. The criteria for selection of a pilot area included significant costs, the possibility of improving the existing cost allocation system, access to data, and a receptive staff.

• The cost objectives were defined—the internal customers of information management.

• Activities, resources, and cost drivers were identified based on meetings with managers. Examples of key activities are Production (job scheduling, production control), Electronic Media Claims Processing, Printing, and Mail Processing. Resources include Systems Programmers, Mail Labour, Print Labour, Tape Labour, Data Base Administrators, 3080 CPU, 3090 CPU, LSM (robotic cartridge system), DASD (hard disk storage), and Telecommunications, Cost drivers included CPU minutes, single-density volumes (DASD), number of tape/cartridge mounts (LSM), number of jobs, and number of CRTs (telecommunications).

• Once the key activities, resources, and drivers were identified, the project team developed a process map of the operations of the information management function. This map reflected the flow of activities and resources in support of the cost centres. The map also identified the data that needed to be collected to complete the study. (Note that the process map is very similar to Exhibit 4-12 in appearance.)

• Once the ABC model was built and validated, the results were interpreted and recommendations for improvement were made.

As a result of the ABC study, the following actions were taken by management:

• A separate utility meter was placed on the computer room.

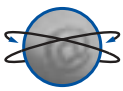
• CRT purchases are now charged directly to the user. Maintenance costs for CRTs are now assigned based on CRT count.

• Three new cost centres were created—EMC Systems, Change Control, and Production Control.

• CPU was upgraded.

ABCBS is now in the process of expanding the new ABM system corporate-wide to include purchasing, actuarial, advertising, and claims processing. The company is also using the new ABM system for activity-based budgeting.

Source: "Implementing Activity-Based Costing—The Model Approach," Institute of Management Accountants and Sapling Corporation, Orlando (November, 1994).



Institute of Management Accountants
www.imanet.org

Sapling: Software Aided Planning
www.sapling.com

Cost Management Systems

Cost Management System. Identifies how management's decisions affect costs, by first measuring the resources used in performing the organization's activities and then assessing the effects on costs of changes in those activities.

To better support managers' decisions, accountants go beyond simply determining the cost of products and services. They develop cost management systems. A **cost management system** identifies how management's decisions affect costs. To do so, it first measures the resources used in performing the organization's activities and then assesses the effects on costs of changes in those activities.

Activity-Based Management

Recall that managers' day-to-day focus is on managing activities, not costs. So, because ABC systems also focus on activities, they are very useful in cost

management. Using an activity-based costing system to improve the operations of an organization is **activity-based management (ABM)**. In the broadest terms, activity-based management aims to improve the value received by customers and to improve profits by providing this value.

Activity-Based Management (ABM). The use of an activity-based costing system to improve the operations of an organization.

The cornerstone of ABM is distinguishing between value-added costs and non-value-added costs. A **value-added cost** is the cost of an activity that cannot be eliminated without affecting a product's value to the customer. Value-added costs are necessary (as long as the activity that drives such costs is performed efficiently). In contrast, companies try to minimize **non-value-added costs**—costs that can be eliminated without affecting a product's value to the customer. Activities such as handling and storing inventories, transporting partly finished products from one part of the plant to another, and changing the set-up of production line operations to produce a different model of the product are all non-value-added activities that can be reduced, if not eliminated, by careful redesign of the plant layout and the production process.

Value-Added Cost. The necessary cost of an activity that cannot be eliminated without affecting a product's value to the customer.

Non-Value-Added Costs. Costs that can be eliminated without affecting a product's value to the customer.

Let us return now to Pacific Power Company to see how the billing department could use the ABC system to improve its operation. Recall that the BD needed to find a way to increase its capacity to handle accounts due to an expected large increase in demand from a new housing development and shopping centre. BD managers also were interested (as always is the case) in reducing the operating costs of the department while not impairing the quality of the service it provided to its customers. To do so, they used the ABC information from Exhibit 5-10 to identify non-value-added activities that had significant costs. Account inquiry and bill verification activities are non-value-added and costly, so management asked for ideas cost reductions. The new information provided by the ABC system generated the following ideas for improvement:

- Use the service bureau for commercial accounts because of the significant cost savings. From Exhibit 5-10, the service bureau's bid is for $8.50 per account compared to the BD's activity-based cost of $14.57, a difference of more than $6 per account! The freed-up capacity can be used to meet the expected increase in residential demand. Bill verification, a non-value-added activity, would also be eliminated because only commercial bills are verified.
- Exhibit 5-10 indicates that account inquiry activity is very costly, accounting for a significant portion of total BD costs. One idea is to make bills more descriptive in order to reduce the number of inquiries. Doing so would add lines to each bill, resulting in higher billing-activity costs, but the number of inquiries would be reduced, thus reducing a significant non-value-added cost. Whether this idea would result in a net cost reduction needs to be evaluated by the accountants with the help of the new ABC system.

Just-in-Time (JIT) Systems

Attempts to minimize non-value-added costs have led many organizations to adopt just-in-time systems to eliminate waste and improve quality. In a **just-in-time (JIT) production system**, an organization purchases materials and parts and produces components just when they are needed in the production process. Goods are not produced until it is time for them to be shipped to a customer. The goal is to have zero inventory, because holding inventory is a non-value-added activity.

Just-In-Time (JIT) Production System. A system in which an organization purchases materials and parts and produces components just when they are needed in the production process, the goal being to have zero inventory, because holding inventory is a non-value-added activity.

JIT companies are customer-oriented because customer orders drive the production process. An order triggers the immediate delivery of materials, followed by production and delivery of the goods. Instead of producing inventory

OBJECTIVE 12

Explain how JIT systems can reduce non-value-added activities.

and hoping an order will come, a JIT system produces products directly for received orders. Several factors are crucial to the success of JIT systems:

1. Focus on quality. JIT companies try to involve all employees in controlling quality. While any system can seek quality improvements, JIT systems emphasize *total quality control (TQC)* and *continuous improvement in quality*. If all employees strive for zero defects, non-value-added activities such as inspection and rework of defective items are minimized.
2. Short **production cycle time**. The time from initiating production to delivery of goods to the customer. Keeping production cycle times short allows timely response to customer orders and reduces the level of inventories. Many JIT companies have achieved remarkable reductions in production cycle times. For example, applying JIT methods in one IBM division in Bromont, Quebec cut process lead times from 30 to 40 days to seven days on a ceramic substrate product.
3. Smooth flow of production. Fluctuations in production rates inevitably lead to delays in delivery to customers and excess inventories. To achieve smooth production flow, JIT companies simplify the production process to reduce the possibilities of delay, to develop close relationships with suppliers to assure timely delivery and high quality of purchased materials, and to perform routine maintenance on equipment to prevent costly breakdowns. For example, Omark, a chain-saw manufacturer in Guelph, Ontario reduced production flow distance from 806 to 53 metres.
4. Flexible production operations. Two dimensions are important: facilities flexibility and employee flexibility. Facilities should be able to produce a variety of components and products to provide extra capacity when a particular product is in high demand and to avoid shutdown when a unique facility breaks down. Facilities should also require short set-up times—the time it takes to switch from producing one product to another. Cross-training employees—training employees to do a variety of jobs—provides further flexibility. Multiskilled workers can fill in when a particular operation is overloaded, and can reduce set-up time. One company reported a reduction in set-up time from 45 minutes to one minute by training production workers to perform the set-up operations.

Production Cycle Time. The time from initiating production to delivering the goods to the customer.

Many companies help achieve these objectives by improving the physical layout of their plants. In conventional manufacturing, similar machines (lathes, molding machines, drilling machines, etc.) are grouped together. Workers specialize on only one machine operation (operating either the moulding or the drilling machine). There are at least two negative effects of such a layout. First, products must be moved from one area of the plant to another for required processing. This increases material handling costs and results in work-in-process inventories that can be substantial. These are non-value-added activities and costs. Second, the specialized labour resource is often idle—waiting for work-in-process. This wasted resource—labour time—is also non-value-added.

In a JIT production system, machines are often organized in cells according to the specific requirements of a product family. This process is called **cellular manufacturing**. Only the machines that are needed for the product family are in the cell, and these machines are located as close to each other as possible. Workers are trained to use all the cellular machines. Each cell (often shaped in the form of a "U") is a mini-factory or focused factory. Both of the problems associated with the conventional production layout are eliminated in cellular manufacturing.

Cellular Manufacturing. In a JIT production system, the process of organizing machines into cells according to the specific requirements of the product family.

Work-in-process inventories are reduced or eliminated because there is no need for moving and storing inventory. Idle time is reduced or eliminated because workers are capable of moving from idle machine activity to needed activities. As a result, cycle times are reduced.

Accounting for a JIT system is often simpler than for other systems. Most cost accounting systems focus on determining product costs for inventory valuation. But JIT systems have minimal inventories, so there is less benefit from an elaborate inventory costing system. In JIT systems, materials, labour, and overhead costs could potentially be charged directly to cost of goods sold because inventories are small enough to be ignored. All costs of production are assumed to apply to products that have already been sold.

HIGHLIGHTS TO REMEMBER

Costs are allocated for three major purposes: (1) motivation, (2) income and asset measurement, and (3) cost justification or cost-plus contracts.

Costs to be allocated are traced to cost pools, preferably keeping variable costs and fixed costs in separate pools. Fixed costs of service departments should be allocated using predetermined monthly lump sums for providing a basic capacity to serve. Variable costs should be assigned by using a predetermined standard unit rate for the services actually used. Often it is best to allocate only those central costs of an organization for which measures of usage by departments are available. Service department costs can be allocated using either the direct method or the step-down method.

Joint costs are often allocated to products for inventory valuation and income determination using the physical-units or relative-sales-value method. However, such allocations should not effect decisions.

Activity-based costing is growing in popularity. It first assigns costs to the activities of an organization. Then costs are traced to products or services based on cost drivers that measure the causes of the costs of a particular activity.

