

## Introduction to Managerial Accounting EBook

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Content

### Chapter3: Systems Design: Activity-Based Costing

## Chapter Opener

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#### A LOOK BACK

[Chapter 2](#) provided an overview of job-order costing. Direct materials and direct labor costs are traced directly to jobs.

Manufacturing overhead is applied to jobs using a predetermined overhead rate.

#### A LOOK AT THIS CHAPTER

In [Chapter 3](#), we continue the discussion of allocation of overhead in job-order costing. Activity-based costing is a technique that uses a number of allocation bases to assign overhead costs to products.

#### A LOOK AHEAD

After comparing job-order and process costing systems, we go into the details of a process costing system in [Chapter 4](#).

## CHAPTER OUTLINE

### Assigning Overhead Costs to Products

- Plantwide Overhead Rate
- Departmental Overhead Rates
- Activity-Based Costing (ABC)

### Designing an Activity-Based Costing System

- Hierarchy of Activities
- An Example of an Activity-Based Costing System Design

### Using Activity-Based Costing

- Comtek Sound, Inc.'s Basic Data
- Direct Labor-Hours as a Base
- Computing Activity Rates
- Computing Product Costs
- Shifting of Overhead Cost

### Targeting Process Improvements

### Evaluation of Activity-Based Costing

- The Benefits of Activity-Based Costing
- Limitations of Activity-Based Costing
- Activity-Based Costing and Service Industries

### Cost Flows in an Activity-Based Costing System

- An Example of Cost Flows

## LEARNING OBJECTIVES



*After studying Chapter 3, you should be able to:*

- LO1** Understand the basic approach in activity-based costing and how it differs from conventional costing.
- LO2** Compute activity rates for an activity-based costing system.
- LO3** Compute product costs using activity-based costing.
- LO4** Contrast the product costs computed under activity-based costing and conventional costing methods.
- LO5** Record the flow of costs in an activity-based costing system.



## The Payoff from Activity-Based Costing

Implementing an activity-based costing system can be expensive. To be worthwhile, the data supplied by

the system must actually be used to make decisions and improve profitability. **Insteel Industries** manufactures a range of products, such as concrete reinforcing steel, industrial wire, and bulk nails, for the construction, home furnishings, appliance, and tire manufacturing industries. The company implemented an activity-based costing system at its manufacturing plant in Andrews, South Carolina, and immediately began using activity-based data to make strategic and operating decisions.

In terms of strategic decisions, Insteel dropped some unprofitable products, raised prices on others, and in some cases even discontinued relationships with unprofitable customers. Insteel realized that simply discontinuing products and customers does not improve profits. The company needed to either deploy its freed-up capacity to increase sales, or it needed to eliminate its freed-up capacity to reduce costs. Insteel chose the former and used its activity-based costing system to identify which new business opportunities to pursue.

In terms of operational improvements, Insteel's activity-based costing system revealed that its 20 most expensive activities consumed 87% of the plant's \$21.4 million in physical and human resource costs. Almost \$4.9 million was being consumed by non-value-added activities. Teams were formed to reduce quality costs, material handling and freight costs, and maintenance costs. Within one year, quality costs had been cut by \$1,800,000 and freight costs by \$550,000. Overall, non-value-added activity costs dropped from 22% to 17% of total activity costs.

Source: V. G. Narayanan and R. Sarkar, "The Impact of Activity-Based Costing on Managerial Decisions at Insteel Industries—A Field Study," *Journal of Economics & Management Strategy*, Summer 2002, pp. 257–288.

**A**s discussed in earlier chapters, direct materials and direct labor costs can be directly traced to products. Overhead costs, on the other hand, cannot be easily traced to products. Some other means must be found for assigning them to products for financial reporting and other purposes. In the previous chapter, overhead costs were assigned to products using a plantwide predetermined overhead rate. This method is simpler than the methods of assigning overhead costs to products described in this chapter, but this simplicity has a cost. A plantwide predetermined overhead rate spreads overhead costs uniformly over products in proportion to whatever allocation base is used—most commonly, direct labor-hours. This procedure results in high overhead costs for products with a high direct labor-hour content and low overhead costs for products with a low direct labor-hour content. However, the real causes of overhead may have little to do with direct labor-hours and as a consequence, product costs may be distorted. Activity-based costing attempts to correct these distortions by more accurately assigning overhead costs to products.

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## Introduction to Managerial Accounting EBook

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### Chapter3: Systems Design: Activity-Based Costing

## Assigning Overhead Costs to Products

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#### LEARNING OBJECTIVE 1

Understand the basic approach in activity-based costing and how it differs from conventional costing.

Companies use three common approaches to assign overhead costs to products. The simplest method is to use a plantwide overhead rate. A slightly more refined approach is to use departmental overhead rates. The most complex method is activity-based costing, which is the most accurate of the three approaches to overhead cost assignment.

#### Plantwide Overhead Rate

The preceding chapter assumed that a single overhead rate, called a *plantwide overhead rate*, was used throughout an entire factory. This simple approach to overhead assignment can result in distorted unit product costs, as we shall see below.



When cost systems were developed in the 1800s, cost and activity data had to be collected by hand and all calculations were done with paper and pen. Consequently, the emphasis was on simplicity. Companies often established a single overhead cost pool for an entire facility or department as described in [Chapter 2](#). Direct labor was the obvious choice as an allocation base for overhead costs. Direct labor-hours were already being recorded for purposes of determining wages. In the labor-intensive production processes of that time, direct labor was a large component of product costs—larger than it is today. Moreover, managers believed direct labor and overhead costs were highly correlated. (Two variables, such as direct labor and overhead costs, are highly correlated if they tend to move together.) And finally, most companies produced a very limited variety of similar products, so in fact there was probably little difference in the overhead costs attributable to different products. Under these conditions, it was not cost-effective to use a more elaborate costing system.

Conditions have changed. Many companies now sell a large variety of products that consume significantly different amounts of overhead resources. Consequently, a costing system that assigns essentially the same overhead cost to every product may no longer be adequate. Additionally, factors other than direct labor often drive overhead costs.

On an economywide basis, direct labor and overhead costs have been moving in opposite directions for a long time. As a percentage of total cost, direct labor has been declining, whereas overhead has

been increasing. Many tasks previously done by hand are now done with largely automated equipment—a component of overhead. Furthermore, product diversity has increased. Companies are introducing new products and services at an ever-accelerating rate. Managing and sustaining this product diversity requires many more overhead resources such as production schedulers and product design engineers, and many of these overhead resources have no obvious connection with direct labor. Finally, computers, bar code readers, and other technology have dramatically reduced the costs of collecting and processing data—making more complex (and accurate) costing systems such as activity-based costing much less expensive to build and maintain.

Nevertheless, direct labor remains a viable base for applying overhead to products in some companies—particularly for external reports. Direct labor is an appropriate allocation base for overhead when overhead costs and direct labor are highly correlated. And indeed, most companies throughout the world continue to base overhead allocations on direct labor or machine-hours. However, if factorywide overhead costs do not move in tandem with factorywide direct labor or machine-hours, product costs will be distorted.

## Departmental Overhead Rates

Rather than use a plantwide overhead rate, many companies use departmental overhead rates with a different predetermined overhead rate in each production department. The nature of the work performed in a department will determine the department's allocation base. For example, overhead costs in a machining department may be allocated on the basis of machine-hours. In contrast, the overhead costs in an assembly department may be allocated on the basis of direct labor-hours.

Unfortunately, even departmental overhead rates will not correctly assign overhead costs in situations where a company has a range of products and complex overhead costs. The reason is that the departmental approach usually relies on a single measure of activity as the base for allocating overhead cost to products. For example, if the machining department's overhead is applied to products on the basis of machine-hours, it is assumed that the department's overhead costs are caused by, and are directly proportional to, machine-hours. However, the department's overhead costs are probably more complex than this and are caused by a variety of factors, including the range of products processed in the department, the number of batch setups that are required, the complexity of the products, and so on. A more sophisticated method like *activity-based costing* is required to adequately account for these diverse factors.

