

refining a costing system: (1) ABC systems trace more costs as direct costs; (2) ABC systems create homogeneous cost pools linked to different activities; and (3) for each activity-cost pool, ABC systems seek a cost-allocation base that has a cause-and-effect relationship with costs in the cost pool.

The homogeneous cost pools and the choice of cost-allocation bases, tied to the cost hierarchy, give Plastim's managers greater confidence in the activity and product cost numbers from the ABC system. The bottom part of Exhibit 5-6 shows that allocating costs to lenses using only an output unit-level allocation base—direct manufacturing labor-hours, as in the single indirect-cost pool system used prior to ABC—overcosts the simple S3 lens by \$8.77 per unit and undercosts the complex CL5 lens by \$35.07 per unit. The CL5 lens uses a disproportionately larger amount of output unit-level, batch-level, and product-sustaining costs than is represented by the direct manufacturing labor-hour cost-allocation base. The S3 lens uses a disproportionately smaller amount of these costs.

The benefit of an ABC system is that it provides information to make better decisions. But this benefit must be weighed against the measurement and implementation costs of an ABC system.

Considerations in Implementing Activity-Based-Costing Systems

Managers choose the level of detail to use in a costing system by evaluating the expected costs of the system against the expected benefits that result from better decisions. There are telltale signs of when an ABC system is likely to provide the most benefits. Here are some of these signs:

- Significant amounts of indirect costs are allocated using only one or two cost pools.
- All or most indirect costs are identified as output unit-level costs (few indirect costs are described as batch-level costs, product-sustaining costs, or facility-sustaining costs).
- Products make diverse demands on resources because of differences in volume, process steps, batch size, or complexity.
- Products that a company is well-suited to make and sell show small profits; whereas products that a company is less suited to produce and sell show large profits.
- Operations staff has substantial disagreement with the reported costs of manufacturing and marketing products and services.

When a company decides to implement ABC, it must make important choices about the level of detail to use. Should it choose many finely specified activities, cost drivers, and cost pools, or would a few suffice? For example, Plastim could identify a different molding machine-hour rate for each different type of molding machine. In making such choices, managers weigh the benefits against the costs and limitations of implementing a more detailed costing system.

The main costs and limitations of an ABC system are the measurements necessary to implement it. ABC systems require management to estimate costs of activity pools and to identify and measure cost drivers for these pools to serve as cost-allocation bases. Even basic ABC systems require many calculations to determine costs of products and services. These measurements are costly. Activity cost rates also need to be updated regularly.

As ABC systems get very detailed and more cost pools are created, more allocations are necessary to calculate activity costs for each cost pool. This increases the chances of misidentifying the costs of different activity cost pools. For example, supervisors are more prone to incorrectly identify the time they spent on different activities if they have to allocate their time over five activities rather than only two activities.

At times, companies are also forced to use allocation bases for which data are readily available rather than allocation bases they would have liked to use. For example, a company might be forced to use the number of loads moved, instead of the degree of difficulty and distance of different loads moved, as the allocation base for

Learning Objective 6

Evaluate the costs and benefits of implementing activity-based costing systems

... measurement difficulties versus more accurate costs that aid in decision making

Concepts in Action

Successfully Championing ABC

Successfully implementing ABC systems requires more than an understanding of the technical details. ABC implementation often represents a significant change in the costing system and, as the chapter indicates, it requires a manager to make major choices with respect to the definition of activities and the level of detail. What then are some of the behavioral issues that the management accountant must be sensitive to?

1. **Gaining support of top management and creating a sense of urgency for the ABC effort.** This requires management accountants to lay out the vision for the ABC project and to clearly communicate its strategic benefits (for example, the resulting improvements in product and process design). It also requires selling the idea to end users and working with members of other departments as business partners of the managers in the various areas affected by the ABC project. For example, at USAA Federal Savings Bank, project managers demonstrated how the information gained from ABC would provide insights into the efficiency of bank operations, which was previously unavailable. Now the finance area communicates regularly with operations about new reports and proposed changes to the financial reporting package that managers receive.
2. **Creating a guiding coalition of managers throughout the value chain for the ABC effort.** ABC systems measure how the resources of an organization are used. Managers responsible for these resources have the best knowledge about activities and cost drivers. Getting managers to cooperate and take the initiative for implementing ABC is essential for gaining the required expertise, the proper credibility, and the necessary leadership.