Designing and implementing an activity-based costing system involves four steps. First, managers determine the cost objectives, key activities, and resources used. Cost drivers (output measures) are also identified for each resource and activity. Second, a process-based map is drawn that represents the flow of activities and resources that support the cost objects. The third is collecting cost and operating data. The last step is to calculate and interpret the new activity-based information. Often, this last step requires the use of a computer due to the complexity of many ABC systems. Using ABC information to improve operations is called activity-based management.

Just in time (JIT) production systems are used to improve profitability of companies by eliminating waste and improving quality. JIT systems focus on quality, short production cycles, reducing inventory, and flexible use of operating assets and human resources. Each of these factors is associated with nonvalue-added activities and thus improvements result in reduced operating costs and improved proftability.

SUMMARY PROBLEMS FOR YOUR REVIEW

Problem One

Non-manufacturing organizations often find it useful to trace costs to final products or services. Consider a hospital. The output of a hospital is not as easy to define as the output of a factory. Assume the following measures of output in three revenue-producing departments:

DEPARTMENT	MEASURES OF OUTPUT*
Radiology	X-ray films processed
Laboratory	Tests administered
Daily Patient Services**	Patient-days of care (that is, the number of patients multiplied by the number of days of each patient's stay)

* These become the "product" cost objectives, the various revenue-producing activities of a hospital.
** There would be many of these departments, such as obstetrics, pediatrics, and orthopedics. Moreover, there may be both in-patient and out-patient care.

Budgeted output for 2002 is 60,000 X-ray films processed in Radiology, 50,000 tests administered in the Laboratory, and 30,000 patients-days in Daily Patient Services.

In addition to the revenue-producing departments, the hospital has three main service departments: Administrative and Fiscal Services, Plant Operations and Maintenance, and Laundry. (Of course, real hospitals have more than three revenue-producing departments and more than three service departments. This problem is simplified to keep the data manageable.)

The hospital has decided that the cost driver for Administrative and Fiscal Services costs is the direct department costs of the other departments. The cost driver for Plant Operations and Maintenance is square metres occupied and for Laundry, kilograms of laundry. The pertinent budget data for 2002 are as follows:

	DIRECT DEPARTMENT COSTS	SQUARE METRES OCCUPIED	KILOGRAMS OF LAUNDRY
Administrative and Fiscal Services	$1,000,000	1,000	—
Plant Operations and Maintenance	800,000	2,000	—
Laundry	200,000	5,000	—
Radiology	1,000,000	12,000	80,000
Laboratory	400,000	3,000	20,000
Daily Patient Services	$1,600,000	80,000	300,000
Total	$5,000,000	103,000	400,000

1. Allocate service department costs using the direct method.
2. Allocate service department costs using the step-down method. Allocate Administrative and Fiscal Services first, Plant Operations and maintenance second, and Laundry third.

3. Compute the cost per unit of output in each of the revenue-producing departments using the costs determined using (a) the direct method for allocating service department costs (requirement 1) and (b) the costs determined using the step-down method for allocating service department costs (requirement 2).

Solution

1. The solutions to all three requirements are shown in Exhibit 5-11. The direct method is presented first. Note that no service department costs are allocated to another cost driver in the revenue-producing department only. For example, in allocating Plant Operations and Maintenance, square metres occupied by the service departments is ignored. The cost driver is the 95,000 square metres occupied by the revenue-producing departments.

EXHIBIT 5-11

Allocation of Service-Department Costs: Two Methods

	ADMINISTRATIVE AND FISCAL SERVICES	PLANT OPERATIONS AND MAINTENANCE	LAUNDRY	RADIOLOGY	LABORATORY	DAILY PATIENT SERVICES
Allocation base	Accumulated costs	Sq metres	Kilograms			
1. **Direct Method**						
Direct department costs before allocation	$1,000,000	$ 800,000	$200,000	$1,000,000	$400,000	$1,600,000
Administrative and Fiscal Services	(1,000,000)	—	—	333,333*	133,333	533,334
Plant Operations and Maintenance		(800,000)	—	101,052†	25,263	673,685
Laundry			(200,000)	40,000††	10,000	150,000
Total costs after allocation				$1,474,385	$568,596	$2,957,019
Product output in films, tests, and patient-days, respectively				60,000	50,000	30,000
3a. Cost per unit of output				$ 24.573	$ 11.372	$ 98.567
2. **Step-Down Method**						
Direct department costs before allocation	$1,000,000	$ 800,000	$200,000	1,000,000	$400,000	$1,600,000
Administrative and Fiscal Services	(1,000,000)	200,000§	50,000	250,000	100,000	400,000
Plant Operations and Maintenance		(1,000,000)	50,000¶	120,000	30,000	800,000
Laundry			(300,000)	60,000#	15,000	225,000
Total costs after allocation				$1,430,000	$545,000	$3,025,000
Product output in films, tests, and patient-days, respectively				60,000	50,000	30,000
3b. Cost per unit of output				$ 23.833	$ 10.900	$ 100.833

* $1,000,000 ÷ ($1,000,000 + $400,000 + $1,600,000) = 33 1/3%; 33 1/3% × $1,000,000 = $333,333; etc.
† $800,000 ÷ (12,000 + 3,000 + 80,000) = $8.4210526; $8.4210526 × 12,000 sq. metres = $101,052; etc.
†† $200,000 ÷ (80,000 + 20,000 + 300,000) = $.50; $.50 × 80,000 = $40,000; etc.
§ $1,000,000 ÷ ($800,000 + $200,000 + $1,000,000 + $400,000 + $1,600,000) = $0.25; $0.25 × $800,000 = $200,000; etc.
¶ $1,000,000 ÷ (5,000 + 12,000 + 3,000 + 80,000) = $10.00; $10.00 x 5,000 sq. metres = $50,000; etc.
# $300,000 ÷ (80,000 + 20,000 + 300,000) = $.75; $.75 × 80,000 = $60,000; etc.

Note that the total cost of the revenue-producing departments after allocation, $1,474,385 + $568,596 + $2,957,019 = $5,000,000, is equal to the total of the direct department costs in all six departments before allocation.

2. The step-down method is shown in the lower half of Exhibit 5-11. The costs of Administrative and Fiscal Services are allocated to all five other departments. Because a department's own costs are not allocated to itself, the cost driver consists of the $4,000,000 direct department costs in the five departments excluding Administrative and Fiscal Services.

Plant Operations and Maintenance is allocated second on the basis of square metres occupied. No cost will be allocated to itself or back to Administrative and Fiscal Services. Therefore, the square metres used for allocation is the 100,000 square metres occupied by the other four departments.

Laundry is allocated third. No cost would be allocated back to the first two departments, even if they had used laundry services.

As in the direct method, note that the total costs of the revenue-producing departments after allocation, $1,430,000 + $545,000 + $3,025,000 = $5,000,000, equal the total of the direct department costs before allocation.

3. The solutions are labelled 3a and 3b in Exhibit 5-11. Compare the unit costs derived from the direct method with those of the step-down method. In many instances, the final product costs may not differ enough to warrant investing in a cost-allocation method that is any fancier than the direct method. But sometimes even small differences may be significant to a government agency or anybody paying for a large volume of services based on costs. For example, in Exhibit 5-11, the "cost" of an "average" laboratory test is either $11.37 or $10.90. This may be significant for the fiscal committee of the hospital's board of trustees, who must decide on hospital prices. Thus cost allocation is often a technique that helps answer the vital question, "Who should pay for what, and how much?"

Problem Two

Last year, TCY Company's demand for product H17 was 14,000 units. At a recent meeting, the sales manager asked the controller about the expected cost for the sales-order activity for the current year. A new ABC system had been installed, and the controller had provided the sketch of the order-processing activity to the sales manager (see Exhibit 5-12). The sales manager wanted to know how the order-processing activity affects costs. The average sales order is for 20 units. The order-processing activity shown in Exhibit 5-12 requires a computer, processing labour, and telecommunications. The computer is leased at a cost of $2,000 per period. Salaries are $7,000, and telecommunication charges are $1.60 per minute.

1. How many labour hours does it take to process each order? How much telecommunication time does each order take?
2. What is the total cost formula for the order processing activity? What is the total and unit cost for demand of 14,000 units?
3. The sales manager calculated the cost per order to be $32.06 based on the expected demand of 14,000 units of H17. Because he believed that

this year's demand for H17 may be only 12,000 units, he then calculated the total cost of processing 600 orders as $19,236 = 600 × $32.06. Comment on the validity of the sales manager's analysis.

Solution

1. It takes .1 hours or 6 minutes of labour time and 12 minutes of telecommunications time to process an order.
2. The total cost formula for order processing activity is:

Total Cost = Fixed Costs + Variable Costs
= Lease Cost + Labour Cost + Telecom. cost/min. × min./order × no. of orders
= $2,000 + $7,000 + $1.60 × 12 × Number of Orders
= $9,000 + $19.20 × Number of Orders

For 14,000 units, there will be 700 orders processed. The total cost to process these orders is:

Total Cost = $9,000 + ($19.20 × 700) = $22,440 and the unit cost is $32.06 (22,440/700).

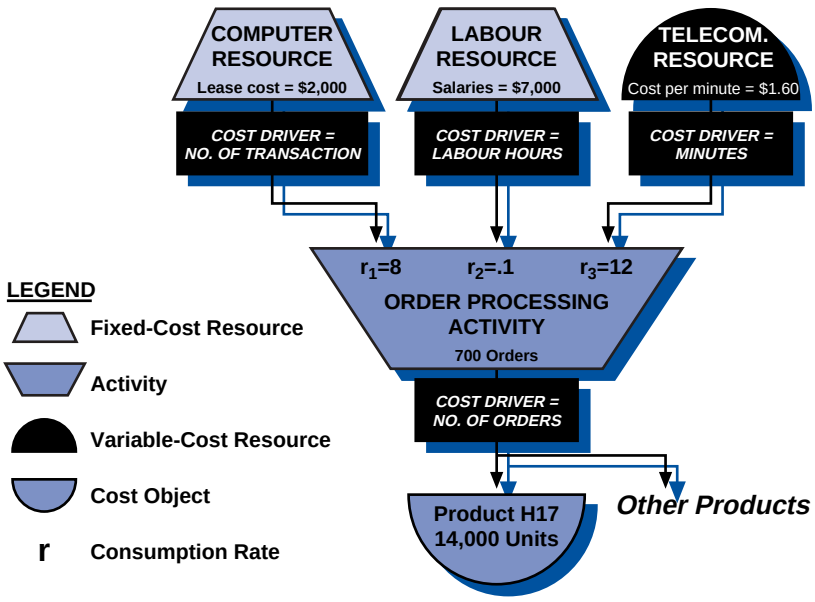
3. The sales manager has fallen into the trap of ignoring cost behaviour. His calculation assumes that unit fixed costs will not change with changes in demand or the cost driver. The correct prediction of total cost for a demand of 12,000 units (or 600 orders) is:

Total Cost = $9,000 + $19.20 × 600 = $20,520

This problem illustrates why it is important to take cost behaviour into consideration when using any costing system for planning purposes.

