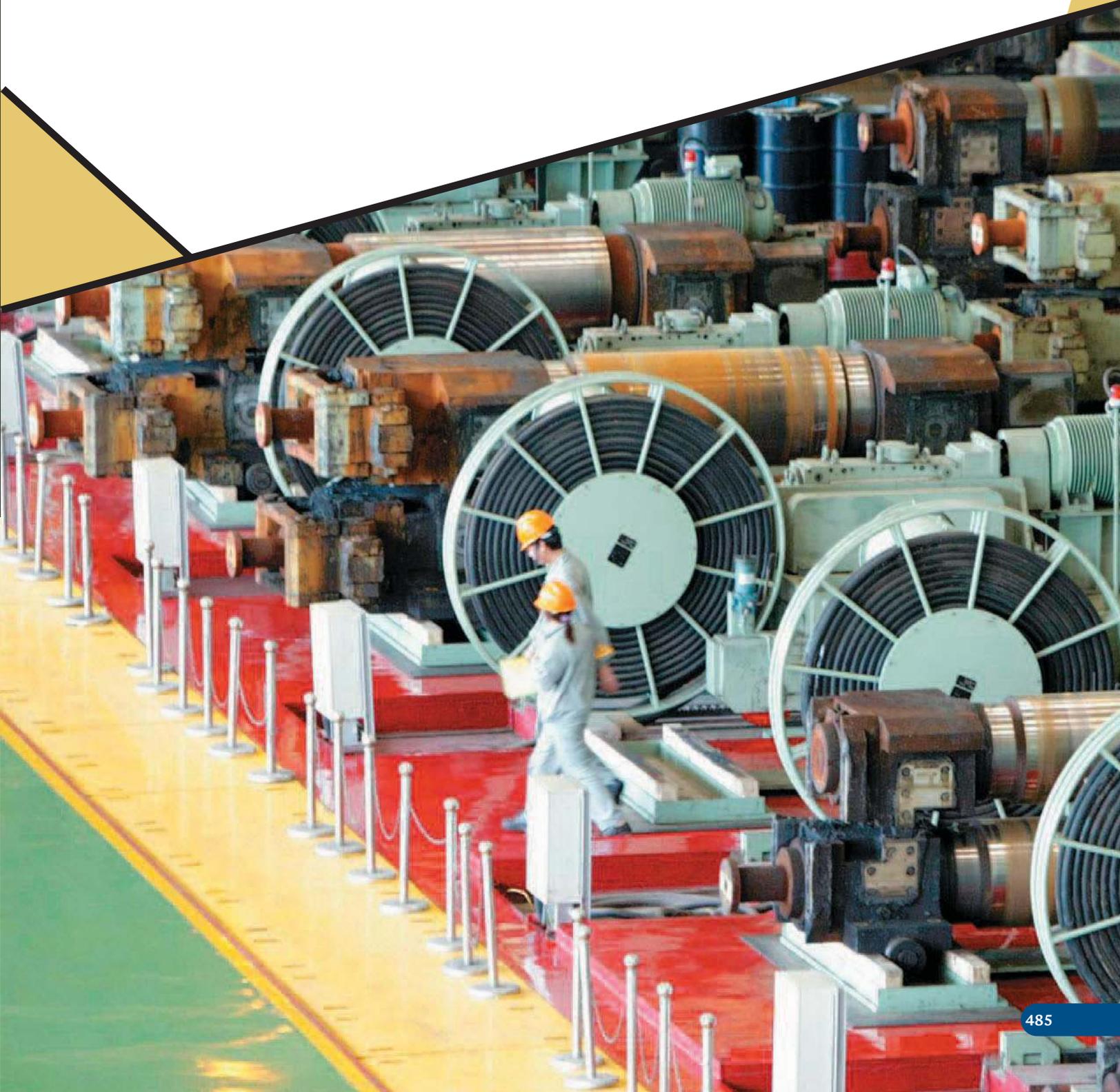


ADVANCED COSTING AND CONTROL

PART 3

CHAPTER

- 11 Strategic Cost Management
- 12 Activity-Based Management
- 13 The Balanced Scorecard: Strategic-Based Control
- 14 Quality Cost Management
- 15 Productivity Measurement and Control
- 16 Environmental Costs: Measurement and Control





CHAPTER

11

Strategic Cost Management

AFTER STUDYING THIS CHAPTER, YOU SHOULD BE ABLE TO:

1. Explain what strategic cost management is and how it can be used to help a firm create a competitive advantage.
2. Discuss value-chain analysis and the strategic role of activity-based customer and supplier costing.
3. Tell what life-cycle cost management is and how it can be used to maximize profits over a product's life cycle.
4. Identify the basic features of JIT purchasing and manufacturing.
5. Describe the effect JIT has on cost traceability and product costing.