Gaining wider participation among managers has other benefits. Managers who feel more involved in the process are likely to commit more time to and be less skeptical of the ABC effort. Engaging managers throughout the value chain also creates greater opportunities for coordination and cooperation across the different functions, for example, design and manufacturing.

3. **Educating and training employees in ABC as a basis for employee empowerment.** Disseminating information about ABC throughout an organization allows workers in all areas of a business to use their knowledge of ABC to make improvements. For example, WS Industries, an Indian manufacturer of insulators, not only shared ABC information with its workers but also established an incentive plan that gave employees a percentage of the cost savings. The results were dramatic because employees were empowered and motivated to implement numerous cost-saving projects.
4. **Seeking small short-run successes as proof that the ABC implementation is yielding results.** Too often, managers and management accountants seek big results and major changes far too quickly. In many situations, achieving a significant change overnight is difficult. However, showing how ABC information has helped improve a process and save costs, even if only in small ways, motivates the team to stay on course and build momentum. The credibility gained from small victories leads to additional and bigger improvements involving larger numbers of people and different parts of the organization. Eventually ABC and ABM become rooted in the culture of the organization. Sharing short-term successes may also help motivate employees to be innovative. At USAA Federal Savings Bank, managers created a "process improvement" mailbox in Microsoft Outlook to facilitate the sharing of process improvement ideas.
5. **Recognizing that ABC information is not perfect because it balances the need for better information against the costs of creating a complex system that few managers and employees can understand.** The management accountant must help managers recognize both the value and the limitations of ABC and not oversell it. Open and honest communication about ABC ensures that managers use ABC thoughtfully to make good decisions. Critical judgments can then be made without being adversarial, and tough questions can be asked to help drive better decisions about the system.

material-handling costs, because data on degree of difficulty and distance of moves are difficult to obtain. When erroneous cost-allocation bases are used, activity-cost information can be misleading. For example, if the cost per load moved decreases, a company may conclude that it has become more efficient in its materials-handling operations. In fact, the lower cost per load move may have resulted solely from moving many lighter loads over shorter distances.

Many companies, such as Kanthal, the Swedish manufacturer of heating elements, have found the strategic and operational benefits of a less-detailed ABC system to be good enough to not warrant incurring the costs and challenges of operating a more-detailed system. Other organizations, such as Hewlett-Packard, implement ABC in chosen divisions or functions. As improvements in information technology and accompanying

Decision Point

What should managers consider when deciding to implement ABC systems?

Learning Objective 7

Explain how activity-based costing systems are used in activity-based management

... such as pricing decisions, product-mix decisions, and cost reduction

declines in measurement costs continue, more-detailed ABC systems have become a practical alternative in many companies. As such trends persist, more detailed ABC systems will be better able to pass the cost-benefit test.

Global surveys of company practice suggest that ABC implementation varies among companies. Nevertheless, its framework and ideas provide a standard for judging whether any simple costing system is good enough for a particular management's purposes. Any contemplated changes in a simple costing system will inevitably be improved by ABC thinking. The Concepts in Action box on page 155 describes some of the behavioral issues that management accountants must be sensitive to as they seek to immerse an organization in ABC thinking.

Using ABC Systems for Improving Cost Management and Profitability

The emphasis of this chapter so far has been on the role of ABC systems in obtaining better product costs. However, Plastim's managers must now use this information to make decisions (Step 4 of the 5-step decision process, p. 145) and to implement the decision, evaluate performance, and learn (Step 5, p. 145). Activity-based management (ABM) is a method of management decision making that uses activity-based costing information to improve customer satisfaction and profitability. We define ABM broadly to include decisions about pricing and product mix, cost reduction, process improvement, and product and process design.