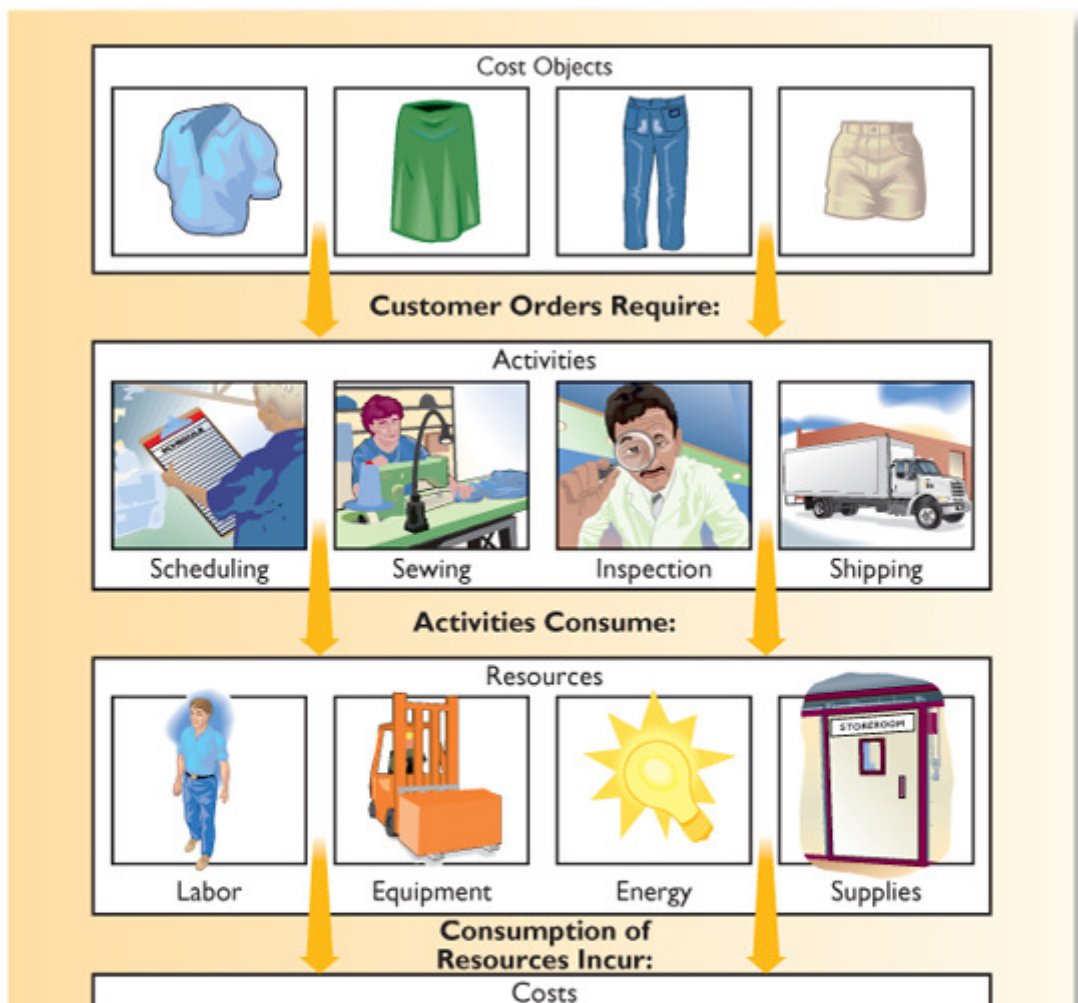
## Activity-Based Costing (ABC)

**Activity-based costing (ABC)** is a technique that attempts to assign overhead costs more accurately to products than the simpler methods discussed thus far. The basic idea underlying the activity-based costing approach is illustrated in [Exhibit 3-1](#). A customer order triggers a number of activities. For example, if [Nordstrom](#) orders a line of women's skirts from [Calvin Klein](#), a production order is generated, patterns are created, materials are ordered, textiles are cut to pattern and then sewn, and the finished products are packed for shipping. These activities consume resources. For example, ordering the appropriate materials consumes clerical time—a resource the company must pay for. In activity-based costing, an attempt is made to trace these costs directly to the products that cause them.

Rather than a single allocation base such as direct labor-hours or machine-hours, in activity-based costing a company uses a number of allocation bases for assigning costs to products. Each allocation base in an activity-based costing system represents a major *activity* that causes overhead costs. An **activity** in activity-based costing is an event that causes the consumption of overhead resources. Examples of activities in various organizations include the following:

- Setting up machines.
- Admitting patients to a hospital.
- Scheduling production.
- Performing blood tests at a clinic.
- Billing customers.
- Maintaining equipment.
- Ordering materials or supplies.
- Stocking shelves at a store.
- Meeting with clients at a law firm.
- Preparing shipments.
- Inspecting materials for defects.
- Opening an account at a bank.

**EXHIBIT 3-1 The Activity-Based Costing Model**





| Costs          |  |  |                   |  |  |
|----------------|--|--|-------------------|--|--|
| Account Title  |  |  | Account Title     |  |  |
| Dr.            |  |  | Dr.               |  |  |
| Cr.            |  |  | Cr.               |  |  |
| Salary Expense |  |  | Utilities Expense |  |  |
| XX             |  |  | XX                |  |  |
| Depreciation   |  |  | Supplies Expense  |  |  |
| XX             |  |  | XX                |  |  |

Activity-based costing focuses on these activities. Each major activity has its own overhead cost pool (also known as an *activity cost pool*), its own *activity measure*, and its own predetermined overhead rate (also known as an *activity rate*). An **activity cost pool** is a “cost bucket” in which costs related to a particular activity measure are accumulated. The **activity measure** expresses how much of the activity is carried out and it is used as the allocation base for applying overhead costs to products and services. For example, *the number of patients admitted* is a natural choice of an activity measure for the activity *admitting patients to the hospital*. An **activity rate** is a predetermined overhead rate in an activity-based costing system. Each activity has its own activity rate that is used to apply overhead costs to cost objects.

For example, the activity *setting up machines to process a batch* would have its own activity cost pool. Products are ordinarily processed in batches. And because each product has its own machine settings, machines must be set up when changing over from a batch of one product to another. If the total cost in this activity cost pool is \$150,000 and the total expected activity is 1,000 machine setups, the predetermined overhead rate (i.e., activity rate) for this activity would be \$150 per machine setup ( $\$150,000 \div 1,000 \text{ machine setups} = \$150 \text{ per machine setup}$ ). Each product that requires a machine setup would be charged \$150. Note that this charge does not depend on how many units are produced after the machine is set up. A small batch requiring a machine setup would be charged \$150—just the same as a large batch.

Taking each activity in isolation, this system works exactly like the job-order costing system described in the last chapter. A predetermined overhead rate is computed for each activity and then applied to jobs and products based on the amount of activity consumed by the job or product.

## IN BUSINESS

## Shedding Light on Product Profitability

**Reichhold, Inc.**, one of the world's leading suppliers of synthetic materials, has adopted activity-based costing. Reichhold's prior cost system used one allocation base, reactor hours, to assign overhead costs to products. The new ABC system uses four additional activity measures—preprocess preparation hours, thin-tank hours, filtration hours, and waste disposal costs per batch—to assign costs to products. Reichhold has adopted ABC in all 19 of its North American plants because the management team believes that ABC helps improve the company's “capacity management, cycle times, value-added pricing decisions, and analysis of product profitability.”

Source: Edward Blocher, Betty Wong, and Christopher McKittrick, “Making Bottom-Up ABC Work at Reichhold, Inc.,” *Strategic Finance*, April 2002, pp. 51–55.

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## Chapter3: Systems Design: Activity-Based Costing

### Designing An Activity-Based Costing System

**p. 132** The most important decisions in designing an activity-based costing system concern what activities will be included in the system and how the activities will be measured. In most companies, hundreds or even thousands of different activities cause overhead costs. These activities range from taking a telephone order to training new employees. Setting up and maintaining a complex costing system that includes all of these activities would be prohibitively expensive. The challenge in designing an activity-based costing system is to identify a reasonably small number of activities that explain the bulk of the variation in overhead costs. This is usually done by interviewing a broad range of managers in the organization to find out what activities they think are important and that consume most of the resources they manage. This often results in a long list of potential activities that could be included in the activity-based costing system. This list is refined and pruned in consultation with top managers. Related activities are frequently combined to reduce the amount of detail and record-keeping cost. For example, several actions may be involved in handling and moving raw materials, but these may be combined into a single activity titled *material handling*. The end result of this stage of the design process is an *activity dictionary* that defines each of the activities that will be included in the activity-based costing system and how the activities will be measured.