EXHIBIT 5-12

TCY's Order-Processing Activity



ACCOUNTING VOCABULARY

activity-based costing (ABC) *p. 196*
activity-based management (ABM) *p. 208*
by-product *p. 194*
cellular manufacturing *p. 209*
cost accounting system *p. 179*
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ASSIGNMENT MATERIAL

QUESTIONS

Q5-1 What is the purpose of a cost accounting system?

Q5-2 "A cost pool is a group of costs that is physically traced to the appropriate cost objective." Do you agree? Explain.

Q5-3 Give five terms that are sometimes used as substitutes for the term "allocate."

Q5-4 What are the three purposes of cost allocation?

Q5-5 What are the three types of allocations?

Q5-6 Give three guides for the allocation of service department costs.

Q5-7 Why should budgeted-cost rates, rather than actual-cost rates, be used for assigning the variable costs of service departments?

Q5-8 Why do many companies allocate fixed costs separately from variable costs?

Q5-9 "We used a lump-sum allocation method for fixed costs a few years ago, but we gave it up because managers always predicted usage below what they actually used." Is this a common problem? How might it be prevented?

Q5-10 "A commonly misused basis for allocation is dollar sales." Explain.

Q5-11 How could national advertising costs be allocated to territories?

Q5-12 Briefly describe the two popular methods for allocating service-department costs.

Q5-13 "The step-down method allocates more costs to the producing departments than does the direct method." Do you agree? Explain.

Q5-14 How does the term *cost application* differ from *cost allocation*?

Q5-15 What is a non-volume-related cost driver? Give two examples.

Q5-16 How are costs of various overhead resources allocated to products, services, or customers in an ABC system?

Q5-17 Briefly explain each of the two conventional ways of allocating joint costs to products.

Q5-18 What are by-products and how do we account for them?

Q5-19 Give four examples of activities and related cost drivers that can be used in an ABC system to allocate costs to products, series, or customers.

Q5-20 "Activity-based costing is useful for product costing but not for planning and control." Do you agree? Explain.

Q5-21 Refer to Exhibit 5-6. Suppose the appliance maker has two plants—the Salem plant and the Youngstown plant. The Youngstown plant produces only three appliances that are very similar in material and production requirements. The Salem plant produces a wide variety of appliances with diverse material and production requirements. Which type of costing system would you recommend for each plant (traditional or ABC)? Explain.

Q5-22 Name four steps in the design and implementation of an activity-based costing system.

Q5-23 Refer to the Pacific Power illustration. Which resource costs depicted in Exhibit 5-7 could have variable cost behaviour?

Q5-24 Why do organizations adopt activity-based costing systems?

Q5-25 Why do managers want to distinguish between value-added activities and non-value-added activities?

Q5-26 Name four factors crucial to the success of just-in-time production systems.

Q5-27 "ABC and JIT are alternative techniques for achieving competitiveness." Do you agree?

PROBLEMS

P5-1 FIXED- AND VARIABLE-COST POOLS. The city of Castle Rock signed a lease for a photocopy machine at $2,500 per month and $.02 per copy. Operating costs for toner, paper, operator salary, etc. are all variable at $.03 per copy. Departments had projected a need for 100,000 copies a month. The City Planning Department predicted its usage at 36,000 copies a month. It made 42,000 copies in August.

1. Suppose one predetermined rate per copy was used for all photocopy costs. What rate would be used and how much cost would be allocated to the City Planning Department in August?
2. Suppose fixed- and variable-cost pools were charged separately. Specify how each pool should be charged. Compute the cost charged to the City Planning Department in August.
3. Which method, the one in requirement 1 or the one in requirement 2, do you prefer? Explain.

P5-2 SALES-BASED ALLOCATIONS. Pioneer Markets has three grocery stores in the metropolitan area. Central costs are allocated using sales as the cost driver. The following are budgeted and actual sales during November:

	SUNNYVILLE	WEDGEWOOD	CAPITAL
Budgeted sales	$600,000	$1,000,000	$400,000
Actual sales	600,000	700,000	500,000

Central costs of $200,000 are to be allocated in November.

1. Compute the central costs allocated to each store with *budgeted* sales as the cost driver.
2. Compute the central costs allocated to each store with *actual* sales as the cost driver.

3. What advantages are there to using budgeted rather than actual sales for allocating the central costs?

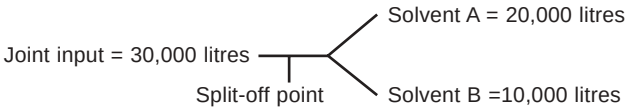
P5-3 DIRECT AND STEP-DOWN ALLOCATIONS. Bulter Home Products has two producing departments, machining and assembly, and two service departments, personnel and custodial. The company's budget's for April, 2001 is:

	SERVICE DEPARTMENT		PRODUCTION DEPARTMENTS	
	PERSONNEL	CUSTODIAL	MACHINING	ASSEMBLY
Direct department costs	$32,000	$70,000	$600,000	$800,000
Square metres	2,000	1,000	10,000	25,000
Number of employees	15	30	200	250

Bulter allocates personnel costs on the basis of number of employees and custodial costs on the basis of square metres.

1. Allocate personnel and custodial costs to the producing departments using the direct method.
2. Allocate personnel and custodial costs to the producing departments using the step-down method. Allocate personnel costs first.

P5-4 JOINT COSTS. Robinson Company's production process for two of its solvents can be diagrammed as follows:



The cost of the joint inputs, including processing costs before the split-off point, is $400,000. Solvent A can be sold at split-off for $10 per litre and Solvent B for $30 per litre.

1. Allocate the $400,000 joint cost to Solvents A and B by the physical-units method.
2. Allocate the $400,000 joint cost to Solvents A and B by the relative-sales-value method.

P5-5 JOINT PRODUCTS. Millbank Milling buys oats at $.60 per kilogram and produces MM Oat Flour, MM Oat Flakes, and MM Oat Bran. The process of separating the oats into oat flour and oat bran costs $.30 per kilogram. The oat flour can be sold for $1.50 per kilogram, the oat bran for $2.00 per kilogram. Each kilogram of oats has .2 kilograms of oat bran and .8 kilograms of oat flour. A kilogram of oat flour can be made into oat flakes for a fixed cost of $240,000 plus a variable cost of $.60 per kilogram. Millbank Milling plans to process one-million kilograms of oats in 2001, at a purchase price of $600,000.

1. Allocate all the joint costs to oat flour and oat bran using the physical-units method.

2. Allocate all the joint costs to oat flour and oat bran using the relative-sales-value method.
3. Suppose there was no market for oat flour. Instead, it must be made into oat flakes to be sold. Oat flakes sell for $2.90 per kilogram. Allocate the joint cost to oat bran and oat flakes using the relative-sales-value method.

P5-6 BY-PRODUCT COSTING. The Wenatchee Company buys apples from local orchards and presses them to produce apple juice. The pulp that remains after pressing is sold to farmers as livestock food. This livestock food is accounted for as a by-product.

During the 2001 fiscal year, the company paid $1,000,000 to purchase eight-million kilograms of apples. After processing, one-million kilograms of pulp remained. Jones spent $35,000 to package and ship the pulp, which was sold for $50,000.

1. How much of the joint cost of the apples is allocated to the pulp?
2. Compute the total inventory cost (and therefore the cost of goods sold) for the pulp.
3. Assume that $130,000 was spent to press the apples and $150,000 was spent to filter, pasteurize, and pack the apple juice. Compute the total inventory cost of the apple juice produced.

P5-7 JIT AND NON-VALUE-ADDED ACTIVITIES. A motorcycle manufacturer was concerned with declining market share because of foreign competition. To become more efficient, the company was considering changing to a just-in-time (JIT) production system. As a first step in analyzing the feasibility of the change, the company identified its major activities. Among the 120 activities were the following:

Materials receiving and inspection
Production scheduling
Production set-up
Rear-wheel assembly
Move engine from fabrication to assembly building
Assemble handlebars
Paint inspection
Rework defective brake assemblies
Instal speedometer
Put completed motorcycle in finished goods storage

1. From the list of 10 activities given above, prepare two lists—one of value-added activities and one of non-value-added activities.
2. For each non-value-added activity, explain how a JIT production system might eliminate, or at least reduce, the cost of the activity.

P5-8 COST ASSIGNMENT AND ALLOCATION. Hwang Manufacturing Company has two departments—machining and finishing. For a given period, the following costs were incurred by the company as a whole: direct materials, $120,000; direct labour, $60,000; and manufacturing overhead, $78,000. The total costs were $258,000.

The machining department incurred 80 percent of the direct-materials costs, but only 20 percent of the direct-labour costs. As is commonplace, manufacturing

overhead incurred by each department was allocated to products in proportion to the direct-labour costs of products within the departments.

Three products were produced:

PRODUCT	DIRECT MATERIALS	DIRECT LABOUR
X-1	50%	33⅓%
Y-1	25	33⅓
Z-1	25	33⅓
Total for the machining department	100%	100%
X-1	33⅓%	40%
Y-1	33⅓	40
Z-1	33⅓	20
Total added by finishing department	100%	100%

The manufacturing overhead incurred by the machining department and allocated to all products therein amounted to the following: machining, $36,000; finishing, $42,000.