Pricing and Product-Mix Decisions

An ABC system gives managers information about the costs of making and selling diverse products. With this information, managers can make pricing and product-mix decisions. For example, the ABC system indicates that Plastim can match its competitor's price of \$53 for the S3 lens and still make a profit because the ABC cost of S3 is \$49.98 (see Exhibit 5-5).

Plastim's managers offer Giovanni Motors a price of \$52 for the S3 lens. Plastim's managers are confident that they can use the deeper understanding of costs that the ABC system provides to improve efficiency and further reduce the cost of the S3 lens. Without information from the ABC system, Plastim managers might have erroneously concluded that they would incur an operating loss on the S3 lens at a price of \$53. This incorrect conclusion would have probably caused Plastim to reduce its business in simple lenses and focus instead on complex lenses, where its single indirect-cost-pool system indicated it is very profitable.

Focusing on complex lenses would have been a mistake. The ABC system indicates that the cost of making the complex lens is much higher—\$132.07 versus \$97 indicated by the direct manufacturing labor-hour-based costing system Plastim had been using. As Plastim's operations staff had thought all along, Plastim has no competitive advantage in making CL5 lenses. At a price of \$137 per lens for CL5, the profit margin is very small ($\$137.00 - \$132.07 = \$4.93$). As Plastim reduces its prices on simple lenses, it would need to negotiate a higher price for complex lenses with Giovanni Motors.

Cost Reduction and Process Improvement Decisions

Manufacturing and distribution personnel use ABC systems to focus on how and where to reduce costs. Managers set cost reduction targets in terms of reducing the cost per unit of the cost-allocation base in different activity areas. For example, the supervisor of the distribution activity area at Plastim could have a performance target of decreasing distribution cost per cubic foot of products delivered from \$5.80 to \$5.40 by reducing distribution labor and warehouse rental costs. The goal is to reduce these costs by improving the way work is done without compromising customer service or the actual or perceived value (usefulness) customers obtain from the product or service. That is, Plastim will

attempt to take out only those costs that are *nonvalue added*. Controlling physical cost drivers, such as setup-hours or cubic feet delivered, is another fundamental way that operating personnel manage costs. For example, Plastim can decrease distribution costs by packing the lenses in a way that reduces the bulkiness of the packages delivered.

The following table shows the reduction in distribution costs of the S3 and CL5 lenses as a result of actions that lower cost per cubic foot delivered (from \$5.80 to \$5.40) and total cubic feet of deliveries (from 45,000 to 40,000 for S3 and 22,500 to 20,000 for CL5).

	60,000 (S3) Lenses		15,000 (CL5) Lenses	
	Total (1)	per Unit (2) = (1) ÷ 60,000	Total (3)	per Unit (4) = (3) ÷ 15,000
Distribution costs (from Exhibit 5-5)				
S3, 45,000 cubic feet × \$5.80/cubic foot	\$261,000	\$4.36		
CL5, 22,500 cubic feet × \$5.80/cubic foot			\$130,500	\$8.70
Distribution costs as a result of process improvements				
S3, 40,000 cubic feet × \$5.40/cubic foot	216,000	3.00		
CL5, 20,000 cubic feet × \$5.40/cubic foot			108,000	7.20
Savings in distribution costs from process improvements	<u>\$ 45,000</u>	<u>\$0.75</u>	<u>\$ 22,500</u>	<u>\$1.50</u>

In the long run, total distribution costs will decrease from \$391,500 (\$261,000 + \$130,500) to \$324,000 (\$216,000 + \$108,000). In the short run, however, distribution costs may be fixed and may not decrease. Suppose all \$391,500 of distribution costs are fixed costs in the short run. The efficiency improvements (using less distribution labor and space) mean that the same \$391,500 of distribution costs can now be used to distribute 72,500 $\left(\frac{\$391,500}{\$5.40 \text{ per cubic foot}}\right)$ cubic feet of lenses. In this case, how should costs be allocated to the S3 and CL5 lenses?