**p. 130** **EXHIBIT 3-2** Examples of Activities and Activity Measures in Manufacturing Companies

| Level   | Activities  | Activity Measures  |
|---|---|--|
| <i>Unit-level</i>   | Processing units on machines<br>Processing units by hand<br>Consuming factory supplies                  | Machine-hours<br>Direct labor-hours<br>Units produced  |
| <i>Batch-level</i>  | Processing purchase orders<br>Processing production orders<br>Setting up equipment<br>Handling material | Purchase orders processed<br>Production orders processed<br>Number of setups; setup hours<br>Pounds of material handled;<br>number of times material moved |
| <i>Product-level</i>  | Testing new products<br>Administering parts inventories<br>Designing products                           | Hours of testing time<br>Number of part types<br>Hours of design time  |
| <i>Facility-level</i>   | General factory administration<br>Plant building and grounds  | Direct labor-hours*<br>Direct labor-hours*   |
| *Facility-level costs cannot be traced on a cause-and-effect basis to individual products. Nevertheless, these costs are usually allocated to products for external reports using some arbitrary allocation basis such as direct labor-hours. |   |  |

Some of the activities commonly found in activity-based costing systems in manufacturing companies are listed in [Exhibit 3-2](#). In the exhibit, activities have been grouped into a four-level hierarchy: *unit-level activities*, *batch-level activities*, *product-level activities*, and *facility-level activities*. This cost hierarchy is useful in understanding the difference between activity-based costing and conventional approaches. It also serves as a guide when simplifying an activity-based costing system. In general, activities and costs should be combined in the activity-based costing system only if they fall within the same level in the cost hierarchy.

## IN BUSINESS

### Gastronomic Cost Drivers at the Club Med—Bora Bora



The Club Med—Bora Bora of Tahiti is a resort owned and operated by the French company [Club Med](#). Most guests buy all-inclusive packages that include lodging, participation in the resort's many activities, a full range of beverages, and sumptuous buffet meals. The resort's guests come from around the world including Asia, North America, South America, and Europe. The international nature of the club's guests poses challenges for the kitchen staff—for example, Japanese breakfasts feature miso soup, stewed vegetables in soy sauce, and rice porridge whereas Germans are accustomed to cold cuts, cheese, and bread for breakfast. Moreover, the number of guests varies widely from 300 in the high season to 20 in the low season. The chefs in the kitchen must ensure that food in the correct quantities and variety are available to please the club's varied clientele. To make this possible, a report is prepared each day that lists how many Japanese guests, German guests, French guests, Polish guests, U.S. guests, and so forth, are currently registered. This information helps the chefs prepare the appropriate quantities of specialized foods. In essence, costs in the kitchen are driven not by the number of guests alone, but by how many guests are Japanese, how many German, how many French, and so on. The costs are driven by multiple drivers.

Source: Conversation with Dominique Tredano, Chef de Village (i.e., general manager), Club Med—Bora Bora. For information about Club Med, see [www.clubmed.com](http://www.clubmed.com).

## Hierarchy of Activities

**Unit-level activities** are performed each time a unit is produced. The costs of unit-level activities should be proportional to the number of units produced. For example, providing power to run processing equipment is a unit-level activity because power tends to be consumed in proportion to the number of units produced.

**Batch-level activities** consist of tasks that are performed each time a batch is processed, such as processing purchase orders, setting up equipment, packing shipments to customers, and handling material. Costs at the batch level depend on *the number of batches processed* rather than on the number of units produced. For example, the cost of processing a purchase order is the same no matter how many units of an item are ordered.

**Product-level activities** (sometimes called *product-sustaining activities*) relate to specific products and typically must be carried out regardless of how many batches or units of the product are manufactured. Product-level activities include maintaining inventories of parts for a product, issuing engineering change notices to modify a product to meet a customer's specifications, and developing special test routines when a product is first placed into production.

**Facility-level activities** (also called *organization-sustaining activities*) are activities that are carried out regardless of which products are produced, how many batches are run, or how many units are made. Facility-level costs include items such as factory management salaries, insurance, property taxes, and building depreciation. The costs of facility-level activities must be allocated to products for external financial reports. This is usually accomplished by combining all facility-level costs into a single cost pool and allocating those costs to products using an arbitrary allocation base such as direct labor-hours. However, as we will see later in the book, allocating such costs to products results in misleading data that can lead to bad decisions.

### IN BUSINESS

### Dining in the Canyon





**Western River Expeditions** ([www.westernriver.com](http://www.westernriver.com)) runs river rafting trips on the Colorado, Green, and Salmon rivers. One of its most popular trips is a six-day trip down the Grand Canyon, which features famous rapids such as Crystal and Lava Falls as well as the awesome scenery accessible only from the bottom of the Grand Canyon. The company runs trips of one or two rafts, each of which carries two guides and up to 18 guests. The company provides all meals on the trip, which are prepared by the guides.

In terms of the hierarchy of activities, a guest can be considered as a unit and a raft as a batch. In that context, the wages paid to the guides are a batch-level cost because each raft requires two guides regardless of the number of guests in the raft. Each guest is given a mug to use during the trip and to take home at the end of the trip as a souvenir. The cost of the mug is a unit-level cost because the number of mugs given away is strictly proportional to the number of guests on a trip.

What about the costs of food served to guests and guides—is this a unit-level cost, a batch-level cost, a product-level cost, or an organization-sustaining cost? At first glance, it might be thought that food costs are a unit-level cost—the greater the number of guests, the higher the food costs. However, that is not quite correct. Standard menus have been created for each day of the trip. For example, the first night's menu might consist of shrimp cocktail, steak, cornbread, salad, and cheesecake. The day before a trip begins, all of the food needed for the trip is taken from the central warehouse and packed in modular containers. It isn't practical to finely adjust the amount of food for the actual number of guests planned to be on a trip—most of the food comes prepackaged in large lots. For example, the shrimp cocktail menu may call for two large bags of frozen shrimp per raft and that many bags will be packed regardless of how many guests are expected on the raft. Consequently, the costs of food are not a unit-level cost that varies with the number of guests actually on a trip. Instead, the costs of food are a batch-level cost.

Source: Conversations with Western River Expeditions personnel.

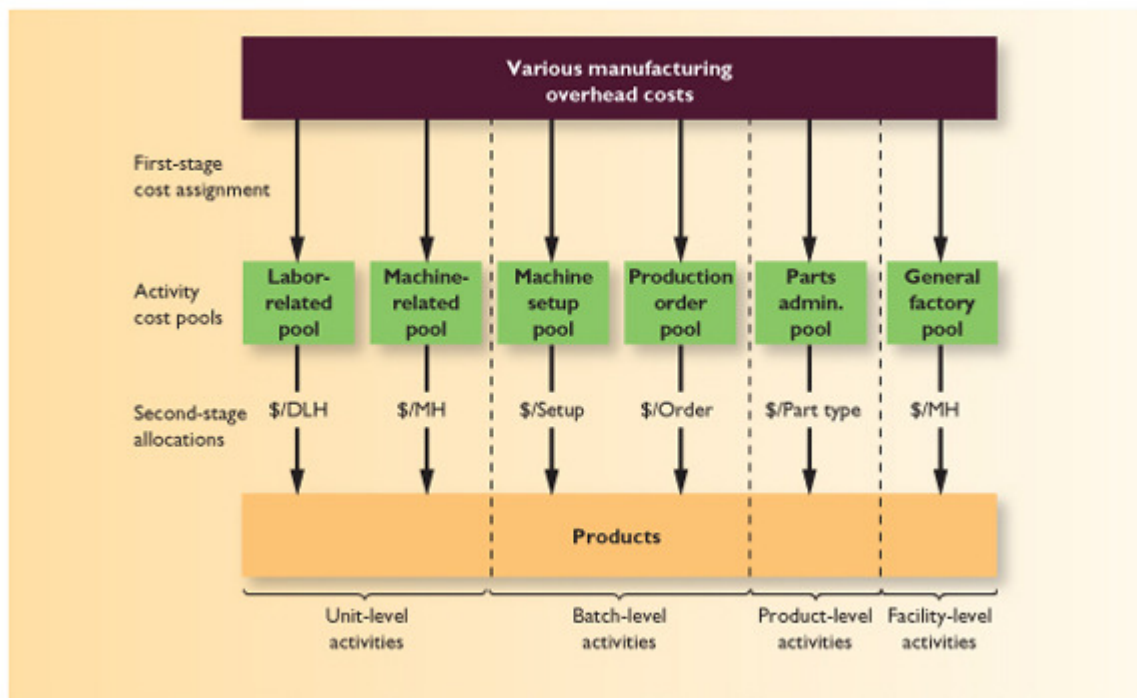
## An Example of an Activity-Based Costing System Design

The complexity of an activity-based costing system will differ from company to company. In some companies, the activity-based costing system will be simple with only one or two activity cost pools at the unit, batch, and product levels. For other companies, the activity-based costing system will be much more complex.