1. Compute the total costs incurred by the machining department and added by the finishing department.
2. Compute the total costs of each product that would be shown as finished goods inventory if all the products were transferred to finished stock upon completion.

P5-9 COST ALLOCATION AND ACTIVITY-BASED ACCOUNTING. The cordless phone manufacturing division of a consumer electronics company uses activity-based accounting. For simplicity, assume that its accountants have identified only the following three activities and related cost drivers for manufacturing overhead:

ACTIVITY	COST DRIVER
Materials handling	Direct materials cost
Engineering	Engineering change orders
Power	Kilowatt hours

Three types of cordless phones are produced: SA2, SA5, and SA9. Direct costs and cost-driver activity for each product for a recent month are:

	SA2	SA5	SA9
Direct materials cost	$25,000 (12.5%)	$50,000 (25%)	$125,000 (62.5%)
Direct labour cost	$4,000 (50%)	$1,000 (12.5%)	$3,000 (37.5%)
Kilowatt hours	50,000 (12.5%)	200,000 (50%)	150,000 (37.5%)
Engineering change orders	13 (65%)	5 (25%)	2 (10%)

Manufacturing overhead for the month was

Materials handling	$ 8,000
Engineering	20,000
Power	16,000
Total manufacturing overhead	$44,000

1. Compute the manufacturing overhead allocated to each product with the activity-based accounting system.
2. Suppose all manufacturing overhead costs have been allocated to products in proportion to their direct labour costs. Compute the manufacturing overhead allocated to each product.
3. In which product costs—those in requirement 1 or those in requirement 2—do you have the most confidence? Why?

P5-10 HOSPITAL ALLOCATION BASE. Jade Soon, the administrator of Saint Jude Hospital, is interested in obtaining more accurate cost allocations on the basis of cause and effect. The $180,000 of laundry costs had been allocated on the basis of 600,000 kilograms processed for all departments, or $.30 per kilogram.

Soon is concerned that government health-care officials will require weighted statistics to be used for cost allocation. She asks you, "Please develop a revised base for allocating laundry costs. It should be better than our present base, but should not be overly complex either."

You study the situation and find that the laundry processes a large volume of uniforms for student nurses and physicians, and for dietary, housekeeping, and other personnel. In particular, the coats or jackets worn by personnel in the radiology department require unusual handwork.

A special study of laundry for radiology revealed that 7,500 of the 15,000 kilograms were jackets and coats that were five times more expensive to process than regular laundry items. A number of reasons explained the difference, but it was principally because of handwork involved.

Ignore the special requirements of the departments other than radiology. Revise the cost-allocation base and compute the new cost-allocation rate. Compute the total cost charged to radiology using kilograms and using the new base.

P5-11 COST OF PASSENGER TRAFFIC. Northern Pacific Railroad (NP) has a commuter operation that services passengers along a route between San Jose and San Francisco. Problems of cost allocation were highlighted in a news story about NP's application to the Public Utilities Commission (PUC) for a rate increase. The PUC staff claimed that the "avoidable annual cost" of running the operation was $700,000, in contrast to NP officials' claim of a loss of $9 million. PUC's estimate was based on what NP would be able to save if it shut down the commuter operations.

The NP loss estimate was based on a "full-allocation-of-costs" method, which allocates a share of common maintenance and overhead costs to the passenger service.

If the PUC accepted its own estimate, a 25 percent fare increase would have been justified, whereas NP sought a 96 percent fare increase.

The PUC stressed that commuter costs represent less than 1 percent of the systemwide costs of NP and that 57 percent of the commuter costs are derived from some type of allocation method—sharing the costs of other operations.

NP's representative stated that "avoidable cost" is not an appropriate way to allocate costs for calculating rates. He said that "it is not fair to include just so-called above-the-rail costs" because there are other real costs associated with commuter service. Examples are maintaining smoother connections and making more frequent track inspections.

1. As Public Utilities Commissioner, what approach toward cost allocation would you favour for making decisions regarding fares? Explain.

2. How would fluctuations in freight traffic affect commuter costs under the NP method?

P5-12 ALLOCATING AUTOMOBILE COSTS. The motor pool of a Megalopolis provides automobiles for the use of various city departments. Currently, the motor pool has 50 autos. A recent study showed that it costs $3,600 of annual fixed cost per automobile plus $.10 per kilometre variable cost to own, operate, and maintain autos such as those provided by the motor pool.

Each month, the costs of the motor pool are charged to the user departments on the basis of kilometres driven. On average, each auto is driven 24,000 kilometres annually, although wide month-to-month variations occur. In April 2001, the 50 autos were driven a total of 50,000 kilometres. The motor pool's total costs for April were $24,000.

The chief planner for the city always seemed concerned about her auto costs. She was especially upset in April when she was charged $7,200 for the 15,000 kilometres driven in the department's five autos. This is the normal monthly mileage in the department. Her memo to the head of the motor pool stated, "I can certainly get autos at less than the $.48 per kilometre you charged in April." The response was, "I am under instructions to allocate the motor-pool costs to the user departments. Your department was responsible for 30 percent of the April usage (15,000 kilometres ÷ 50,000 kilometres), so I allocated 30 percent of the motor pool's April costs to you (.30 × $24,000). That just seems fair."

1. Calculate the city's average annual cost per kilometre for owning, maintaining, and operating an auto.
2. Explain why the allocated cost in April ($.48 per kilometre) exceeds the average in requirement 1 above.
3. Describe any undesirable behavioural effects of the cost-allocation method used.
4. How would you improve the cost-allocation method?

P5-13 ALLOCATION OF COSTS. The Pegasus Trucking Company has one service department and two regional operating departments. The budgeted cost behaviour pattern of the service department is $750,000 monthly in fixed costs plus $.80 per 1,000 tonne-kilometres operated in the East and West regions. (Tonne-kilometres are the number of metric tonnes carried times the number of kilometres travelled.) The actual monthly costs of the service department are allocated using tonne-kilometres operated as the cost driver.

1. Pegasus processed 500-million tonne-kilometres of traffic in April, half for each operating region. The actual costs of the services department were exactly equal to those predicted by the budget for 500-million tonne-kilometres. Compute the costs that would be allocated to each operation region.
2. Suppose the East region was plagued by strikes, so that the freight handled was much lower than originally anticipated. East moved only 150-million tonne-kilometres of traffic. The West region handled 250-million tonne-kilometres. The actual costs were exactly as budgeted for this lower level of activity. Compute the costs that would be allocated to East and West. Note that the total costs will be lower.

3. Refer to the facts in requirement 1 above. Various inefficiencies caused the service department to incur costs of $1,275,000. Compute the costs to be allocated to East and West. Are the allocations justified? If not, what improvement do you suggest?
4. Refer to the facts in requirement 2 above. Assume that assorted investment outlays for equipment and space in the service department were made to provide a basic maximum capacity to serve the East Region at a level of 360-million tonne-kilometres and the West region at a level of 240-million tonne-kilometres. Suppose fixed costs are allocated on the basis of this capacity to serve. Variable costs are assigned by using a predetermined standard rate per 1,000 tonne-kilometres. Compute the costs to be allocated to each department. What are the advantages of this method over other methods?

P5-14 HOSPITAL EQUIPMENT. Many provinces have a hospital regulatory board that must approve the acquisition of specified medical equipment before the hospitals in the province can qualify for cost-based reimbursement related to that equipment. That is, hospitals cannot bill government agencies for the later use of the equipment unless the board originally authorized the acquisition.

Two hospitals in one such province proposed the acquisition and sharing of some expensive X-ray equipment to be used for unusual cases. The amortization and related fixed costs of operating the equipment were predicted at $12,000 per month. The variable costs were predicted at $30 per patient procedure.

The board asked each hospital to predict its usage of the equipment over its expected useful life of five years. Premier Hospital predicted an average usage of 75 X-rays per month, and St. Mary's Hospital predicted 50 X-rays per month. The commission regarded this information as critical to the size and degree of sophistication that would be justified. That is, if the number of X-rays exceeded a certain quantity per month, a different configuration of space, equipment, and personnel would be required, which would mean higher fixed costs per month.

1. Suppose fixed costs are allocated on the basis of the hospitals' predicted average use per month. Variable costs are assigned on the basis of $30 per X-ray, the budgeted variable-cost rate for the current fiscal year. In October, Premier Hospital had 50 X-rays and St. Mary's Hospital had 50 X-rays. Compute the total costs allocated to Premier Hospital and St. Mary's Hospital.
2. Suppose the manager of the equipment had various operating inefficiencies so that the total October costs were $16,500. Would you change your answers in requirement 1? Why?
3. A traditional method of cost allocation does not use the method in requirement 1. Instead, an allocation rate depends on the actual costs and actual volume encountered. The actual costs are totalled for the month and divided by the actual number of X-rays during the month. Suppose the actual costs agreed exactly with the budget for a total of 100 actual X-rays. Compute the total costs allocated to Premier Hospital and St. Mary's Hospital. Compare the results with those in requirement 1. What is the major weakness in this traditional method? What are some of its possible behavioural effects?

4. Describe any undesirable behavioural effects of the method described in requirement 1. How would you counteract any tendencies toward deliberate false predictions of long-run usage?

P5-15 DIRECT METHOD FOR SERVICE DEPARTMENT ALLOCATION. Wheelock Controls Company has two producing departments, Mechanical Instruments and Electronic Instruments. In addition, there are two service departments, Building Services and Materials Receiving and Handling. The company purchases a variety of component parts from which the departments assemble instruments for sale in domestic and international markets.

The Electronic Instruments division is highly automated. The manufacturing costs depend primarily on the number of subcomponents in each instrument. In contrast, the Mechanical Instruments division relies primarily on a large labour force to hand-assemble instruments. Its costs depend on direct labour hours.

The cost of Building Services depend primarily on the square metres occupied. The costs of Materials Receiving and Handling depend primarily on the total number of components handled.