ABC systems distinguish costs incurred from resources used to design, manufacture, and deliver products and services. For the distribution activity, after process improvements,

$$\text{Costs incurred} = \$391,500$$

$$\text{Resources used} = \$216,000 \text{ (for S3 lens)} + \$108,000 \text{ (for CL5 lens)} = \$324,000$$

On the basis of the resources used by each product, Plastim's ABC system allocates \$216,000 to S3 and \$108,000 to CL5 for a total of \$324,000. The difference of \$67,500 (\$391,500 - \$324,000) is shown as costs of unused but available distribution capacity. Plastim's ABC system does not allocate the costs of unused capacity to products so as not to burden the product costs of S3 and CL5 with the cost of resources not used by these products. Instead, the system highlights the amount of unused capacity as a separate line item to signal to managers the need to reduce these costs, such as by redeploying labor to other uses or laying off workers. Chapter 9 discusses issues related to unused capacity in more detail.

Design Decisions

Management can evaluate how its current product and process designs affect activities and costs as a way of identifying new designs to reduce costs. For example, design decisions that decrease complexity of the mold reduce costs of design, materials, labor, machine setups, machine operations, and mold cleaning and maintenance. Plastim's customers may be willing to give up some features of the lens in exchange for a lower price. Note that Plastim's previous costing system, which used direct manufacturing labor-hours as the cost-allocation base for all indirect costs, would have mistakenly signaled that Plastim choose those designs that most reduce direct manufacturing labor-hours when, in fact, there is a weak cause-and-effect relationship between direct manufacturing labor-hours and indirect costs.

Planning and Managing Activities

Many companies implementing ABC systems for the first time analyze actual costs to identify activity-cost pools and activity-cost rates. To be useful for planning, making decisions, and managing activities, companies calculate a budgeted cost rate for each activity and use these budgeted cost rates to cost products as we saw in the Plastim example. At year-end, budgeted costs and actual costs are compared to provide feedback on how well activities were managed and to make adjustments for underallocated or overallocated indirect costs for each activity using methods described in Chapter 4. As activities and processes are changed, new activity-cost rates are calculated.

We will return to activity-based management in later chapters. Management decisions that use activity-based costing information are described in Chapter 6, in which we discuss activity-based budgeting; Chapter 11, in which we discuss outsourcing and adding or dropping business segments; in Chapter 12, in which we evaluate alternative design choices to improve efficiency and reduce nonvalue-added costs; in Chapter 13, in which we cover reengineering and downsizing; in Chapter 14, in which we explore managing customer profitability; in Chapter 19, in which we explain quality improvements; and in Chapter 20, in which we describe how to evaluate suppliers.

Decision Point

How can ABC systems be used to manage better?

Activity-Based Costing and Department Costing Systems

Companies often use costing systems that have features of ABC systems—such as multiple cost pools and multiple cost-allocation bases—but that do not emphasize individual activities. Many companies have evolved their costing systems from using a single indirect cost rate system to using separate indirect cost rates for each department (such as design, manufacturing, distribution, and so on) or each subdepartment (such as machining and assembly departments within manufacturing) that can be thought of as representing broad tasks. ABC systems, with its focus on specific activities, are a further refinement of department costing systems. In this section, we compare ABC systems and department costing systems.

Plastim uses the design department indirect cost rate to cost its design activity. Plastim calculates the design activity rate by dividing total design department costs by total parts-square feet, a measure of the complexity of the mold and the driver of design department costs. Plastim does not find it worthwhile to calculate separate activity rates within the design department for the different design activities, such as designing products, making temporary molds, and designing processes. Why? Because complexity of a mold is an appropriate cost-allocation base for costs incurred in each design activity. Design department costs are homogeneous with respect to this cost-allocation base.

In contrast, the manufacturing department identifies two activity cost pools—a setup cost pool and a machine operations cost pool—instead of a single manufacturing department overhead cost pool. It identifies these activity cost pools for two reasons. First, each of these activities within manufacturing incurs significant costs and has a different cost driver, setup-hours for the setup cost pool and machine-hours for the machine operations cost pool. Second, the S3 and CL5 lenses do not use resources from these two activity areas in the same proportion. For example, CL5 uses 75% ($1,500 \div 2,000$) of the setup-hours but only 29.4% ($3,750 \div 12,750$) of the machine-hours. Using only machine-hours, say, to allocate all manufacturing department costs at Plastim would result in CL5 being undercosted because it would not be charged for the significant amounts of setup resources it actually uses.