Why is one brand of ice cream viewed as better than another brand? It may reflect a deliberate decision by an ice cream producer to design and make an ice cream product that uses special ingredients and flavors rather than simply the ordinary. It is a means of differentiating the product and making it unlike those of competitors. It also may mean a conscious decision has been made to target certain types of consumers—consumers who are willing to pay for a higher quality, specialized ice cream. Whether this is a good strategy or not depends on its profitability. Cost management plays a vital role in strategic decision making. Cost information is critical in formulating and choosing strategies as well as in evaluating the continued viability of existing strategic positions.

In Chapter 4, the basic concepts of activity-based costing were introduced. These concepts were illustrated using the traditional product cost definition. Activity-based product costing can significantly im-

prove the accuracy of traditional product costs. Thus, inventory valuation is improved, and managers (and other information users) have better information concerning the costs of products leading to more informed decision making. Yet, the value of the traditional product cost definition is limited and may not be very useful in certain decision contexts. For example, corporations engage in decision making that affects their long-run competitive position and profitability. Strategic planning and decision making require a much broader set of cost information than that provided by product costs. Cost information about customers, suppliers, and different product designs is also needed to support strategic management objectives.

This broader set of information should satisfy two requirements. First, it should include information about the firm's environment and internal workings. Second, it must be prospective and thus should provide insight about future periods and activities. A value-chain framework with cost data to support a value-chain analysis satisfies the first requirement. Cost information to support product life-cycle analysis is needed to satisfy the second requirement. Value-chain analysis can produce organizational changes that fundamentally alter the nature and demand for cost information. Just-in-time (JIT) manufacturing is an example of a strategic approach that alters the nature of the cost accounting information system. In this chapter, we introduce strategic cost management, life-cycle cost management, and JIT manufacturing. The JIT approach is used to illustrate the value-chain concepts. However, given the breadth of its application and its effect on cost accounting, JIT is a topic that by itself merits study. Furthermore, JIT's linkages to strategic cost management justify this topic's inclusion in the same chapter with strategic cost management.

OBJECTIVE 1

Explain what strategic cost management is and how it can be used to help a firm create a competitive advantage.

Strategic Cost Management: Basic Concepts

Decision making that affects the long-term competitive position of a firm must explicitly consider the strategic elements of a decision. The most important strategic elements for a firm are its long-term growth and survival. Thus, **strategic decision making** is choosing among alternative strategies with the goal of selecting a strategy, or strategies, that provides a company with reasonable assurance of long-term growth and survival. The key to achieving this goal is to gain a *competitive advantage*. **Strategic cost management** is the use of cost data to develop and identify superior strategies that will produce a sustainable competitive advantage.

Strategic Positioning: The Key to Creating and Sustaining a Competitive Advantage

Competitive advantage is creating better customer value for the same or lower cost than offered by competitors or creating equivalent value for lower cost than offered by competitors. **Customer value** is the difference between what a customer receives (customer realization) and what the customer gives up (customer sacrifice). What a customer receives is more than simply the basic level of performance provided by a product.¹ What is received is called the *total product*. The **total product** is the complete range of tangible and intangible benefits that a customer receives from a purchased product. Thus, customer realization includes basic and special product features, service, quality, instructions for use, reputation, brand name, and any other factors deemed important by customers. Customer sacrifice includes the cost of purchasing the product, the time and effort spent acquiring and learning to use the product, and **post-purchase costs**, which are the costs of using, maintaining, and disposing of the product.