Instruments M1 and M2 are produced in the Mechanical Instruments department, and E1 and E2 are produced in the Electronic Instruments department. Information about these products is as follows:

	DIRECT MATERIALS COST	NUMBER OF COMPONENTS	DIRECT LABOUR HOURS
M1	$74	25	4.0
M2	86	21	8.0
E1	63	10	1.5
E2	91	15	1.0

Budget figures for 2002 include:

	BUILDING SERVICES	MATERIALS RECEIVING AND HANDLING	MECHANICAL INSTRUMENTS	ELECTRONIC INSTRUMENTS
Direct department costs (excluding direct materials cost)	$150,000	$120,000	$680,000	$548,000
Square metres occupied		5,000	50,000	25,000
Number of final instruments produced			8,000	10,000
Average number of components per instrument			10	16
Direct labour hours			30,000	8,000

1. Allocate the costs of the service departments using the direct method.
2. Using the results of requirement 1, compute the cost per comonent in the Electronic Instruments department.
3. Using the results of requirement 2, compute the cost per unit of roduct for insruments M1, M2, E1, and E2

P5-16 STEP-DOWN METHOD FOR SERVICE DEPARTMENT ALLOCATION. Refer to the data in Problem 5-15.

1. Allocate the costs of the service departments using the step-down method.
2. Using the results of requirement 1, compute the cost per direct-labour hour in the Mechanical Instruments department and the cost per component in the Electronic Instruments department.
3. Using the results of requirement 2, compute the cost per unit of product for instruments M1, M2, E1, and E2.

P5-17 ACTIVITY-BASED COSTING. Reliable Machining Products (RMP) is an automotive component supplier. RMP has been approached by Chrysler with a proposal to significantly increase production of Part T151A to a total annual quantity of 100,000. Chrysler believes that by increasing the volume of production of Part T151A, RMP should realize the benefits of economies of scale and hence should accept a lower price than the current $6 per unit. Currently, RMP's gross margin on Part T151A is 3.3 percent, computed as follows:

The 400 percent overhead allocation rate is based on $3,300,000 annual factory overhead divided by $825,000 annual direct labour.

	TOTAL	PER UNIT (÷100,000)
Direct materials	$150,000	$1.50
Direct labour	86,000	.86
Factory overhead [400% × direct labour]	344,000	3.44
Total cost	$580,000	$5.80
Sales price		6.00
Gross margin		$ .20
Gross margin percentage		3.3%

Activity Centre: Cost Drivers	Annual Cost Driver Quantity
Quality: No. of pieces scrapped	10,000
Production Scheduling and Set-up:	
No. of set-ups	500
Shipping: No. of containers shipped	60,000
Shipping Administration: No. of shipments	1,000
Production: No. of machine hours	10,000

Part T151A seems to be a marginal profit product. If additional volume of production of Part T151A is to be added, RMP management believes that the sales price must be increased, not reduced as requested by Chrysler. The management of RMP sees this quoting situation as an excellent opportunity to examine the effectiveness of their traditional costing system versus an activity-based costing system. Data have been collected by a team consisting of accounting and engineering analysts.

Activity Centre	Traceable Factor Overhead Costs (Annual)
Quality	$800,000
Production Scheduling	50,000
Set-Up	600,000
Shipping	300,000
Shipping Administration	50,000
Production	1,500,000
Total costs	$3,300,000

The accounting and engineering team has provided the following cost-driver consumption estimates for the production of 100,000 units of Part T151A:

Cost Driver	Cost-Driver Consumption
Pieces scrapped	1,000
Set-ups	12
Containers shipped	500
Shipments	100
Machine hours	500

1. Prepare a schedule calculating the unit cost and gross margin of Part T151A using the activity-based costing approach.
2. Based on the ABC results, what course of action would you recommend regarding the proposal by Chrysler? List the benefits and costs associated with implementing an activity-based costing system at RMP.

P5-18 DIRECT AND STEP-DOWN METHODS OF ALLOCATION. General Textiles Company has prepared departmental overhead budgets for normal activity levels before reapportionments, as follows:

Building and grounds	$ 20,000
Personnel	1,200
General factory administration*	28,020
Cafeteria operating loss	1,430
Storeroom	2,750
Machining	35,100
Assembly	56,500
	$145,000

*To be reapportioned before cafeteria.

Management has decided that the most sensible product costs are achieved by using departmental overhead rates. These rates are developed after appropriate service department costs are allocated to production departments.

Cost drivers for allocation are to be selected from the following data:

DEPARTMENT	DIRECT LABOUR HOURS	NUMBER OF EMPLOYEES	SQUARE METRES OF FLOOR SPACE OCCUPIED	TOTAL LABOUR HOURS	NUMBER OF REQUISITIONS
Building and grounds	—	—	—	—	—
Personnel*	—	—	2,000	—	—
General factory administration	—	35	7,000	—	—
Cafeteria operating loss	—	10	4,000	1,000	—
Storeroom	—	5	7,000	1,000	—
Machining	5,000	50	30,000	8,000	3,000
Assembly	15,000	100	50,000	17,000	1,500
	20,000	200	100,000	27,000	4,500

* Basis used is number of employees.

1. Allocate service-department costs by the step-down method. Develop overhead rates per direct labour hour for machining and assembly.
2. Same as requirement 1, using the direct method.
3. What would be the blanket plantwide factory-overhead application rate, assuming that direct labour hours are used as a cost driver?
4. Using the following information about Job K10 and Job K11, prepare three different total overhead costs for each job, using rates developed in requirements 1, 2, and 3.

	DIRECT LABOUR HOURS	
	MACHINING	ASSEMBLY
Job K10	19	2
Job K12	3	18

P5-19 JOINT COSTS AND DECISIONS. A chemical company has a batch process that takes 1,000 litres of a raw material and transforms it into 80 kilograms of X-1 and 400 kilograms of X-2. Although the joint costs of their production are $1,200, both products are worthless at their split-off point. Additional separable costs of $350 are necessary to give X-1 a sales value of $1,000 as Product A. Similarly, additional separable costs of $200 are necessary to give X-2 a sales value of $1,000 as Product B.

You are in charge of the batch process and the marketing of both products. (Show your computations for each answer.)

1. **a.** Assuming that you believe in assigning joint costs on a physical basis, allocate the total profit of $250 per batch to Products A and B.
   b. Would you stop processing one of the products? Why?
2. **a**. Assuming that you believe in assigning joint costs on a net-realizable-value (relative-sales-value) basis, allocate the total operating profit of $250 per batch to Products A and B. If there is no market for X-1 and X-2 at their split-off point, a net realizable value is usually imputed by taking the ultimate sales value at the point of sale and working backward to obtain approximated "synthetic" relative sales values at the split-off point. These synthetic values are then used as weights for allocating the joint costs to the products.

b. You have internal product-profitability reports in which joint costs are assigned on a net-realizable-value basis. Your chief engineer says that, after seeing these reports, she has developed a method of obtaining more of Product B and correspondingly less of Product A from each batch, without changing the per-kilogram cost factors. Would you approve this new method? Why? What would the overall operating profit be if 40 kilograms more of B were produced and 40 kilograms less of A?

P5-20 ALLOCATION, DEPARTMENT RATES, AND DIRECT LABOUR HOURS VERSUS MACHINE-HOURS. The Manning Manufacturing company has two producing departments, machining and assembly. Mr. Manning recently automated the machining department. The installation of a computer-aided manufacturing (CAM) system, together with robotic workstations, drastically reduced the amount of direct labour required. Meanwhile the assembly department remained labour-intensive.

The company had always used one firmwide rate based on direct labour hours as the cost driver for applying all costs (except direct materials) to the final products. Mr. Manning was considering two alternatives: (1) continue using direct labour hours as the only cost driver, but use different rates in machining and assembly, and (2) use machine-hours as the cost driver in the machining department while continuing with direct labour hours in assembly.

Budgeted data for 2001 are:

	MACHINING	ASSEMBLY	TOTAL
Total cost (except direct materials), after allocating service department costs	$630,000	$450,000	$1,080,000
Machine hours	105,000	*	105,000
Direct labour hours	15,000	30,000	45,000

*Not applicable

	MACHINE-HOURS OF MACHINING	DIRECT LABOUR HOURS IN MACHINING	DIRECT LABOUR HOURS IN ASSEMBLY
Product A	10.0	1.0	14.0
Product B	17.0	1.5	3.0
Product C	14.0	1.3	8.0

1. Suppose Manning continued to use one firmwide rate based on direct labour hours to apply all manufacturing costs (except direct materials) to the final products. Compute the cost-application rate that would be used.
2. Suppose Manning continued to use direct labour hours as the only cost driver but used different rates on machining and assembly:
   a. Compute the cost-application rate for machining.
   b. Compute the cost-application rate for assembly.
3. Suppose Manning changed the cost accounting system to use machine-hours as the cost driver in machining and direct labour hours in assembly:
   a. Compute the cost-application rate for machining.
   b. Compute the cost-application rate for assembly.
4. Three products use the following machine-hours and direct labour hours:

a. Compute the manufacturing cost of each product (excluding direct materials) using one firmwide rate based on direct labour hours.
b. Compute the manufacturing cost of each product (excluding direct materials) using direct labour hours as the cost driver, but with different cost-application rates in machining and assembly.
c. Compute the manufacturing cost of each product (excluding direct materials) using a cost-application rate based on direct labour hours in assembly and machine-hours in machining.
d. Compare and explain the result in requirements 4a, 4b, and 4c.

P5-21 MULTIPLE ALLOCATION BASES. The Glasgow Electronics Company produces three types of circuit boards; L, M, and N. The cost accounting system used by Glasgow until 1999 applied all costs except direct materials to the products using direct labour hours as the only cost driver. In 1999 the company undertook a cost study. The study determined that there were six main factors causing costs to be incurred. A new system was designed with a separate cost pool for each of the six factors. The factors and the costs associated with each are as follows:

1. Direct labour hours—direct labour cost and related fringe benefits and payroll taxes.
2. Machine-hours—amortization and repairs and maintenance costs.
3. Kilograms of materials—materials receiving, handling, and storage costs.
4. Number of production setups—labour used to change machinery and computer configurations for a new production batch.
5. Number of production orders—costs of production scheduling and order processing.
6. Number of orders shipped—all packaging and shipping expenses.