Based on what we just explained, using department indirect cost rates to allocate costs to products results in similar information as activity cost rates if (1) a single activity accounts for a sizable proportion of the department's costs; or (2) significant costs are incurred on different activities within a department, but each activity has the same cost driver and hence cost-allocation base (as was the case in Plastim's design department). From a purely product costing standpoint, department and activity indirect cost rates

Learning Objective 8

Compare activity-based costing systems and department costing systems

... activity-based costing systems are a refinement of department costing systems into more-focused and homogenous cost pools

will also result in the same product costs if (1) significant costs are incurred for different activities with different cost-allocation bases within a department but (2) different products use resources from the different activity areas in the same proportions (for example, if CLS had used 65%, say, of the setup-hours and 65% of the machine-hours). In this case, though, not identifying activities and cost drivers within departments conceals activity cost information that would be valuable for cost management and design and process improvements.

We close this section with a note of caution. Do not assume that because department costing systems require the creation of multiple indirect cost pools that they properly recognize the drivers of costs within departments as well as how resources are used by products. As we have indicated, in many situations, department costing systems can be refined using ABC. Emphasizing activities leads to more-focused and homogeneous cost pools, aids in identifying cost-allocation bases for activities that have a better cause-and-effect relationship with the costs in activity cost pools, and leads to better design and process decisions. But these benefits of an ABC system would need to be balanced against its costs and limitations.

ABC in Service and Merchandising Companies

Although many of the early examples of ABC originated in manufacturing, ABC has many applications in service and merchandising companies. In addition to manufacturing activities, the Plastim example includes the application of ABC to a service activity—design—and to a merchandising activity—distribution. Companies such as the Cooperative Bank, Braintree Hospital, BCTel in the telecommunications industry, and Union Pacific in the railroad industry have implemented some form of ABC system to identify profitable product mixes, improve efficiency, and satisfy customers. Similarly, many retail and wholesale companies—for example, Supervalu, a retailer and distributor of grocery store products, and Owens and Minor, a medical supplies distributor—have used ABC systems. Finally, as we describe in Chapter 14, a large number of financial services companies (as well as other companies) employ variations of ABC systems to analyze and improve the profitability of their customer interactions.

The widespread use of ABC systems in service and merchandising companies reinforces the idea that ABC systems are used by managers for strategic decisions rather than for inventory valuation. (Inventory valuation is fairly straightforward in merchandising companies and not needed in service companies.) Service companies, in particular, find great value from ABC because a vast majority of their cost structure comprises indirect costs. After all, there are few direct costs when a bank makes a loan, or when a representative answers a phone call at a call center. As we have seen, a major benefit of ABC is its ability to assign indirect costs to cost objects by identifying activities and cost drivers. As a result, ABC systems provide greater insight than traditional systems into the management of these indirect costs. The general approach to ABC in service and merchandising companies is similar to the ABC approach in manufacturing.

The Cooperative Bank followed the approach described in this chapter when it implemented ABC in its retail banking operations. It calculated the costs of various activities, such as performing ATM transactions, opening and closing accounts, administering mortgages, and processing Visa transactions. It then used the activity cost rates to calculate costs of various products, such as checking accounts, mortgages, and Visa cards and the costs of supporting different customers. ABC information helped the Cooperative Bank to improve its processes and to identify profitable products and customer segments. The Concepts in Action feature on page 160 describes how Charles Schwab has similarly benefited from using ABC analysis.

Activity-based costing raises some interesting issues when it is applied to a public service institution such as the U.S. Postal Service. The costs of delivering mail to remote locations are far greater than the costs of delivering mail within urban areas. However, for fairness and community-building reasons, the Postal Service cannot charge higher prices to customers in remote areas. In this case, activity-based costing is valuable for understanding, managing, and reducing costs but not for pricing decisions.