1. Keep in mind that our definition of *product* includes services. Services are intangible products.

Increasing customer value to achieve a competitive advantage is tied closely to judicious strategy selection. Three general strategies have been identified: *cost leadership*, *product differentiation*, and *focusing*.²

Cost Leadership

The objective of a **cost leadership strategy** is to provide the same or better value to customers at a *lower cost* than offered by competitors. Essentially, if customer value is defined as the difference between realization and sacrifice, a low-cost strategy increases customer value by minimizing customer sacrifice. In this case, cost leadership is the goal of the organization. For example, a company might redesign a product so that fewer parts are needed, lowering production costs and the costs of maintaining the product after purchase.

Differentiation

A **differentiation strategy**, on the other hand, strives to increase customer value by increasing what the customer receives (customer realization). A competitive advantage is created by providing something to customers that is not provided by competitors. Therefore, product characteristics must be created that set the product apart from its competitors. This differentiation can occur by adjusting the product so that it is different from the norm or by promoting some of the product's tangible or intangible attributes. Differences can be functional, aesthetic, or stylistic. For example, a retailer of computers might offer on-site repair service, a feature not offered by other rivals in the local market. Or a producer of crackers may offer animal-shaped crackers, as **Nabisco** did with Teddy Grahams[®], to differentiate its product from other brands with more conventional shapes. To be of value, however, customers must see the variations as important. Furthermore, the value added to the customer by differentiation must exceed the firm's costs of providing the differentiation. If customers see the variations as important and if the value added to the customer exceeds the cost of providing the differentiation, then a competitive advantage has been established.

Focusing

A **focusing strategy** is selecting or emphasizing a market or customer segment in which to compete. One possibility is to select the markets and customers that appear attractive and then develop the capabilities to serve these targeted segments. Another possibility is to select specific segments where the firm's core competencies in the segments are superior to those of competitors. A focusing strategy recognizes that not all segments (e.g., customers and geographic regions) are the same. Given the capabilities and potential capabilities of the organization, some segments are more attractive than others.

Strategic Positioning

In reality, many firms will choose not just one general strategy, but a combination of the three general strategies. **Strategic positioning** is the process of selecting the optimal mix of these three general strategic approaches. The mix is selected with the objective of creating a sustainable competitive advantage. A **strategy**, reflecting combinations of the three general strategies, can be defined as:

. . . choosing the market and customer segments the business unit intends to serve, identifying the critical internal business processes that the unit must excel at to deliver the value propositions to customers in the targeted market segments, and selecting the individual and organizational capabilities required for the internal, customer, and financial objectives.³

2. See M. E. Porter, *Competitive Advantage: Creating and Sustaining Superior Performance* (New York: Free Press, 1985) for a more complete discussion of the three strategic positions.

3. Robert S. Kaplan and David P. Norton, *The Balanced Scorecard* (Boston: Harvard Business School Press, 1996): 37.

As used in the definition, “choosing the market and customer segments” is actually focusing; “deliver[ing] the value propositions” is choosing to increase customer realization and/or decrease sacrifice and, therefore, entails cost leadership and/or differentiation strategies, or a combination of the two. Developing the necessary capabilities to serve the segments is related to all three general strategies.