Under activity-based costing, the manufacturing overhead costs at the top of [Exhibit 3-3](#) are allocated to products via a two-stage process. In the first stage, overhead costs are assigned to the activity cost pools. In the second stage, the costs in the activity cost pools are allocated to products using activity

rates and activity measures. For example, in the first-stage cost assignment, various manufacturing overhead costs are assigned to the production-order activity cost pool. These costs could include the salaries of engineers who modify products for individual orders, the costs of scheduling and monitoring orders, and other costs that are incurred as a consequence of the number of different orders received and processed by the company. We will not go into the details of how these first-stage cost assignments are made. In all of the examples and assignments in this book, the first-stage cost assignments have already been completed. Once the amount of cost in the production-order activity cost pool is known, procedures from [Chapter 2](#) can be followed. The activity rate for the production-order cost pool is computed by dividing the total cost in the production-order activity cost pool by the anticipated number of orders for the upcoming year. For example, the total cost in the production-order activity cost pool might be \$450,000 and the company might expect to process a total of 1,200 orders. In that case, the activity rate would be \$375 per order. Each order would be charged \$375 for production-order costs. This is no different from the way overhead was applied to products in [Chapter 2](#) except that the number of orders is the allocation base rather than direct labor-hours.

### EXHIBIT 3-3 Graphic Example of Activity-Based Costing



1. Which of the following statements is false? (You may select more than one answer.)
  - a. In recent years, most companies have experienced increasing manufacturing overhead costs in relation to direct labor costs.
  - b. Activity-based costing systems may use direct labor-hours and/or machine-hours to assign unit-level costs to products.
  - c. Facility-level costs are not caused by particular products.



- d. Product-level costs are larger for high-volume products than for low-volume products.

## IN BUSINESS

### ABC Helps a Dairy Understand Its Costs



**Kemps LLC**, headquartered in Minneapolis, Minnesota, produces dairy products such as milk, yogurt, and ice cream. The company implemented an ABC system that helped managers understand the impact of product and customer diversity on profit margins. The ABC model “captured differences in how the company entered orders from customers (customer phone call, salesperson call, fax, truck-driver entry, EDI, or Internet), how it packaged orders (full stacks of six cases, individual cases, or partial break-pack cases for small orders), how it delivered orders (commercial carriers or its own fleet, including route miles), and time spent by the driver at each customer location.”

Kemps' ABC system helped the company acquire a large national customer because it identified “the specific manufacturing, distribution, and order handling costs associated with serving this customer.” The ability to provide the customer with accurate cost information built a trusting relationship that distinguished Kemps from other competitors. Kemps also used its ABC data to transform unprofitable customers into profitable ones. For example, one customer agreed to accept a 13% price increase, to eliminate two low-volume products, and to begin placing full truckload orders rather than requiring partial truckload shipments, thereby lowering Kemps' costs by \$150,000 per year.

Source: Robert S. Kaplan, and Steven R. Anderson, “Time-Driven Activity-Based Costing,” *Harvard Business Review*, November 2004, pp. 131–139.

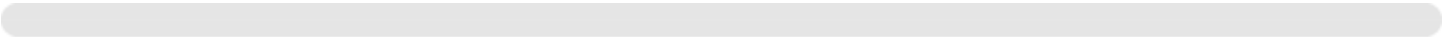
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## Chapter3: Systems Design: Activity-Based Costing

### Using Activity-Based Costing

p. 138 Different products place different demands on resources. This is not recognized by conventional costing systems, which assume that overhead resources are consumed in direct proportion to direct labor-hours or machine-hours. The following example illustrates the distortions in product costs that can result from using a traditional costing system.

Comtek Sound, Inc., makes two products, a radio with a built-in CD player (called a CD unit) and a radio with a built-in DVD player (called a DVD unit). Both of these products are sold to automobile manufacturers for installation in new vehicles. Recently, the company has been losing bids to supply CD players because competitors have been bidding less than Comtek Sound has been willing to bid. At the same time, Comtek Sound has been winning every bid it has submitted for its DVD player, which management regards as a secondary product. The marketing manager has been complaining that at the prices Comtek Sound is willing to bid, competitors are taking the company's high-volume CD business and leaving Comtek Sound with just the low-volume DVD business. However, the prices competitors quote on the CD players are below Comtek Sound's manufacturing cost for these units—at least according to Comtek Sound's conventional accounting system that applies manufacturing overhead to products based on direct labor-hours. Production managers suspected that the conventional costing system might be distorting the relative costs of the CD player and the DVD player—the DVD player takes more overhead resources to make than the CD player and yet their manufacturing overhead costs are identical under the conventional costing system. With the enthusiastic cooperation of the company's accounting department, a cross-functional team was formed to develop an activity-based costing system to more accurately assign overhead costs to the two products.

p. 134 **Comtek Sound, Inc.'s Basic Data**

The ABC team gathered basic information relating to the company's two products. A summary of some of this information follows. For the current year, the company's budget provides for selling 50,000 DVD units and 200,000 CD units. Both products require two direct labor-hours to complete. Therefore, the company plans to work 500,000 direct labor-hours (DLHs) during the current year, computed as follows:

|   |                |
|---|----------------|
| DVD units: 50,000 units × 2 DLHs per unit.....  | 100,000        |
| CD units: 200,000 units × 2 DLHs per unit ..... | 400,000        |
| Total direct labor-hours.....                   | <u>500,000</u> |

Costs for direct materials and direct labor for one unit of each product are given below:

|                                      | DVD Units | CD Units |
|--------------------------------------|-----------|----------|
| Direct materials.....                | \$90      | \$50     |
| Direct labor (at \$10 per DLH) ..... | \$20      | \$20     |

The company's estimated manufacturing overhead costs for the current year total \$10,000,000. The ABC team discovered that although the same amount of direct labor time is required for each product, the more complex DVD units require more machine time, more machine setups, and more testing than the CD units. Also, the team found that it is necessary to manufacture the DVD units in smaller batches; consequently, they require more production orders than the CD units.

The company has always used direct labor-hours as the base for assigning overhead costs to its products.

With these data in hand, the ABC team was prepared to begin the design of the new activity-based costing system. But first, they wanted to compute the cost of each product using the company's existing cost system.

## Direct Labor-Hours as a Base

Under the company's existing costing system, the predetermined overhead rate would be \$20 per direct labor-hour, computed as follows:

$$\begin{aligned}\text{Predetermined overhead rate} &= \frac{\text{Estimated total manufacturing overhead}}{\text{Estimated total amount of the allocation base}} \\ &= \frac{\$10,000,000}{500,000 \text{ DLHs}} = \$20 \text{ per DLH}\end{aligned}$$

Using this rate, the ABC team computed the unit product costs as given below:

|  | DVD Units    | CD Units     |
|--|--------------|--------------|
| Direct materials .....                               | \$ 90        | \$ 50        |
| Direct labor.....                                    | 20           | 20           |
| Manufacturing overhead (2 DLHs × \$20 per DLH) ..... | 40           | 40           |
| Unit product cost .....                              | <u>\$150</u> | <u>\$110</u> |

The problem with this costing approach is that it relies entirely on direct labor-hours to assign overhead cost to products and does not consider the impact of other factors—such as setups and testing—on the overhead costs of the company. Even though these other factors suggest that the two products place different demands on overhead resources, under the company's traditional costing system, the two products are assigned the same overhead cost per unit because they require equal amounts of direct labor time.

While this method of computing costs is fast and simple, it is accurate only in those situations where other factors affecting overhead costs are not significant. These other factors *are* significant in the case of Comtek Sound, Inc.

## Computing Activity Rates

### LEARNING OBJECTIVE 2

Compute activity rates for an activity-based costing system.

The ABC team then analyzed Comtek Sound, Inc.'s operations and identified six major activities to include in the new activity-based costing system. Cost and other data relating to the activities are presented in [Exhibit 3-4](#). That exhibit shows the amount of overhead cost for each activity cost pool, along with the expected amount of activity for the current year. The machine setups activity cost pool, for example, was assigned \$1,600,000 in overhead cost. The company expects to complete 4,000 setups during the year, of which 3,000 will be for DVD units and 1,000 will be for CD units. Data for other activities are also shown in the exhibit.



The ABC team then computed an activity rate for each activity. (See the middle panel in [Exhibit 3-4](#).) The activity rate of \$400 per machine setup, for example, was computed by dividing the total estimated overhead cost in the activity cost pool, \$1,600,000, by the expected amount of activity, 4,000 setups. This process was repeated for each of the other activities in the activity-based costing system.