Decision Point

When can department costing systems be used instead of ABC systems?

Concepts in Action

Time-Driven Activity-Based Costing at Charles Schwab



Time-driven activity-based costing ("TDABC") helps Charles Schwab, the leading stock brokerage, with strategic analysis, measurement, and management of its stock trading activity across multiple channels such as branches, call centers, and the Internet. Because the costs for each channel are different, TDABC helps answer questions such as the following: What are the total costs of branch transactions versus online transactions? Which channels help reduce overall costs? How can Charles Schwab price its services to drive changes in customer behavior?

TDABC assigns all of the company's resource costs to cost objects using a framework that requires two sets of estimates. TDABC first calculates the cost of supplying resource capacity, such as broker time. The total cost of resources including personnel, management, occupancy, technology, and supplies is divided by the available capacity—the time available for brokers to do the work—to obtain the capacity cost rate. Next, TDABC uses the capacity cost rate to drive resource costs to cost objects, such as stock trades executed through brokers at a branch, by estimating the demand for resource capacity (time) that the cost object requires.

Realizing that trades executed online cost much less than trades completed through brokers, Charles Schwab developed a fee structure for trading of mutual funds to stimulate the use of cheaper channels. Charles Schwab also used TDABC information to lower process costs by several

hundred million dollars annually and to better align product pricing and account management to the company's diverse client segments. The company is working on other opportunities, including priority-call routing and email marketing, to further reduce costs while maintaining or enhancing Charles Schwab's already top-rated customer service.

Sources: Kaplan, R. S. and S. R. Anderson. 2007. The innovation of time-driven activity-based costing. *Cost Management*, March–April: 5–13; Kaplan, R. S. and S. R. Anderson. 2007. *Time-driven activity-based costing*. Boston, MA: Harvard Business School Press; Martinez-Jerez, F. Aza. 2007. Understanding customer profitability at Charles Schwab. Harvard Business School Case Study No. 9-306-102, January.

Problem for Self-Study

Family Supermarkets (FS) has decided to increase the size of its Memphis store. It wants information about the profitability of individual product lines: soft drinks, fresh produce, and packaged food. FS provides the following data for 2011 for each product line:

	Soft Drinks	Fresh Produce	Packaged Food
Revenues	\$317,400	\$840,240	\$483,960
Cost of goods sold	\$240,000	\$600,000	\$360,000
Cost of bottles returned	\$ 4,800	\$ 0	\$ 0
Number of purchase orders placed	144	336	144
Number of deliveries received	120	876	264
Hours of shelf-stocking time	216	2,160	1,080
Items sold	50,400	441,600	122,400

FS also provides the following information for 2011:

Activity (1)	Description of Activity (2)	Total Support Costs (3)	Cost-Allocation Base (4)
1. Bottle returns	Returning of empty bottles to store	\$ 4,800	Direct tracing to soft-drink line
2. Ordering	Placing of orders for purchases	\$ 62,400	624 purchase orders
3. Delivery	Physical delivery and receipt of merchandise	\$100,800	1,280 deliveries
4. Shelf-stocking	Stocking of merchandise on store shelves and ongoing restocking	\$ 69,120	3,456 hours of shelf-stocking time
5. Customer support	Assistance provided to customers, including checkout and bagging	\$122,880	614,400 items sold
Total		<u>\$360,000</u>	

- Family Supermarkets currently allocates store support costs (all costs other than cost of goods sold) to product lines on the basis of cost of goods sold of each product line. Calculate the operating income and operating income as a percentage of revenues for each product line.
- If Family Supermarkets allocates store support costs (all costs other than cost of goods sold) to product lines using an ABC system, calculate the operating income and operating income as a percentage of revenues for each product line.
- Comment on your answers in requirements 1 and 2.