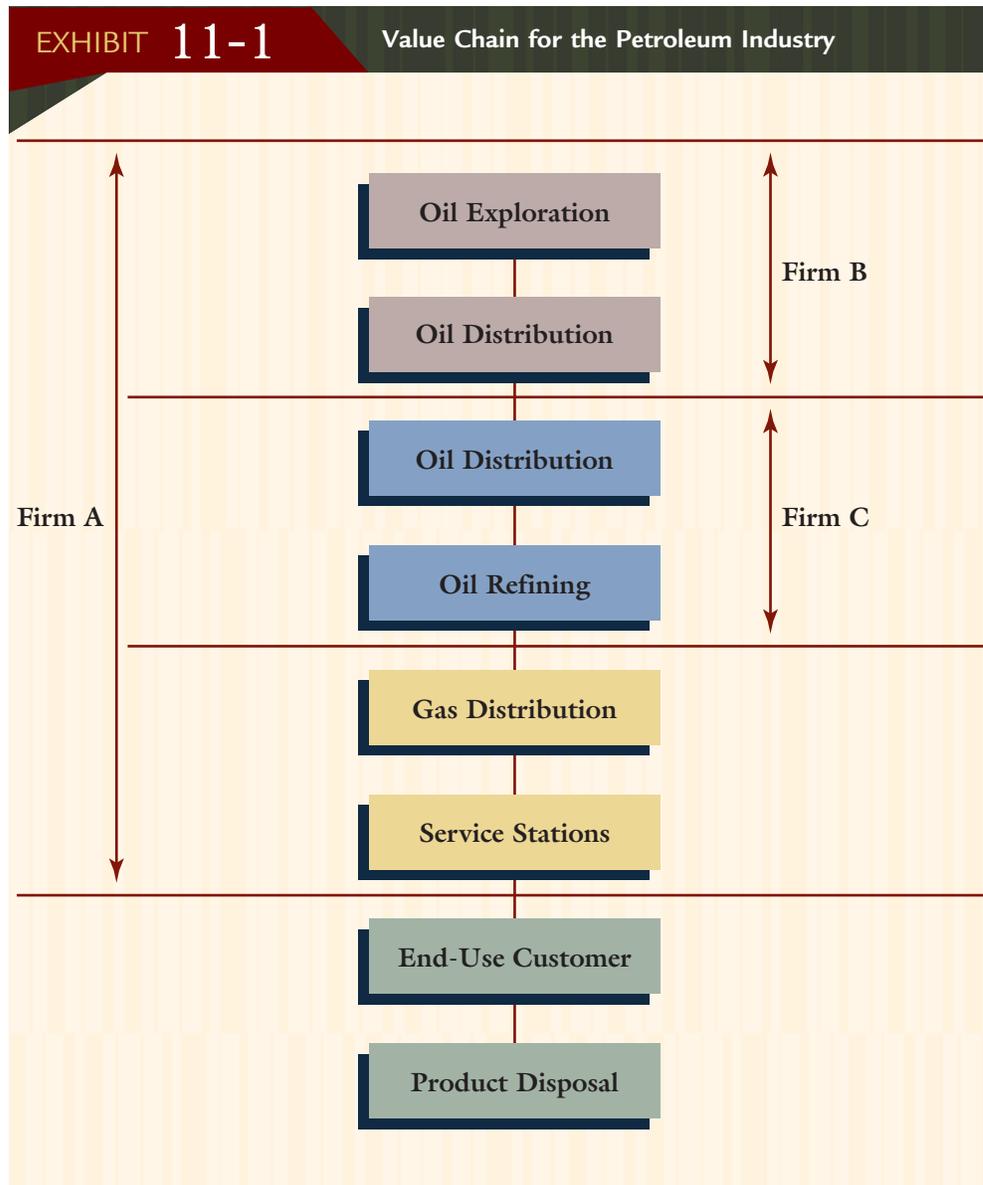
What is the role of cost management in strategic positioning? The *objective* of strategic cost management is to *reduce* costs while simultaneously *strengthening* the chosen strategic position. Remember that a competitive advantage is tied to costs. For example, suppose that an organization is providing the same customer value at a higher cost than its competitors. By increasing customer value for specific customer segments (e.g., differentiation and focusing are used to strengthen the strategic position) and, at the same time, *decreasing* costs, the organization might reach a state where it is providing greater value at the same or less cost than its competitors, thus creating a competitive advantage.

Value-Chain Framework, Linkages, and Activities

Choosing an optimal (or most advantageous) strategic position requires managers to understand the activities that contribute to its achievement. Successful pursuit of a sound strategic position mandates an understanding of the *industrial value chain*. The **industrial value chain** is the linked set of value-creating activities from basic raw materials to the disposal of the finished product by end-use customers. Exhibit 11-1, on the following page, illustrates a possible industrial value chain for the petroleum industry. A given firm operating in the oil industry may not—and likely will not—span the entire value chain. The exhibit illustrates that different firms participate in different portions of the value chain. Most large oil firms such as **Exxon-Mobil** and **ConocoPhillips** are involved in the value chain from exploration to service stations (like Firm A in Exhibit 11-1). Yet, even these oil giants purchase oil from other producers and also supply gasoline to service station outlets that are owned by others. Furthermore, there are many oil firms that engage exclusively in smaller segments of the chain such as exploration and production or refining and distribution (like Firms B and C in Exhibit 11-1). Regardless of its position in the value chain, to create and sustain a competitive advantage, a firm must understand the entire value chain and not just the portion in which it operates.