The company is now preparing a budget for 2001. The budget includes the following predictions:

	BOARD L	BOARD M	BOARD N
Units to be produced	10,000	800	5,000
Direct material cost	£66/unit	£88/unit	£45/unit
Direct labour hours	4/unit	18/unit	9/unit
Machine hours	7/unit	15/unit	7/unit
Kilograms of materials	3/unit	4/unit	2/unit
Number of production setups	100	50	50
Number of production orders	300	200	70
Number of orders shipped	1,000	800	2,000

The total budgeted cost for 2001 is £3,712,250, of which £955,400 was direct materials cost, and the amount in each of the six pools defined above is:

COST POOL	COST
1	£1,391,600
2	936,000
3	129,600
4	160,000
5	25,650
6	114,000
Total	£2,756,850

1. Prepare a budget that shows the total budgeted cost and the unit cost for each circuit board. Use the new system with six cost pools (plus a separate direct application of direct materials cost).
2. Compute the budgeted total and unit costs of each circuit board if the old direct labour hour-based system had been used.
3. How would you judge whether the new system is better than the old one?

P5-22 ALLOCATING CENTRAL COSTS. The Central Railroad allocates all central corporate overhead costs to its divisions. Some costs, such as specified internal auditing and legal costs, are identified on the basis of time spent. However, other costs are harder to allocate, so the revenue achieved by each division is used as an allocation base. Examples of such costs were executive salaries, travel, secretarial, utilities, rent, amortization, donations, corporate planning, and general marketing costs.

Allocations on the basis of revenue for 2001 were (in millions):

DIVISION	REVENUE	ALLOCATED COSTS
Northern	$120	$ 7
Mesa	240	14
Plains	240	14
Total	$600	$35

In 2002, Northern's revenue remained unchanged. However, Plains' revenue soared to $280 million because of unusually bountiful crops. The latter are troublesome to forecast because unpredictable weather has a pronounced influence on volume. Mesa had expected a sharp rise in revenue, but severe competitive conditions resulted in a decline to $200 million. The total cost allocated on the basis of revenue was again $35 million, despite rises in other costs. The president was pleased that central costs did not rise for the year.

1. Compute the allocations of costs to each division for 2002.
2. How would each division manager probably feel about the cost allocation in 2002 as compared with 2001? What are the weaknesses of using revenue as a basis for cost allocation?
3. Suppose the budgeted revenues for 2002 were $120 million, $240, and $280, respectively, and the budgeted revenues were used as a cost driver for allocation. Compute the allocations of costs to each division for 2002. Do you prefer this method to the one used in requirement 1? Why?
4. Many accountants and managers oppose allocating any central costs. Why?

P5-23 ALLOCATION OF SERVICE-DEPARTMENT COSTS. Chief Cleaning, Inc., provides cleaning services for a variety of clients. The company has two producing divisions, Residential and Commercial, and two service-departments, Personnel and Administrative. The company has decided to allocate all service-department costs to the producing departments: Personnel, on the basis of number of employees, and Administrative, on the basis of direct department costs. The budget for 2002 shows the following:

	PERSONNEL	ADMINISTRATIVE	RESIDENTIAL	COMMERCIAL
Direct department costs	$70,000	$90,000	$ 240,000	$ 400,000
Number of employees	3	5	12	18
Direct labour hours			24,000	36,000
Square metres cleaned			4,500,000	9,970,000

1. Allocate service-department costs using the direct method.
2. Allocate service-department costs using the step-down method. The Personnel Department costs should be allocated first.
3. Suppose the company prices by the hour in the Residential Department and by the square metre cleaned in Commercial. Using the results of the step-down allocations in requirement 2,
   a. Compute the cost of providing one direct labour hour of service in the Residential Department.
   b. Compute the cost of cleaning one square metre of space in the Commercial Department.

P5-24 ACTIVITY-BASED COSTING. Yamaguchi Company makes printed circuit boards in a suburb of Kyoto. The production process is automated with computer-controlled robotic machines assembling each circuit board from a supply of parts. Yamaguchi has identified four activities:

ACTIVITY	COST DRIVER	RATE
Materials handling	Cost of direct materials	5% of materials cost
Assembly	Number of parts used	¥50 per part
Soldering	Number of circuit boards	¥1,500 per board
Quality assurance	Minutes of testing	¥400 per minute

Yamaguchi makes three types of circuit boards, Model A, Model B, and Model C. Requirements for production of 100 circuit boards are as follows:

	MODEL A	MODEL B	MODEL C
Direct materials cost	¥4,000	¥6,000	¥8,000
Number of parts used	60	40	20
Minutes of testing	5	3	2

1. Compute the cost of production of 100 of the three types of circuit boards and the cost per circuit board for each type.
2. Suppose the design of Model A could be simplified so that it required only 30 parts (instead of 60) and took only three minutes of testing time (instead of five). Compute the cost of 100 Model A circuit boards and the cost per circuit board.

P5-25 ACTIVITY-BASED COSTING. The Maori Novelty company makes a variety of souvenirs for visitors to New Zealand. The Otago Division manufactures stuffed kiwi birds using a highly automated operation. A recently installed activity-based costing system has four activities:

ACTIVITY	COST DRIVER	RATE
Materials receiving and handling	Kilograms of materials	$1.20 per kilogram
Production setup	Number of setups	$60 per setup
Cutting, sewing, and assembly	Number of units	$0.40 per unit
Packing and shipping	Number of orders	$10 per order

Two products are called "Standard Kiwi" and "Giant Kiwi." They require .20 and .40 kilograms of materials, respectively, at a materials cost of $1.30 for Standard Kiwis and $2.20 for Giant Kiwis. One computer-controlled assembly line makes all products. When a production run of a different product is started, a setup procedure is required to reprogram the computers and make other changes in the process. Normally, 600 Standard Kiwis are produced per setup, but only 240 Giant Kiwis. Products are packed and shipped separately, so a request from a customer for, say, three different products is considered three different orders.

Ausiland Waterfront Market just placed an order for 100 Standard Kiwis and 50 Giant Kiwis.

1. Compute the cost of products shipped to Ausiland Waterfront Market.
2. Suppose the products made for Ausiland Waterfront required "AWM" to be printed on each kiwi. Because of the automated process, printing the initials takes no extra time or materials, but it requires a special production setup for each product. Compute the cost of products shipped to the Ausiland Waterfront Market.
3. Explain how the activity-based costing system helps Maori Novelty to measure costs of individual products or orders better than a traditional system that allocates all non-materials costs based on direct labour.

P5-26 ACTIVITY-BASED ALLOCATIONS. Winnipeg Wholesaler Distributors uses an activity-based costing system to determine the cost of handling its products. One important activity is the receiving of shipments in the warehouse. Three resources support that activity: recording and record-keeping; labour; and inspection.

Recording and record-keeping is a cost driven by number of shipments received. The cost per shipment is $16.50.

Labour is driven by kilograms of merchandise received. Because labour is hired in shifts, it is fixed for large ranges of volume. Currently, labour costs are running $23,000 per month for handling 460,000 kilograms. This same cost would apply to all volumes between 300,000 kilograms and 550,000 kilograms.

Finally, inspection is a cost driven by the number of boxes received. Inspection costs are $2.75 per box.

One product distributed by Winnipeg Wholesale Distributors is candy. There is a wide variety of types of candy, so many different shipments are handled in the warehouse. In July the warehouse received 550 shipments, consisting of 4,000 boxes weighing a total of 80,000 kilograms.

1. Compute the cost of receiving shipments during July.
2. Management is considering elimination of brands of candy that have small sales levels. This would reduce the warehouse volume to 220 shipments, consisting of 2,500 boxes weighing a total of 60,000 kilograms. Compute the amount of savings from eliminating the small-sales-level brands.
3. Suppose receiving costs were estimated on a per kilogram basis. What was the total receiving cost per kilogram of candy received in July? If management had used this cost to estimate the effect of eliminating the 20,000 kilograms of candy, what mistake might be made?

P5-27 COLLABORATIVE LEARNING EXERCISE: LIBRARY RESEARCH ON ABC. Form groups of three to six students. Each student should choose a different article about activity-based costing (ABC) or activity-based management (ABM) from the current literature. The article should include evidence about at least one company's application of ABC. Such articles are available in a variety of sources. You might try bibliographic searches for "activity-based costing" or "activity-based management." Journals that will have articles on ABC and ABM include:

Management (CMA Magazine) (Canada)
Management Accounting (USA)
Management Accounting (United Kingdom)
Journal of Cost Management

1. After reading the article, note the following (if given in the article) for one company:
   a. The benefits of ABC or ABM
   b. The problems encountered in implementing ABC or ABM
   c. Suggestions by the author(s) about employing ABC or ABM
2. As a group, using the collective wisdom garnered from the articles, respond to the following:
   a. What kinds of companies can benefit from ABC or ABM?
   b. What kinds of companies have little to gain from ABC or ABM?
   c. What steps should be taken to ensure successful implementation of ABC or ABM?
   d. What potential pitfalls are there to avoid in implementing ABC or ABM?

CASES

C5-1 IDENTIFYING ACTIVITIES, RESOURCES, AND COST DRIVERS IN MANUFACTURING. Extrusion Plastics is a multinational, diversified organization. One of its manufacturing divisions, Northeast Plastics Division, has become less profitable due to increased competition. The division produces three major lines of plastic products within its single plant. Product Line A is high-volume, simple pieces produced in large batches. Product Line B is medium-volume, more complex pieces. Product Line C is low-volume, small-order, highly complex pieces.

Currently, the division allocates indirect manufacturing costs based on direct labour. The vp manufacturing is uncomfortable using the traditional cost

figures. He thinks the company is under-pricing the more complex products. He decides to conduct an activity-based costing analysis of the business.

Interviews were conducted with the key managers in order to identify activities, resources, cost drivers, and their interrelationships.

Interviewee: production manager

Q1: What activities are carried out in your area?