## Computing Product Costs

### LEARNING OBJECTIVE 3

Compute product costs using activity-based costing.

Once the activity rates were calculated, it was easy to compute the overhead cost that would be allocated to each product. (See the bottom panel of [Exhibit 3-4](#).) For example, the amount of machine setup cost allocated to DVD units was determined by multiplying the activity rate of \$400 per setup by the 3,000 expected setups for DVD units during the year. This yielded a total of \$1,200,000 in machine setup costs to be assigned to the DVD units.

Note from the exhibit that the use of an activity approach has resulted in \$97.80 in overhead cost being assigned to each DVD unit and \$25.55 to each CD unit. The ABC team then used these amounts to determine unit product costs under activity-based costing, as presented in [Exhibit 3-5](#). For comparison, the exhibit also shows the unit product costs derived earlier when direct labor-hours were used as the base for assigning overhead costs to the products.



The ABC team members summarized their findings as follows in the team's report:

In the past, the company has been charging \$40.00 in overhead cost to a unit of either product, whereas it should have been charging \$97.80 in overhead cost to each DVD unit and only \$25.55 to each CD unit. Thus, unit costs have been badly distorted as a result of using direct labor-hours as the allocation base. The company may even have been suffering a loss on the DVD units without knowing it because the cost of these units has been so vastly understated. Through activity-based costing, we have been able to more accurately assign overhead costs to each product.

### EXHIBIT 3-4 Comtek Sound's Activity-Based Costing System

| Basic Data                       |                         |                   |          |       |
|----------------------------------|-------------------------|-------------------|----------|-------|
| Activities and Activity Measures | Estimated Overhead Cost | Expected Activity |          |       |
|                                  |                         | DVD Units         | CD Units | Total |

| Activities and Activity Measures         | Cost                | DVD Units | CD Units | Total     |
|--|---------------------|-----------|----------|-----------|
| Labor related (direct labor-hours) ..... | \$ 800,000          | 100,000   | 400,000  | 500,000   |
| Machine related (machine-hours) .....    | 2,100,000           | 300,000   | 700,000  | 1,000,000 |
| Machine setups (setups) .....            | 1,600,000           | 3,000     | 1,000    | 4,000     |
| Production orders (orders) .....         | 3,150,000           | 800       | 400      | 1,200     |
| Parts administration (part types) .....  | 350,000             | 400       | 300      | 700       |
| General factory (machine-hours) .....    | 2,000,000           | 300,000   | 700,000  | 1,000,000 |
|  | <u>\$10,000,000</u> |           |          |           |

| Computation of Activity Rates |                                      |                                      |                               |
|-------------------------------|--------------------------------------|--------------------------------------|-------------------------------|
| Activities                    | (a)<br>Estimated<br>Overhead<br>Cost | (b)<br>Total<br>Expected<br>Activity | (a) ÷ (b)<br>Activity<br>Rate |
| Labor related .....           | \$800,000                            | 500,000 DLHs                         | \$1.60 per DLH                |
| Machine related .....         | \$2,100,000                          | 1,000,000 MHs                        | \$2.10 per MH                 |
| Machine setups .....          | \$1,600,000                          | 4,000 setups                         | \$400.00 per setup            |
| Production orders .....       | \$3,150,000                          | 1,200 orders                         | \$2,625.00 per order          |
| Parts administration .....    | \$350,000                            | 700 part types                       | \$500.00 per part type        |
| General factory .....         | \$2,000,000                          | 1,000,000 MHs                        | \$2.00 per MH                 |

| Computation of the Overhead Cost per Unit of Product |                      |                    |                      |                    |
|--|----------------------|--------------------|----------------------|--------------------|
| Activities and Activity Rates                        | DVD Units            |                    | CD Units             |                    |
|  | Expected<br>Activity | Amount             | Expected<br>Activity | Amount             |
| Labor related, at \$1.60 per DLH .....               | 100,000              | \$ 160,000         | 400,000              | \$ 640,000         |
| Machine related, at \$2.10 per MH .....              | 300,000              | 630,000            | 700,000              | 1,470,000          |
| Machine setups, at \$400 per setup .....             | 3,000                | 1,200,000          | 1,000                | 400,000            |
| Production orders, at \$2,625 per order .....        | 800                  | 2,100,000          | 400                  | 1,050,000          |
| Parts administration, at \$500 per part type .....   | 400                  | 200,000            | 300                  | 150,000            |
| General factory, at \$2.00 per MH .....              | 300,000              | 600,000            | 700,000              | 1,400,000          |
| Total overhead costs assigned (a) .....              |                      | <u>\$4,890,000</u> |                      | <u>\$5,110,000</u> |
| Number of units produced (b) .....                   |                      | 50,000             |                      | 200,000            |
| Overhead cost per unit (a) ÷ (b) .....               |                      | <u>\$97.80</u>     |                      | <u>\$25.55</u>     |

Although in the past we thought our competitors were pricing below their cost on the CD units, it turns out that we were overcharging for these units because our costs were overstated. Similarly, we always used to believe that our competitors were overpricing the DVD units, but now we realize that our prices have been way too low because the cost of our DVD units was being understated. It turns out that we, not our competitors, had everything backwards.

### EXHIBIT 3-5 Comparison of Unit Product Costs

|                              | Activity-Based<br>Costing |                 | Direct-Labor-Based<br>Costing |                 |
|------------------------------|---------------------------|-----------------|-------------------------------|-----------------|
|                              | DVD Units                 | CD Units        | DVD Units                     | CD Units        |
| Direct materials .....       | \$ 90.00                  | \$ 50.00        | \$ 90.00                      | \$ 50.00        |
| Direct labor .....           | 20.00                     | 20.00           | 20.00                         | 20.00           |
| Manufacturing overhead ..... | 97.80                     | 25.55           | 40.00                         | 40.00           |
| Unit product cost .....      | <u>\$207.80</u>           | <u>\$ 95.55</u> | <u>\$150.00</u>               | <u>\$110.00</u> |

The pattern of cost distortion shown by the ABC team's findings is quite common. Such distortion can happen in any company that relies on direct labor-hours or machine-hours in assigning overhead cost to products and ignores other significant causes of overhead costs.

## IN BUSINESS

## Finding That Golden Top 20%

According to **Meridien Research** of Newton, Massachusetts, 20% of a bank's customers generate about 150% of its profits. At the other end of the spectrum, 30% of a bank's customers drain 50% of its profits. The question becomes how do banks identify which customers are in that golden top 20%? For many banks, the answer is revealed through customer relationship management software that provides activity-based costing capability.

"We had some customers that we thought, on the surface, would be very profitable, with an average of \$300,000 in business accounts," said Jerry Williams, chairman and chief executive officer of **First Bancorp.** "What we didn't pull out was the fact that some write more than 275 checks a month. Once you apply the labor costs, it's not a profitable customer."

Meridien Research estimates that large commercial banks are increasing their spending on customer profitability systems by 14% a year with total annual expenditures exceeding \$6 billion dollars.

Source: Joseph McKendrick, "Your Best Customers May Be Different Tomorrow," *Bank Technology News*, July 2001, pp. 1–4.

## Shifting of Overhead Cost

### LEARNING OBJECTIVE 4

Contrast the product costs computed under activity-based costing and conventional costing methods.

When a company implements activity-based costing, overhead cost often shifts from high-volume products to low-volume products, with a higher unit product cost resulting for the low-volume products. We saw this happen in the example above, where the product cost of the low-volume DVD units increased from \$150.00 to \$207.80 per unit. This increase in cost resulted from batch-level and product-level costs, which shifted from the high-volume product to the low-volume product. For example, consider the cost of issuing production orders, which is a batch-level activity. As shown in **Exhibit 3-4**, the average cost to Comtek Sound to issue a single production order is \$2,625. This cost is assigned to a production order regardless of how many units are processed in that order. The key here is to realize that fewer DVD units (the low-volume product) are processed per production order than CD units:



|  | DVD Units | CD Units |
|--|-----------|----------|
| Number of units produced per year (a) .....                  | 50,000    | 200,000  |
| Number of production orders issued per year (b) .....        | 800       | 400      |
| Number of units processed per production order (a) ÷ (b).... | 62.5      | 500      |

Spreading the \$2,625 cost to issue a production order over the number of units processed per order results in the following average cost per unit:

|   | DVD Units | CD Units |
|---|-----------|----------|
| Cost to issue a production order (a) .....  | \$2,625   | \$2,625  |
| Average number of units processed per production order (see prior page) (b) ..... | 62.5      | 500      |
| Production order cost per unit (a) ÷ (b) .....                                    | \$42.00   | \$5.25   |



Thus, the production order cost for a DVD unit (the low-volume product) is \$42, which is *eight times* the \$5.25 cost for a CD unit.