Thus, breaking down the value chain into its strategically relevant activities is basic to successful implementation of cost leadership and differentiation strategies. A value-chain framework is a compelling approach to understanding a firm’s strategically important activities. Fundamental to a value-chain framework is the recognition that there exist complex linkages and interrelationships among activities both within and beyond the firm. Two types of linkages must be analyzed and understood: *internal linkages* and *external linkages*. **Internal linkages** are relationships among activities that are performed within a firm’s portion of the value chain. **External linkages**, on the other hand, describe the relationship of a firm’s value-chain activities that are performed with its suppliers and customers. External linkages, therefore, are of two types: *supplier linkages* and *customer linkages*.

External linkages emphasize the fact that a company must understand the entire value chain and not just the portion of the chain in which it participates. An *external* focus is needed for effective strategic cost management. A company cannot ignore supplier and customer linkages and expect to establish a sustainable competitive advantage. A company needs to understand its relative position in the industrial value chain. An assessment of the economic strength and relationships of each stage in the entire value-chain system can provide a company with several significant strategic insights. For example, knowing the revenues and costs of the different stages may reveal the need to forward or backward integrate to increase overall economic performance. Alternatively, it may reveal that divestiture and a narrowing of participation in the industrial value chain is a good strategy. Finally, knowing the supplier power and buyer power can have



a significant effect on how external linkages are exploited. Supplier and buyer power can be assessed for a company by comparing the percentage of profits earned in the industrial value chain with the percentages earned by suppliers and by customers. For example, suppose that the profit earned per gallon of gasoline by an independent refiner and producer is \$0.15 and the profit earned by a network of service stations that buy the gasoline (not owned by the independent) is \$0.05 per gallon. The percentage of profit earned in this segment of the value chain by the downstream stage is 25 percent ($\$0.05/\0.20), while the independent earns 75 percent of the profit. Buyer power is weak relative to the refiner and producer. If, in addition, the return on assets being earned by the service station segment is high, this may reveal that integrating forward is both desirable and possible.

To exploit a firm's internal and external linkages, we must identify the firm's activities and select those that can be used to produce (or sustain) a competitive advantage. This selection process requires knowledge of the cost and value of each activity. For strategic analysis, activities are classified as *organizational activities* and *operational activities*; the costs of these activities, in turn, are determined by *organizational* and *operational cost drivers*.

Organizational Activities and Cost Drivers

Organizational activities are of two types: *structural* and *executional*. **Structural activities** are activities that determine the underlying economic structure of the organization. **Executional activities** are activities that define the processes and capabilities of an organization and thus are directly related to the ability of an organization to execute successfully. **Organizational cost drivers** are structural and executional factors that determine the long-term cost structure of an organization. Thus, there are two types of organizational drivers: *structural cost drivers* and *executional cost drivers*. Possible structural and executional activities with their cost drivers are listed by category in Exhibit 11-2.

EXHIBIT 11-2 Organizational Activities and Drivers	
Structural Activities	Structural Cost Drivers
Building plants	Number of plants, scale, degree of centralization
Management structuring	Management style and philosophy
Grouping employees	Number and type of work units
Complexity	Number of product lines, number of unique processes, number of unique parts, degree of complexity
Vertically integrating	Scope, buying power, selling power
Selecting and using process technologies	Types of process technologies, experience
Executional Activities	Executional Cost Drivers
Using employees	Degree of involvement
Providing quality	Quality management approach
Providing plant layout	Plant layout efficiency
Designing and producing products	Product configuration
Providing capacity	Capacity utilization

As the exhibit shows, it is possible (and perhaps common) that a given organizational activity can be driven by more than one driver. For example, the cost of building plants is affected by number of plants, scale, and degree of centralization. Firms that have a commitment to a high degree of centralization may build larger plants so that there can be more geographic concentration and greater control. Similarly, complexity may be driven by number of different products, number of unique processes, and number of unique parts.

Organizational drivers are factors that affect an organization's long-term cost structure. This is readily understood by simply considering the various drivers shown in Exhibit 11-2. Among the structural drivers are the familiar drivers of scale, scope, experience, technology, and complexity. For example, economies and diseconomies of scale are well-known economic phenomena, and the learning curve effect (experience) is also well documented. An interesting property of structural cost drivers is that more is not always better. Moreover, the efficiency level of a structural driver can change. For example, changes in technology can affect the scale driver by changing the optimal size of a plant. In the steel industry, minimill technology has eliminated scale economies (in

the form of megamills) as a competitive advantage. Plants of much smaller scale can now achieve the same level of efficiency once produced only by larger steel plants.