A1: *All products are manufactured using three similar, complex, and expensive molding machines. Each molding machine can be used in the production of the three product lines. Each setup takes about the same time irrespective of the product.*

Q2: Who works in your area?

A2: *Last year, we employed thirty machine operators, two maintenance mechanics, and two supervisors.*

Q3: How are the operators used in the molding process?

A3: *It requires nine operators to support a machine during the actual production process.*

Q4: What do the maintenance mechanics do?

A4: *Their primary function is to perform machine setups. However, they were also required to provide machine maintenance during the molding process.*

Q5: Where do the supervisors spend their time?

A5: *They provide supervision for the machine operators and the maintenance mechanics. For the most part, the supervisors appear to spend the same amount of time with each of the employees that they supervise.*

Q6: What other resources are used to support manufacturing?

A6: *The molding machines use energy during the molding process and during the setups. We put meters on the molding machines to get a better understanding of their energy consumption. We discovered that for each hour that a machine ran, it used 6.3 kilowatts of energy. The machines also require consumable shop suppliers (e.g., lubricants, hoses, etc.). We have found a direct correlation between the amount of suppliers used and the actual processing time.*

Q7: How is the building used, and what costs are associated with it?

A7: *We have a 100,000-square-metre building. The total rent and insurance costs for the year were $675,000. These costs are allocated to production, sales, and administration based on square metres.*

Required:

1. Identified the activities, resources, and cost drivers for the division.
2. For each resource identified in requirement 1, indicate its cost behaviour with respect to the activities it supports (assume a planning period of 1 month).

C5-2 CASE OF ALLOCATION OF DATA-PROCESSING COSTS. (CMA, adapted) Independent Outside Underwriters Co. (IOU) established a Systems Department two years ago to implement and operate its own data-processing systems. IOU believed that its own system would be more cost effective than the service bureau it had been using.

IOU's three departments—Claims, Records, and Finance—have different requirements with respect to hardware and other capacity-related resources and operating resources. The system was designed to recognize these differing needs. In addition, the system was designed to meet IOU's long-term capacity needs. The excess capacity designed into the system would be sold to outside users until needed by IOU. The estimated resource requirements used to design and implement the system are shown in the following schedule.

	HARDWARE AND OTHER CAPACITY-RELATED RESOURCES	OPERATING RESOURCES
Records	25%	60%
Claims	50	15
Finance	20	20
Expansion (outside use)	5	5
Total	100%	100%

IOU currently sells the equivalent of its expansion capacity to a few outside clients. At the time the system became operational, management decided to redistribute total expenses of the Systems Department to the user departments based on actual computer time used. The actual costs for the first quarter of the current fiscal year were distributed to the user departments as follows:

DEPARTMENT	PERCENTAGE UTILIZATION	AMOUNT
Records	60%	$330,000
Claims	15	82,500
Finance	20	110,000
Outside	5	27,500
Total	100%	$550,000

The three user departments have complained about the cost distribution method since the Systems Department was established. The Records Department's monthly costs have been as much as three times the costs experienced with the service bureau. The Finance Department is concerned about the costs distributed to the outside-user category because these allocated costs form the basis for the fees billed to the outside clients.

Jerry Owens, IOU's controller, decided to review the cost-allocation method. The additional information he gathered for his review is reported in Exhibits 5A-1, 5A-2, and 5A-3.

Owens has concluded that the method of cost allocation should be changed. He believes that the hardware and capacity-related costs should be allocated to the user departments in proportion to the planned long-term needs. Any difference between actual and budgeted hardware costs would not be allocated to the departments but remain with the Systems Department.

The costs for software development and operations would be charged to the user departments based on actual hours used. A pre-determined hourly rate based on the annual budget data would be used. The hourly rates that would be used for the current fiscal year are as follows:

FUNCTION	HOURLY RATE
Software development	$ 30
Operations:	
Computer related	200
Input/output related	10

EXHIBIT 5A-1

Systems-Department Costs and Activity Levels

	ANNUAL BUDGET		FIRST QUARTER			
			BUDGET		ACTUAL	
	HOURS	DOLLARS	HOURS	DOLLARS	HOURS	DOLLARS
Hardware and other capacity-related costs	—	$ 600,000	—	$150,000	—	$155,000
Software development	18,750	562,500	4,725	141,750	4,250	130,000
Operations:						
Computer related	3,750	750,000	945	189,000	920	187,000
Input/output related	30,000	300,000	7,560	75,600	7,900	78,000
		$2,212,500		$556,350		$550,000

EXHIBIT 5A-2

Historical Usage

	HARDWARE AND OTHER CAPACITY	DEVELOPMENT		OPERATIONS			
				COMPUTER		INPUT/OUTPUT	
DEPARTMENT	NEEDS	RANGE	AVERAGE	RANGE	AVERAGE	RANGE	AVERAGE
Records	25%	0-30%	15%	55-65%	60%	10-30%	15%
Claims	50	15-60	40	10-25	15	60-80	75
Finance	20	25-75	40	10-25	20	3-10	5
Outside	5	0-25	5	3-8	5	3-10	5
	100%		100%		100%		100%

EXHIBIT 5A-3

Usage of Systems Department's Services First Quarter (in hours)

		OPERATIONS	
	SOFTWARE DEVELOPMENT	COMPUTER RELATED	INPUT/OUTPUT
Records	450	540	1,540
Claims	1,800	194	5,540
Finance	1,600	126	410
Outside	400	60	410
Total	4,250	920	7,900

Owens plans to use first-quarter activity and cost data to illustrate his recommendations. The recommendations will be presented to the Systems Department and the user departments for their comments and reaction. He then expects to present his recommendations to management for approval.

Required:

1. Calculate the amount of data-processing costs that would be included in the Claims Department's first-quarter budget according to the method Jerry Owens has recommended.

Required:

2. Prepare a schedule to show how the actual first-quarter costs of the Systems Department would be charged to the users if Owens' recommended method were adopted.
3. Explain whether Owens' recommended system for charging costs to the user departments will
   a. improve cost control in the Systems Department, or
   b. improve planning and cost control in the user departments.

C5-3 COST DRIVERS AND PRICING DECISIONS. (SMAC) The Eastclock Corporation (EC) manufactures timing devices that are used in industrial settings. Recently, profits have fallen and management is seeking your advice as an outside consultant on changes which should be made.

During its 60-year history, EC has developed a strong and loyal customer base due largely to its reputation for quality timing devices. Significant investments in new computer-designed products and automated tooling have reduced operating costs and enabled EC to maintain its competitive edge. However, during the past three years, sales of its two major products have declined or have become stagnant. Had it not been for increased sales of its "custom" timing devices, EC would have incurred losses.

EC's basic product line consists of the "standard" model and the "deluxe" model. The "standard" model requires $8 in direct materials and requires one hour of direct labour (0.4 hours of machining and 0.6 hours of assembly). The "deluxe" model requires an additional $4 worth of direct materials and requires a total of 1.5 hours of direct labour (0.5 hours of machining and one hour of assembly). The standard labour rate is $12 per hour.

In addition to the basic product line, the company manufactures custom timing devices. The average direct material and direct labour costs for a custom timing device are approximately $20 and $30 per unit respectively. Each custom unit requires 2.5 hours of direct labour (0.8 hours of machining and 1.7 hours of assembly).

Indirect manufacturing overhead costs are significant and totalled $1,700,000 in 2001. Variable overhead costs include small tools, lubricants, and indirect labour charges. Fixed overhead costs consist of the following: Engineering (design and estimating) $80,000; Quality Control (set-up time and materials) $130,000; Amortization on buildings and equipment $690,000; and other costs such as property taxes, maintenance and supervisory salaries of $200,000. A complete income statement for 2001 is shown in Exhibit 5B-1 of this case.

As an outside consultant, you begin your analysis of the current situation by meeting with the controller, Jack Downie, in early January, 2002. Jack, who has no formal training in accounting, is nonetheless proud of the internal accounting system and the changes that he has introduced during the past five years. "We've spent a lot of time converting to the contribution format. We've carefully analyzed the variable and fixed costs using our little microcomputer and some pretty powerful software. I'm really confident that we've got an accurate handle on how costs behave as volume rises and falls in the various product lines. Because the volume of 'custom' orders has increased during the past three years, we have charged relatively more overhead to this line on each of the semi-annual statements. The 5 percent sales commission is tacked on to the analysis of each of the product lines and we charge out the fixed selling and administrative expenses based on the volume of orders processed."

EXHIBIT 5B-1

EASTCLOCK CORPORATION
Income Statement for the Year Ended December 31, 2001

	STANDARD	DELUXE	CUSTOM	TOTAL
Volume (units)	50,000	25,000	5,000	80,000
Revenue	$2,100,000	$1,575,000	$525,000	$4,200,000
VARIABLE COSTS:				
Material	400,000	300,000	100,000	800,000
Labour	600,000	450,000	150,000	1,200,000
Overhead[1]	300,000	225,000	75,000	600,000
Commission	105,000	78,750	26,250	210,000
Total variable costs	1,405,000	1,053,750	351,250	2,810,000
Contribution margin	695,000	521,250	173,750	1,390,000
FIXED COSTS:				
Engineering[2]	40,000	30,000	10,000	80,000
Quality control[2]	65,000	48,750	16,250	130,000
Amortization[2]	345,000	258,750	86,250	690,000
Other manufacturing[3]	125,000	62,500	12,500	200,000
Selling & administrative[3]	78,125	39,063	7,812	125,000
Total fixed costs	653,125	439,063	132,812	1,225,000
Net income	$ 41,875	$ 82,187	$ 40,938	$ 165,000

NOTES:

1. It has been reliably determined that variable overhead is a function of direct labour dollars.
2. Fixed manufacturing overhead (Engineering, Quality Control, and Amortization) is allocated to products based on their relative proportion of total direct labour dollars.
3. Other fixed manufacturing overhead and fixed selling and administrative expenses are allocated to products based on the relative volume of units sold.