Product-level costs—such as parts administration—have a similar impact. In a conventional costing system, these costs are spread more or less uniformly across all units that are produced. In an activity-based costing system, these costs are assigned more accurately to products. Because product-level costs are fixed with respect to the number of units processed, the average cost per unit of an activity such as parts administration will be higher for low-volume products than for high-volume products.

## IN BUSINESS

### Process Improvements Help Nurses

**Providence Portland Medical Center (PPMC)** used ABC to improve one of the most expensive and error-prone processes within its nursing units—ordering, distributing, and administering medications to patients. To the surprise of everyone involved, the ABC data showed that “medication-related activities made up 43% of the nursing unit's total operating costs.” The ABC team members knew that one of the root causes of this time-consuming process was the illegibility of physician orders that are faxed to the pharmacy. Replacing the standard fax machine with a much better \$5,000 machine virtually eliminated unreadable orders and decreased follow-up telephone calls by more than 90%—saving the hospital \$500,000 per year. In total, the ABC team generated improvement ideas that offered \$1 million of net savings in redeployable resources. “This amount translates to additional time that nurses and pharmacists can spend on direct patient care.”

Source: “How ABC Analysis Will Save PPMC Over \$1 Million a Year,” *Financial Analysis, Planning & Reporting*, November 2003, pp. 6–10.

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## Chapter3: Systems Design: Activity-Based Costing

### Targeting Process Improvements

Activity-based costing can be used to identify activities that would benefit from process improvements. When used in this way, activity-based costing is often called *activity-based management*. Basically, **activity-based management** involves focusing on activities to eliminate waste, decrease processing time, and reduce defects. Activity-based management is used in organizations as diverse as manufacturing companies, hospitals, and the U.S. Marine Corps.

The first step in any improvement program is to decide what to improve. The Theory of Constraints approach discussed in the Prologue is a powerful tool for targeting the area in an organization whose improvement will yield the greatest benefit. Activity-based management provides another approach. The activity rates computed in activity-based costing can provide valuable clues concerning where there is waste and opportunity for improvement. For example, looking at the activity rates in [Exhibit 3-4](#), Comtek's managers may conclude that \$2,625 to process a production order is far too expensive for an activity that adds no value to the product. As a consequence, they may target production-order processing for process improvement using Six Sigma as discussed in the Prologue.

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*Benchmarking* is another way to leverage the information in activity rates. **Benchmarking** is a systematic approach to identifying the activities with the greatest room for improvement. It is based on comparing the performance in an organization with the performance of other, similar organizations known for their outstanding performance. If a particular part of the organization performs far below the world-class standard, managers will target that area for improvement.

#### IN BUSINESS

#### Comparing Activity-Based and Traditional Product Costs

**Airco Heating and Air Conditioning (Airco)**, located in Van Buren, Arkansas, implemented an ABC system to better understand the profitability of its products. The ABC system assigned \$4,458,605 of overhead costs to eight activities as follows:

| Activity Cost Pool      | Total Cost  | Total Activity           | Activity Rate |
|-------------------------|-------------|--------------------------|---------------|
| Machines                | \$ 435,425  | 73,872 machine-hours     | \$5.89        |
| Data record maintenance | 132,597     | 14 products administered | \$9,471.21    |
| Material handling       | 1,560,027   | 16,872 products          | \$92.46       |
| Product changeover      | 723,338     | 72 setup hours           | \$10,046.36   |
| Scheduling              | 24,877      | 2,788 production runs    | \$8.92        |
| Raw material receiving  | 877,107     | 2,859 receipts           | \$306.79      |
| Product shipment        | 561,014     | 13,784,015 miles         | \$0.04        |
| Customer service        | 144,220     | 2,533 customer contacts  | \$56.94       |
| Total                   | \$4,458,605 |                          |               |

|       |                    |
|-------|--------------------|
| Total | <u>\$4,458,605</u> |
|-------|--------------------|

Airco's managers were surprised that 55% [ $(\$1,560,027 + \$877,107) \div \$4,458,605$ ] of its overhead resources were consumed by material handling and receiving activities. They responded by reducing the raw material and part transport distances within the facility. In addition, they compared the traditional and ABC product margin percentages (computed by dividing each product's margin by the sales of the product) for the company's seven product lines of air conditioners as summarized below:

|                                 | Product |       |         |        |          |        |        |
|---------------------------------|---------|-------|---------|--------|----------|--------|--------|
|                                 | 5-ton   | 6-ton | 7.5 ton | 10-ton | 12.5 ton | 15-ton | 20-ton |
| Traditional product margin %... | -20%    | 4%    | 40%     | -4%    | 20%      | 42%    | 70%    |
| ABC product margin %.....       | -15%    | -8%   | 50%     | 1%     | -6%      | 40%    | 69%    |

In response to the ABC data, Airco decided to explore the possibility of raising prices on 5-ton, 6-ton, and 12.5-ton air conditioners while at the same time seeking to reduce overhead consumption by these products.

Source: Copyright 2004 from "An Application of Activity-Based Costing in the Air Conditioner Manufacturing Industry," *The Engineering Economist*, Volume 49, Issue 3, 2004, pp. 221–236, by Heather Nachtmann and Mohammad Hani Al-Rifai. Reproduced by permission of Taylor & Francis Group, LLC., <http://www.taylorandfrancis.com>.

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## Introduction to Managerial Accounting EBook

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Content

### Chapter3: Systems Design: Activity-Based Costing

## Evaluation of Activity-Based Costing

**p. 140** Activity-based costing improves the accuracy of product costs, helps managers to understand the nature of overhead costs, and helps target areas for improvement through benchmarking and other techniques. These benefits are discussed in this section.

### The Benefits of Activity-Based Costing

Activity-based costing improves the accuracy of product costs in three ways. First, activity-based costing usually increases the number of cost pools used to accumulate overhead costs. Rather than accumulating all overhead costs in a single, plantwide pool, or accumulating them in departmental pools, the company accumulates costs for each major activity. Second, the activity cost pools are more homogeneous than departmental cost pools. In principle, all of the costs in an activity cost pool pertain to a single activity. In contrast, departmental cost pools contain the costs of many different activities carried out in the department. Third, activity-based costing uses a variety of activity measures to assign overhead costs to products, some of which are correlated with volume and some of which are not. This differs from conventional approaches that rely exclusively on direct labor-hours or other measures of volume such as machine-hours to assign overhead costs to products.

Because conventional costing systems typically apply overhead costs to products using direct labor-hours, it may appear to managers that overhead costs are caused by direct labor-hours. Activity-based costing makes it clear that batch setups, engineering change orders, and other activities cause overhead costs rather than just direct labor. Managers thus have a better understanding of the causes of overhead costs, which should lead to better decisions and better cost control.

Finally, activity-based costing highlights the activities that could benefit most from Six Sigma and other improvement initiatives. Thus, activity-based costing can be used as a part of programs to improve operations.

### IN BUSINESS

### Costs in Health Care

**Owens & Minor**, a \$3 billion medical supplies distributor, offers an activity-based billing option to its customers. Instead of charging a fixed amount for items that are ordered by customers, the charges are based on activities required to fill the order as well as on the cost of the item ordered. For example, Owens & Minor charges extra for weekend deliveries. These charges encourage customers to reduce their weekend delivery requests. This results in decreased costs for Owens & Minor, which can then be passed on to customers in the form of lower charges for the specific items that are ordered. As many as 25% of Owens &



Minor's 4,000 health care customers have used this billing option to identify and realize cost reduction opportunities. For example, Bill Wright of **Sutter Health** in Sacramento, California, said that Owens & Minor's activity-based billing has motivated his company to eliminate weekend deliveries, place more items per order, align purchase quantities with prepackaged specifications, and transmit orders electronically. The end result is that one Sutter affiliate decreased its purchasing costs from 4.25% of product costs to 3.75%. In all, Owens & Minor has identified about 250 activity-driven procurement costs that hospitals can manage more efficiently to reduce costs.

Source: Todd Shields, "Hospitals Turning to Activity-Based Costing to Save and Measure Distribution Costs," *Healthcare Purchasing News*, November 2001, pp. 14–15.