Of more recent interest and emphasis are executional drivers. Considerable managerial effort is being expended to improve how things are done in an organization. Continuous improvement and its many faces (employee empowerment, total quality management, process value analysis, life-cycle assessment, etc.) are what executional efficiency is all about. Consider employee involvement and empowerment. The cost of using employees decreases as the degree of involvement increases. Employee or worker involvement refers to the culture, degree of participation, and commitment to the objective of continuous improvement.

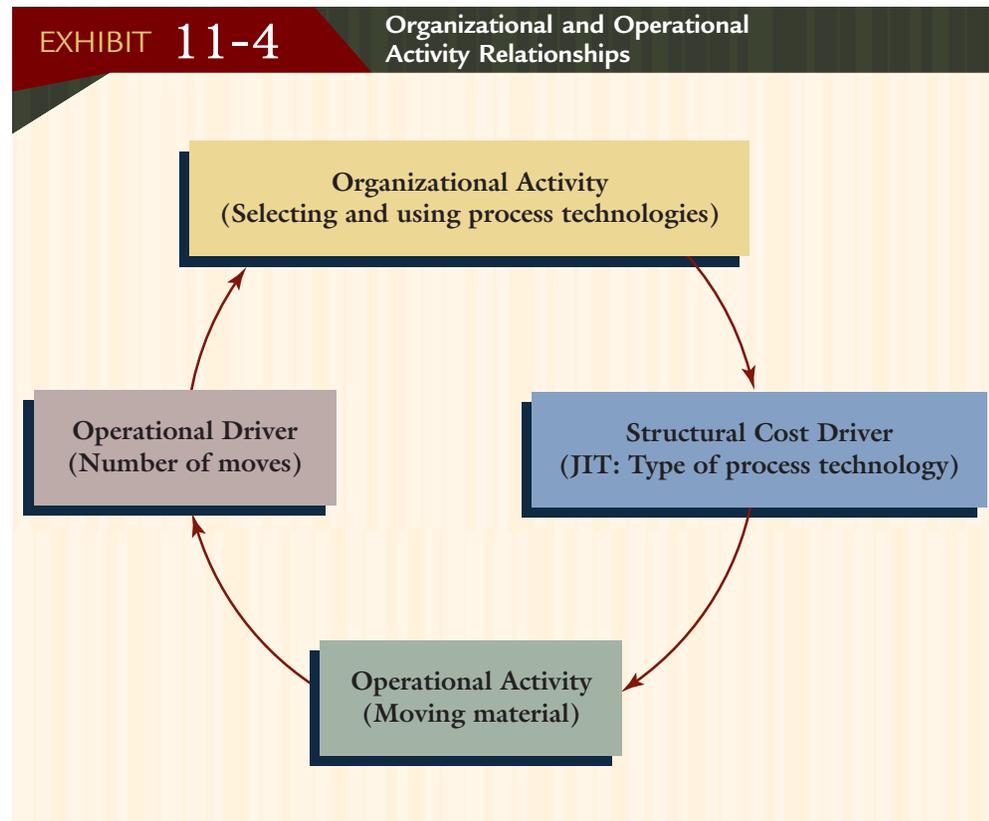
Operational Activities and Drivers

Operational activities are day-to-day activities performed as a result of the structure and processes selected by the organization. Examples include receiving and inspecting incoming parts, moving materials, shipping products, testing new products, servicing products, and setting up equipment. **Operational cost drivers** (activity drivers) are those factors that drive the cost of operational activities. They include such factors as number of parts, number of moves, number of products, number of customer orders, and number of returned products. As should be evident, operational activities and drivers are the focus of activity-based costing. Possible operational activities and their drivers are listed in Exhibit 11-3.