Required

Solution

- The following table shows the operating income and operating income as a percentage of revenues for each product line. All store support costs (all costs other than cost of goods sold) are allocated to product lines using cost of goods sold of each product line as the cost-allocation base. Total store support costs equal \$360,000 (cost of bottles returned, \$4,800 + cost of purchase orders, \$62,400 + cost of deliveries, \$100,800 + cost of shelf-stocking, \$69,120 + cost of customer support, \$122,880). The allocation rate for store support costs = $\$360,000 \div \$1,200,000$ (soft drinks \$240,000 + fresh produce \$600,000 + packaged food, \$360,000) = 30% of cost of goods sold. To allocate support costs to each product line, FS multiplies the cost of goods sold of each product line by 0.30.

	Soft Drinks	Fresh Produce	Packaged Food	Total
Revenues	\$317,400	\$840,240	\$483,960	\$1,641,600
Cost of goods sold	240,000	600,000	360,000	1,200,000
Store support cost ($\$240,000; \$600,000; \$360,000$) \times 0.30	72,000	180,000	108,000	360,000
Total costs	312,000	780,000	468,000	1,560,000
Operating income	\$ 5,400	\$ 60,240	\$ 15,960	\$ 81,600
Operating income \div Revenues	1.70%	7.17%	3.30%	4.97%

2. Under an ABC system, FS identifies bottle-return costs as a direct cost because these costs can be traced to the soft drink product line. FS then calculates cost-allocation rates for each activity area (as in Step 5 of the seven-step costing system, described in the chapter, p. 152). The activity rates are as follows:

Activity (1)	Cost Hierarchy (2)	Total Costs (3)	Quantity of Cost-Allocation Base (4)	Overhead Allocation Rate (5) = (3) ÷ (4)
Ordering	Batch-level	\$ 62,400	624 purchase orders	\$100 per purchase order
Delivery	Batch-level	\$100,800	1,280 deliveries	\$80 per delivery
Shelf-stocking	Output unit-level	\$ 69,120	3,456 shelf-stocking-hours	\$20 per stocking-hour
Customer support	Output unit-level	\$122,880	614,400 items sold	\$0.20 per item sold

Store support costs for each product line by activity are obtained by multiplying the total quantity of the cost-allocation base for each product line by the activity cost rate. Operating income and operating income as a percentage of revenues for each product line are as follows:

	Soft Drinks	Fresh Produce	Packaged Food	Total
Revenues	\$317,400	\$840,240	\$483,960	\$1,641,600
Cost of goods sold	240,000	600,000	360,000	1,200,000
Bottle-return costs	4,800	0	0	4,800
Ordering costs (144; 336; 144) purchase orders × \$100	14,400	33,600	14,400	62,400
Delivery costs (120; 876; 284) deliveries × \$80	9,600	70,080	21,120	100,800
Shelf-stocking costs (216; 2,160; 1,080) stocking-hours × \$20	4,320	43,200	21,600	69,120
Customer-support costs (50,400; 441,600; 122,400) items sold × \$0.20	10,080	88,320	24,480	122,880
Total costs	283,200	835,200	441,600	1,560,000
Operating income	\$ 34,200	\$ 5,040	\$ 42,360	\$ 81,600
Operating income ÷ Revenues	10.78%	0.60%	8.75%	4.97%

3. Managers believe the ABC system is more credible than the simple costing system. The ABC system distinguishes the different types of activities at FS more precisely. It also tracks more accurately how individual product lines use resources. Rankings of relative profitability—operating income as a percentage of revenues—of the three product lines under the simple costing system and under the ABC system are as follows:

Simple Costing System		ABC System	
1. Fresh produce	7.17%	1. Soft drinks	10.78%
2. Packaged food	3.30%	2. Packaged food	8.75%
3. Soft drinks	1.70%	3. Fresh produce	0.60%

The percentage of revenues, cost of goods sold, and activity costs for each product line are as follows:

	Soft Drinks	Fresh Produce	Packaged Food
Revenues	19.34%	51.18%	29.48%
Cost of goods sold	20.00	50.00	30.00
Bottle returns	100.00	0	0
Activity areas:			
Ordering	23.08	53.84	23.08
Delivery	9.53	69.52	20.95
Shelf-stocking	6.25	62.50	31.25
Customer-support	8.20	71.88	19.92