## Limitations of Activity-Based Costing

Any discussion of activity-based costing is incomplete without some cautionary warnings. First, the cost of implementing and maintaining an activity-based costing system may outweigh the benefits. Second, it would be naïve to assume that product costs provided even by an activity-based costing system are always relevant when making decisions. These limitations are discussed below.

**The Cost of Implementing Activity-Based Costing** Implementing ABC is a major project that requires substantial resources. First, the cost system must be designed—preferably by a cross-functional team. This requires taking valued employees away from other tasks for a major project. In addition, the data used in the activity-based costing system must be collected and verified. In some cases, this requires collecting data that has never been collected before. In short, implementing and maintaining an activity-based costing system can present a formidable challenge, and management may decide that the costs are too great to justify the expected benefits. Nevertheless, it should be kept in mind that the costs of collecting and processing data have dropped dramatically over the last several decades due to bar coding and other technologies, and these costs can be expected to continue to fall.

When are the benefits of activity-based costing most likely to be worth the cost? Companies that have some of the following characteristics are most likely to benefit from activity-based costing:

1. Products differ substantially in volume, batch size, and in the activities they require.
2. Conditions have changed substantially since the existing cost system was established.
3. Overhead costs are high and increasing and no one seems to understand why.
4. Management does not trust the existing cost system and ignores cost data from the system when making decisions.

**Limitations of the ABC Model** The activity-based costing model relies on a number of critical assumptions.<sup>1</sup> Perhaps the most important of these assumptions is that the cost in each activity cost pool is strictly proportional to its activity measure. What little evidence we have on this issue suggests that overhead costs are less than proportional to activity.<sup>2</sup> Economists call this increasing returns to scale—as activity increases, the average cost drops. As a practical matter, this means that product costs computed by a traditional or activity-based costing system will be overstated for the purposes of making decisions. The product costs generated by activity-based costing are almost certainly more accurate than those generated by a conventional costing system, but they should nevertheless be

viewed with caution. Managers should be particularly alert to product costs that contain allocations of facility-level costs. As we shall see later in the book, product costs that include facility-level or organization-sustaining costs can easily lead managers astray.

**Modifying the ABC Model** The discussion in this chapter has assumed that the primary purpose of an activity-based costing system is to provide more accurate product costs for external reports. If the product costs are to be used by managers for internal decisions, some modifications should be made. For example, for decision-making purposes, the distinction between manufacturing costs on the one hand and selling and administrative expenses on the other hand is unimportant. Managers need to know what costs a product causes, and it doesn't matter whether the costs are manufacturing costs or selling and administrative expenses. Consequently, for decision-making purposes, some selling and administrative expenses should be assigned to products as well as manufacturing costs. Moreover, as mentioned above, facility-level and organization-sustaining costs should be removed from product costs when making decisions. Nevertheless, the techniques covered in this chapter provide a good basis for understanding the mechanics of activity-based costing. For a more complete coverage of the use of activity-based costing in decisions, see more advanced texts.<sup>3</sup>

## YOU DECIDE

### Bakery Owner

You are the owner of a bakery that makes a complete line of specialty breads, pastries, cakes, and pies for the retail and wholesale markets. A summer intern has just completed an activity-based costing study that concluded, among other things, that one of your largest recurring jobs is losing money. A local luxury hotel orders the same assortment of desserts every week for its Sunday brunch buffet for a fixed price of \$975 per week. The hotel is quite happy with the quality of the desserts the bakery has been providing, but it would seek bids from other local bakeries if the price were increased.

The activity-based costing study conducted by the intern revealed that the cost to the bakery of providing these desserts is \$1,034 per week, resulting in an apparent loss of \$59 per week or over \$3,000 per year. Scrutinizing the intern's report, you find that the weekly cost of \$1,034 includes facility-level costs of \$329. These facility-level costs include portions of the rent on the bakery's building, your salary, depreciation on the office personal computer, and so on. The facility-level costs were arbitrarily allocated to the Sunday brunch job on the basis of direct labor-hours.

Should you demand an increase in price from the luxury hotel for the Sunday brunch desserts to at least \$1,034? If an increase is not forthcoming, should you withdraw from the agreement and discontinue providing the desserts?

## Activity-Based Costing and Service Industries

Although initially developed as a tool for manufacturing companies, activity-based costing is also being used in service industries. Successful implementation of an activity-based costing system depends on identifying the key activities that generate costs and tracking how many of those activities are performed for each service the organization provides. Activity-based costing has been implemented in a wide variety of service industries including railroads, hospitals, banks, and data services companies.

## DECISION MAKER

### Legal Firm Business Manager

You have been hired to manage the business aspects of a local legal firm with a staff of 6 attorneys, 10 paralegals, and 5 staffpersons. Clients of the firm are billed a fixed amount per hour of attorney time. The fixed hourly charge is determined each year by dividing the total cost of the legal office for the preceding year by the total billed hours of attorney time for that year. A markup of 25% is then added to this average cost per hour of billed attorney time to provide for a profit and for inflation.

The firm's partners are concerned because the firm has been unprofitable for several years. The firm has been losing its smaller clients to other local firms—largely because the firm's fees have become uncompetitive. And the firm has been attracting larger clients with more complex legal problems from its competitors. To serve these demanding larger clients, the firm must subscribe to expensive online legal reference services, hire additional paralegals and staffpersons, and lease additional office space.

What do you think might be the reason for the unprofitable operations in recent years?  
What might be done to improve the situation for the coming year?



2. Which of the following statements is false? (You may select more than one answer.)
- a. Activity-based costing systems usually shift costs from low-volume products to high-volume products.
  - b. Benchmarking can be used to identify activities with the greatest potential for improvement.
  - c. Activity-based costing is most valuable to companies that manufacture products that are similar in terms of their volume of production, batch size, and complexity.
  - d. Activity-based costing systems are based on the assumption that the costs included in each activity cost pool are strictly proportional to the cost pool's activity measure.

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<sup>1</sup>Eric Noreen, "Conditions under Which Activity-Based Cost Systems Provide Relevant Costs," *Journal of Management Accounting Research*, Fall 1991, pp. 159–168.

<sup>2</sup>Eric Noreen and Naomi Soderstrom, "The Accuracy of Proportional Cost Models: Evidence from Hospital Service Departments," *Review of Accounting Studies* 2, 1997; and Eric Noreen and Naomi Soderstrom, "Are Overhead Costs Proportional to Activity? Evidence from Hospital Service Departments," *Journal of Accounting and Economics*, January 1994, pp. 253–278.

<sup>3</sup>See, for example, [Chapter 8](#) and its appendix in Ray Garrison, Eric Noreen, and Peter Brewer, *Managerial Accounting*, 13th edition, McGraw-Hill/Irwin © 2010.

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## Chapter3: Systems Design: Activity-Based Costing

# Cost Flows in an Activity-Based Costing System

### p. 146 **LEARNING OBJECTIVE 5**

Record the flow of costs in an activity-based costing system.

In [Chapter 2](#), we discussed the flow of costs in a job-order costing system. The flow of costs through Raw Materials, Work in Process, and other accounts is the same under activity-based costing. The only difference in activity-based costing is that more than one predetermined overhead rate is used to apply overhead costs to products. In this section we provide a detailed example of cost flows in an activity-based costing system.

### An Example of Cost Flows



The company in the following example has five activity cost pools and therefore must compute five predetermined overhead rates (i.e., activity rates). Except for that detail, the journal entries, T-accounts, and general cost flows are the same as described in [Chapter 2](#).

**Basic Data** Sarvik Company uses activity-based costing for its external financial reports. The company has five activity cost pools, which are listed below along with relevant data for the coming year.

| Activity Cost Pool    | Activity Measure   | Estimated Overhead Cost | Expected Activity |
|-----------------------|--------------------|-------------------------|-------------------|
| Machine related ..... | Machine-hours      | \$175,000               | 5,000 MHs         |
| Purchase orders.....  | Number of orders   | \$63,000                | 700 orders        |
| Machine setups.....   | Number of setups   | \$92,000                | 460 setups        |
| Product testing.....  | Number of tests    | \$160,000               | 200 tests         |
| General factory ..... | Direct labor-hours | \$300,000               | 25,000 DLHs       |

At the beginning of the year, the company had inventory balances as follows:

|                      |         |
|----------------------|---------|
| Raw materials.....   | \$3,000 |
| Work in process..... | \$4,000 |
| Finished goods ..... | \$0     |

p. 144 Selected transactions recorded by the company during the year are given below:

- a. Raw materials were purchased on account, \$915,000.
- b. Raw materials were requisitioned for use in production, \$900,000 (\$810,000 direct and \$90,000 indirect).
- c. Labor costs were incurred in the factory, \$370,000 (\$95,000 direct labor and \$275,000 indirect labor).
- d. Depreciation was recorded on factory assets, \$180,000.
- e. Miscellaneous manufacturing overhead costs were incurred, \$230,000.
- f. Manufacturing overhead cost was applied to production. Actual activity during the year was as follows:

| Activity Cost Pool    | Actual Activity |
|-----------------------|-----------------|
| Machine related ..... | 4,600 MHs       |
| Purchase orders ..... | 800 orders      |
| Machine setups .....  | 500 setups      |
| Product testing.....  | 190 tests       |
| General factory ..... | 23,000 DLHs     |

- g. Goods costing \$1,650,000 to manufacture according to the activity-based costing system were completed during the year.