EXHIBIT 11-3	
Operational Activities and Drivers	
Unit-Level Activities	Unit-Level Drivers
Grinding parts	Grinding machine hours
Assembling parts	Assembly labor hours
Drilling holes	Drilling machine hours
Using materials	Pounds of material
Using power	Number of kilowatt-hours
Batch-Level Activities	Batch-Level Drivers
Setting up equipment	Number of setups
Moving batches	Number of moves
Inspecting batches	Inspection hours
Reworking products	Number of defective units
Product-Level Activities	Product-Level Drivers
Redesigning products	Number of change orders
Expediting	Number of late orders
Scheduling	Number of different products
Testing products	Number of procedures

The structural and executional activities define the number and nature of the day-to-day activities performed within the organization. For example, if an organization decides to produce more than one product at a facility, then this structural choice produces a need for scheduling, a product-level activity. Similarly, providing a plant layout defines the nature and extent of the materials handling activity (usually a batch-level activity). Furthermore, although organizational activities define operational activities,

analysis of operational activities and drivers can be used to suggest strategic choices of organizational activities and drivers. For example, knowing that the number of moves is a measure of consumption of the materials handling activity by individual products may suggest that resource spending can be reduced if the plant layout is redesigned to reduce the number of moves needed. Operational and organizational activities and their associated drivers are strongly interrelated. Exhibit 11-4 illustrates the circular nature of these relationships.



OBJECTIVE 2

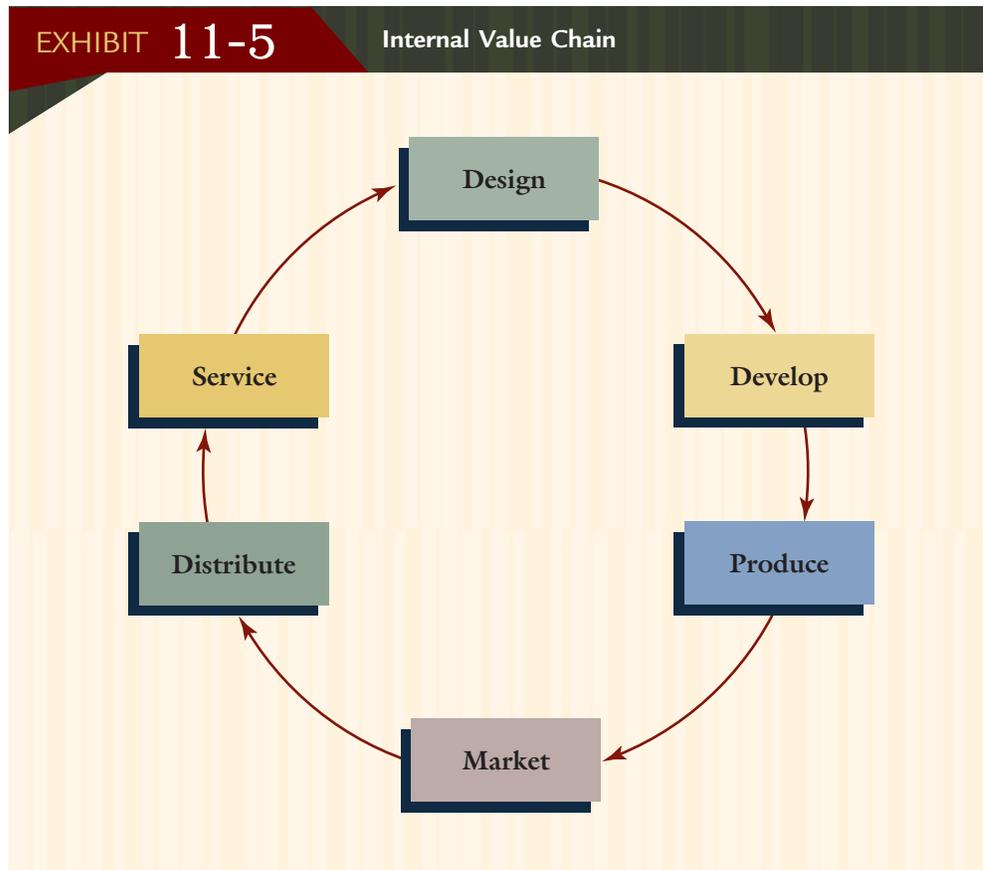
Discuss value-chain analysis and the strategic role of activity-based customer and supplier costing.