Further discussions took place with the production people, including representatives of engineering, quality control, and the machining and assembly departments. Interviews also took place with representatives of the marketing and administrative departments. A summary of the highlights of these discussions follows:

Karl Bechtold (Engineering Department): "Our new computer-assisted design system has really changed the way we do things around here. When an order comes in, it is tagged as being either standard, deluxe, or custom. I'd guess that 75 percent of our time is spent on the custom orders as they usually require significant adaptations. I've pointed this out to the accounting people on several occasions, but they seem pretty tied up lately with their new computer. The standard model requires our attention from time to time but I'd guess that it's only about 5 percent. Revisions to the deluxe model are a little more complicated and take up the remainder of our efforts during the average month. If we were to return to more normal levels of production for the three products, I'd guess that we would spend about half of our time on the custom orders and split the remaining hours between the other two lines."

Harvey Ramsoomair (Quality Control): "Nothing leaves this plant that isn't strictly to our customers' specifications. It may not be what they wanted but it's guaranteed to be what they ordered. This sort of quality assurance is only possible by carefully monitoring the quality of our raw materials and the production process. We check the output of the work centres when they begin each job and monitor outputs randomly. Given that the standard and deluxe models are produced in large batches, I'd guess that they each currently take about 20 percent

of our time on a monthly basis. I couldn't be much more accurate than that because we only get official information on production volumes twice a year. If the volume of standard sales returned to its normal level, I'm sure that the amount of time for the two basic products would increase to about 30 percent per product. Whatever happens, the remaining time goes to the custom work, which really keeps us on our toes."

Fran Sprocket (Supervisor Machining & Assembly): "This new computer-aided manufacturing equipment has really changed our manufacturing procedures. I can remember just a few years ago how we had to carefully monitor each operation. Now, once we get the thing set up, all we have to do is monitor the output. This machinery is very expensive. The annual depreciation on the machinery is $230,000 for each of the product lines. I've never understood why the accounting system charges so little depreciation to the custom line given that we invested a lot in the machinery to accommodate these special orders for customers. The costs that are labelled as "other manufacturing" in the accounting reports seem to relate mostly to the volume of goods produced and sold. My biggest problem is scheduling the assembling hours. The physical layout of the plant restricts the amount of assembly space and, therefore, the number of hours that I can schedule. The maximum number of assembly hours is 70,000 and nothing can be done to increase this in the next 12 months."

Steve Wong (Marketing): "I don't feel that there is any problem with the costing system as far as marketing expenses are concerned. The amount of time, energy, and expense devoted to each of the product lines seems to depend on the volume of orders sold. The big problem I hear about from the salespeople centres around our prices. We're running about $5 above our competitors on the standard model and this is really cutting into our volume. If we could justify a more competitive price, I expect sales would jump to a more normal level of 74,000 units per year. We currently base all of our prices on a 50 percent mark-up over variable costs and then round off to the nearest dollar.

"My people are glad to see those custom orders rolling in. It's hard to find out what our competitors are charging for similar work but there is some evidence to suggest that our prices are way out of line compared to our competition. The strategy of the company is to market the standard and deluxe models and offer the custom model as a service to regular customers at a premium price. As a result, we would normally sell about 1,000 custom units per year, which is the level we operated at several years ago. With respect to the deluxe model, I feel that the current price is more or less correct and, thus, we expect that volume will remain at current levels for the foreseeable future."

Toni Anderson (Vice President): "We've got to turn this situation around or we'll have to sell out. The boss says he's been getting some pretty attractive offers from some American tool-and-die firms. I'd hate to see us sell out without a fight because I think we've got a responsibility to our employees— some of whom have been with us since high school. The bottom line is each product should cover its own costs and earn at least a profit margin of 10 percent before taxes this year."

Required:

Assume the role of the outside consultant. Prepare a report addressed to the management of Eastclock Corporation that clearly identifies and analyzes the issues it faces, and make specific recommendations for improvement. Also include a pro forma income statement for 2002 that incorporates your recommendations.

C5-4 COST ALLOCATION AND CONTRIBUTION MARGIN. (R. Anderson, adapted) An analogy helps to understand the treatment of costs incident to various types of operations. Consider the following conversation between a restaurant owner (Joe) and his Accountant-Efficiency-Expert (Eff Ex) about adding a rack of peanuts to the counter in an effort to pick up additional profit in the usual course of business. Some people may consider this conversation an oversimplification, but the analogy highlights some central issues in cost allocation.

Eff Ex: Joe, you said you put in these peanuts because some people ask for them, but do you realize what this rack of peanuts is *costing* you?

Joe: It isn't going to cost. It's going to be a profit. Sure, I had to pay $250 for a fancy rack to hold the bags, but the peanuts cost $.60 a bag and I will sell them for $1. I figure if I sell 50 bags a week to start, it'll take 121/2 weeks to cover the cost of the rack. After that I am going to clear a profit of $.40 a bag. The more I sell, the more I make.

Eff Ex: That is an antiquated and completely unrealistic approach, Joe. Fortunately, modern accounting procedures permit a more accurate picture, which reveals the complexities involved.

Joe: Huh?

Eff Ex: To be precise, those peanuts must be integrated into your entire operation and be allocated their appropriate share of business overhead. They must share a proportionate part of your expenditure for rent, heat, light, equipment amortization, decorating, salaries for your waitresses, cook ——

Joe: The *cook*? What does he have to do with the peanuts? He doesn't even have them!

Eff Ex: Look Joe, the cook is in the kitchen, the kitchen prepares the food, the food is what brings people in here, and the people ask to buy peanuts. That's why you must charge a portion of the cook's wages as well as part of your own salary to peanut sales. This sheet contains a carefully calculated cost analysis, which indicates that the peanut operation should pay exactly $12,780 per year toward these general overhead costs.

Joe: The peanuts? $12,780 a year for overhead? The nuts?

Eff Ex: It's really a little more than that. You also spend money each week to have the windows washed, have the place swept out in the mornings, keep soap in the washroom, and provide free soft drinks to the police. That raises the total to $13,130 per year.

Joe: [Thoughtfully] But the peanut salesman said that I would make money . . . put them on the end of the counter, he said . . . and get $.40 a bag profit . . .

Eff Ex: [With a sniff] He's not an accountant. Do you actually know what the portion of the counter occupied by the peanut rack is worth to you?

Joe: It's not worth anything . . . no stool there . . . just a dead spot at the end.

Eff Ex: The modern cost picture permits no dead spots. Your counter contains 20 square metres and your counter business grosses $150,000 a year. Consequently, the square metres of space occupied by the peanut rack is worth $2,500 per year. Since you have taken that area away from general counter use, you must charge the value of the space to the occupant.

Joe: You mean I have to add $2,500 a year more to the peanuts?

Eff Ex: Right. That raises their share of the general operating costs to a grand total of $15,630 per year. Now then, if you sell 50 bags of peanuts per week for 52 weeks, these allocated costs will amount to approximately $6 per bag.

Joe: *What*?

Eff Ex: Obviously, to that must be added your purchase price of $.60 per bag, which brings the total to $6.60. So you see by selling peanuts at $1 per bag, you are losing $5.60 on every sale.

Joe: Something is crazy!

Eff Ex: Not at all! Here are the *figures*. They *prove* your peanuts operation cannot stand on its own feet.

Joe: [Brightening] Suppose I sell *lots* of peanuts . . . say a thousand bags a week instead of fifty.

Eff Ex: [Tolerantly] Joe, you don't understand the problem. If the volume of peanuts sales increases, our operating costs will go up . . . you'll have to handle more bags with more time, more amortization, more everything. The basic principle of accounting is firm on that subject: "The Bigger the Operation, the More General Overhead Costs That Must Be Allocated." No, increasing the volume of sales won't help.

Joe: Okay, if you're so smart, *you* tell *me* what I have to do.

Eff Ex: [Condescendingly] Well . . . you could first reduce operating costs.

Joe: How?

Eff Ex: Move to a building with cheaper rent. Cut salaries. Wash the windows bi-weekly. Have the floor swept only on Thursday. Remove the soap from the washrooms. Decrease the square-metre value of your counter. For example, if you can cut your costs 50 percent, that will reduce the amount allocated to peanuts from $15,630 to $7,815 per year, reducing the cost to $3.60 per bag.

Joe: [Slowly] That's better?

Eff Ex: Much, much better. However, even then you would lose $2.60 per bag if you charge only $1. Therefore, you must also raise your selling price. If you want an income of $.40 per bag you would have to charge $4.00.

Joe: [Flabbergasted] You mean even after I cut operating costs by 50 percent I still have to charge $4 for a $1 bag of peanuts? Nobody's that nuts about nuts! Who would buy them?

Eff Ex: That's a secondary consideration. The point is, at $4 you'd be selling at a price based upon a true and proper evaluation of your then reduced costs.

Joe: [Eagerly] Look! I have a better idea. Why don't I just throw the nuts out?

Eff Ex: Can you afford it?

Joe: Sure. All I have is about 50 bags of peanuts . . . which cost about $30 . . . and I would lose $250 on the rack, but I would be out of this nut business with no more grief.

Eff Ex: [Shaking head] Joe it isn't that simple. You are in the peanut business! The minute you throw those peanuts out you are adding $15,630 of annual overhead to the rest of your operation. Joe . . . be realistic . . . *can you afford to do that*?

Joe: [Completely crushed] It's unbelievable! Last week I was making money. Now I'm in trouble . . . just because I think peanuts on the counter is going to bring in some extra profit . . . just because I believe 50 bags of peanuts a week is easy.

Eff Ex: [With raised eyebrow] That is the object of modern cost studies, Joe . . . to dispel those false illusions.

Required:

1. Is Joe losing $5.60 on every sale of peanuts? Explain.
2. Do you agree that if the volume of peanut sales is increased, operating losses will increase? Explain.
3. Do you agree with the Efficiency Expert that, in order to make the peanut operation profitable, the operating costs in the restaurant should be decreased and the selling price of the peanuts should be increased? Give reasons.
4. Do you think that Joe can afford to get out of the peanut business? Give reasons.
5. Do you think that Joe should eliminate his peanut operations? Why or why not?