**Tracking the Flow of Costs** The predetermined overhead rates (i.e., activity rates) for the activity cost pools would be computed as follows:

| Activity Cost Pools   | (a)<br>Estimated<br>Overhead<br>Cost | (b)<br>Total<br>Expected<br>Activity | (a) ÷ (b)<br>Activity<br>Rate |
|-----------------------|--------------------------------------|--------------------------------------|-------------------------------|
| Machine related ..... | \$175,000                            | 5,000 machine-hours                  | \$35 per machine-hour         |
| Purchase orders.....  | \$63,000                             | 700 orders                           | \$90 per order                |
| Machine setups.....   | \$92,000                             | 460 setups                           | \$200 per setup               |
| Product testing.....  | \$160,000                            | 200 tests                            | \$800 per test                |
| General factory ..... | \$300,000                            | 25,000 direct labor-hours            | \$12 per direct labor-hour    |

The following journal entries would be used to record transactions (a) through (g) above:

|    |                                |         |         |
|----|--------------------------------|---------|---------|
| a. | Raw Materials.....             | 915,000 |         |
|    | Accounts Payable*              |         | 915,000 |
| b. | Work in Process .....          | 810,000 |         |
|    | Manufacturing Overhead.....    | 90,000  |         |
|    | Raw Materials.....             |         | 900,000 |
| c. | Work in Process .....          | 95,000  |         |
|    | Manufacturing Overhead.....    | 275,000 |         |
|    | Salaries and Wages Payable*    |         | 370,000 |
| d. | Manufacturing Overhead.....    | 180,000 |         |
|    | Accumulated Depreciation ..... |         | 180,000 |
| e. | Manufacturing Overhead.....    | 230,000 |         |
|    | Accounts Payable*              |         | 230,000 |

\*Other accounts, such as Cash, may be credited.

From [Chapter 2](#) the formula for computing applied overhead cost is:

$$\text{Applied overhead cost} = \text{Predetermined overhead rate} \times \text{Actual activity}$$

In activity-based costing, this formula is applied for each activity cost pool using its own predetermined overhead rate (i.e., activity rate). The computations are as follows:

| Activities            | (1)<br>Activity<br>Rate | (2)<br>Actual<br>Activity | (1) × (2)<br>Applied<br>Overhead<br>Cost |
|-----------------------|-------------------------|---------------------------|--|
| Machine related ..... | \$35 per MH             | 4,600 MHs                 | \$161,000                                |
| Purchase orders.....  | \$90 per order          | 800 orders                | 72,000                                   |
| Machine setups.....   | \$200 per setup         | 500 setups                | 100,000                                  |
| Product testing.....  | \$800 per test          | 190 tests                 | 152,000                                  |
| General factory ..... | \$12 per DLH            | 23,000 DLHs               | 276,000                                  |
| Total .....           |                         |                           | <u>\$761,000</u>                         |

By totaling these five applied overhead cost figures, we find that the company applied \$761,000 in overhead cost to products during the year. The following entry would be used to record this application of overhead cost:

|    |                              |         |         |
|----|------------------------------|---------|---------|
| f. | Work in Process .....        | 761,000 |         |
|    | Manufacturing Overhead ..... |         | 761,000 |

Finally, the following journal entry would be used to record the completion of work in process as described in transaction (g) above:

|    |                       |           |           |
|----|-----------------------|-----------|-----------|
| g. | Finished Goods .....  | 1,650,000 |           |
|    | Work in Process ..... |           | 1,650,000 |

The T-accounts corresponding to the above journal entries appear below:

| Raw Materials            |         | Work in Process  |         | Finished Goods             |           |         |
|--------------------------|---------|------------------|---------|----------------------------|-----------|---------|
| Bal.                     | 3,000   | (b)              | 900,000 | Bal.                       | 0         |         |
| (a)                      | 915,000 | (b)              | 810,000 | (g)                        | 1,650,000 |         |
| Bal.                     | 18,000  | (c)              | 95,000  |                            |           |         |
|                          |         | (f)              | 761,000 |                            |           |         |
|                          |         | Bal.             | 20,000  |                            |           |         |
| Accumulated Depreciation |         | Accounts Payable |         | Salaries and Wages Payable |           |         |
|                          | (d)     | 180,000          | (a)     | 915,000                    | (c)       | 370,000 |
|                          |         |                  | (e)     | 230,000                    |           |         |
| Manufacturing Overhead   |         |                  |         |                            |           |         |
| (b)                      | 90,000  | (f)              | 761,000 |                            |           |         |
| (c)                      | 275,000 |                  |         |                            |           |         |
| (d)                      | 180,000 |                  |         |                            |           |         |
| (e)                      | 230,000 |                  |         |                            |           |         |
|                          | 775,000 |                  | 761,000 |                            |           |         |
| Bal.                     | 14,000  |                  |         |                            |           |         |

The overhead is underapplied by \$14,000. This can be determined directly, as shown below, or by reference to the balance in the Manufacturing Overhead T-account on the prior page.

|   |           |
|---|-----------|
| Actual manufacturing overhead incurred..... | \$775,000 |
| Manufacturing overhead applied.....         | 761,000   |

|                                      |                  |
|--------------------------------------|------------------|
| manufacturing overhead applied ..... | <u>761,000</u>   |
| Overhead underapplied .....          | <u>\$ 14,000</u> |

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## Chapter3: Systems Design: Activity-Based Costing

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### Summary

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**LO1 Understand the basic approach in activity-based costing and how it differs from conventional costing.**

Activity-based costing was developed to more accurately assign overhead costs to products. Activity-based costing differs from conventional costing as described in [Chapter 2](#) in two major ways. First, in activity-based costing, each major activity that consumes overhead resources has its own cost pool and its own activity rate, whereas in [Chapter 2](#) there was only a single overhead cost pool and a single predetermined overhead rate. Second, the allocation bases (or activity measures) in activity-based costing are diverse. They may include machine setups, purchase orders, engineering change orders, and so on, in addition to direct labor-hours or machine-hours. Nevertheless, within each activity cost pool, the mechanics of computing overhead rates and of applying overhead to products are the same as described in [Chapter 2](#). However, the increase in the number of cost pools and the use of better activity measures generally result in more accurate product costs.

**LO2 Compute activity rates for an activity-based costing system.**

Each activity in an activity-based costing system has its own cost pool and its own activity measure. The activity rate for a particular activity is computed by dividing the total cost in the activity's cost pool by the total amount of activity.

**LO3 Compute product costs using activity-based costing.**

Product costs in activity-based costing, as in conventional costing systems, consist of direct materials, direct labor, and overhead. In both systems, overhead is applied to products using predetermined overhead rates. In the case of an activity-based costing system, each activity has its own predetermined overhead rate (i.e., activity rate). The activities required by a product are multiplied by their respective activity rates to determine the amount of overhead that is applied to the product.

**LO4 Contrast the product costs computed under activity-based costing and conventional costing methods.**

Under conventional costing methods, overhead costs are applied to products using some measure of volume such as direct labor-hours or machine-hours. This results in most of the overhead cost being applied to high-volume products. In contrast, under activity-based costing, some overhead costs are applied on the basis of batch-level or product-level activities. This change in allocation bases shifts overhead costs from high-volume products to low-volume products. Accordingly, product costs for

high-volume products are commonly lower under activity-based costing than under conventional costing methods, and product costs for low-volume products are higher.

**LO5 Record the flow of costs in an activity-based costing system.**

The journal entries and general flow of costs in an activity-based costing system are the same as they are in a conventional costing system. The only difference is the use of more than one predetermined overhead rate (i.e., activity rate) to apply overhead to products.

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