Value-Chain Analysis

Value-chain analysis is identifying and exploiting internal and external linkages with the objective of strengthening a firm's strategic position. The exploitation of linkages relies on analyzing how costs and other nonfinancial factors vary as different bundles of activities are considered. For example, organizations change their structure and processes as needed to meet new challenges and take advantage of new opportunities. This may include new approaches to differentiation. Additionally, managing organizational and operational cost drivers to create long-term cost reduction outcomes is an important input in value-chain analysis when cost leadership is emphasized. The objective, of course, is to control cost drivers better than competitors can (thus creating a competitive advantage).

Exploiting Internal Linkages

Sound strategic cost management mandates the consideration of that portion of the value chain in which a firm participates (called the *internal value chain*). Exhibit 11-5 reviews the internal value-chain activities for an organization. Activities before and after production must be identified and their linkages recognized and exploited. Exploiting



internal linkages means that relationships between activities are assessed and used to reduce costs and increase value. For example, product design and development activities occur before production and are linked to production activities. The way the product is designed affects the costs of production. How production costs are affected requires a knowledge of cost drivers. Thus, knowing the cost drivers of activities is crucial for understanding and exploiting linkages. If design engineers know that the number of parts is a cost driver for various production activities (material usage, direct labor usage, assembly, inspection, materials handling, and purchasing are examples of activities where costs could be affected by number of parts), then redesigning the product so that it has standard parts, multiple sources, short lead times, and high quality can significantly reduce the overall cost of the product.

The design activity is also linked to the service activity in the firm's value chain. By producing a product with fewer parts, there is less likelihood of product failure and, thus, less cost associated with warranty agreements (an important customer service). Furthermore, the cost of repairing products under warranty should also decrease because fewer parts usually means simpler repair procedures.

Internal Linkage Analysis: An Example

To provide a more concrete foundation for the internal linkage concepts, let's consider a specific numerical example. Assume that a firm produces a variety of high-tech medical products. One of the products has 20 parts. Design engineers have been told that the number of parts is a significant cost driver (operational cost driver) and that reducing the number of parts will reduce the demand for various activities downstream in the value chain. Based on this input, design engineering has produced a new configuration for the product that requires only eight parts. Management wants to know the cost reduction produced by the new design. They plan on reducing the price per

unit by the per-unit savings. Currently, 10,000 units of the product are produced. The effect of the new design on the demand for four activities follows. Activity capacity, current activity demand (based on the 20-part configuration), and expected activity demand (based on the 8-part configuration) are provided.

<i>Activities</i>	<i>Activity Driver</i>	<i>Activity Capacity</i>	<i>Current Activity Demand</i>	<i>Expected Activity Demand</i>
Material usage	Number of parts	200,000	200,000	80,000
Assembling parts	Direct labor hours	10,000	10,000	5,000
Purchasing parts	Number of orders	15,000	12,500	6,500
Warranty repair	Number of defective products	1,000	800	500

Additionally, the following activity cost data are provided:

Material usage: \$3 per part used; no fixed activity cost.

Assembling parts: \$12 per direct labor hour; no fixed activity cost.

Purchasing parts: Three salaried clerks, each earning a \$30,000 annual salary; each clerk is capable of processing 5,000 purchase orders. Variable activity costs: \$0.50 per purchase order processed for forms, postage, etc.

Warranty repair: Two repair agents, each paid a salary of \$28,000 per year; each repair agent is capable of repairing 500 units per year. Variable activity costs: \$20 per product repaired.

Using the information in the table and the cost data, the potential savings produced by the new design are given in Exhibit 11-6. Cost behavior of individual activities is vital for assessing the impact of the new design. Knowing the cost of different design strategies is made possible by assessing the linkages of activities and the effects of changes in demand for the activities. Notice the key role that the resource usage model plays in this analysis.⁴ The purchasing activity currently supplies 15,000 units of activity capacity, acquired in steps of 5,000 units. (Capacity is measured in the number of purchase orders—see Exhibit 11-7, on the following page, for a graphical illustration of the activity's step-cost behavior.) Unused activity for the current product configuration is 2,500

EXHIBIT 11-6 Cost Reduction from Exploiting Internal Linkages

Material usage	\$360,000 ^a
Labor usage	60,000 ^b
Purchasing	33,000 ^c
Warranty repair	34,000 ^d
Total	<u>\$487,000</u>
Units	10,000
Unit savings	\$48.70

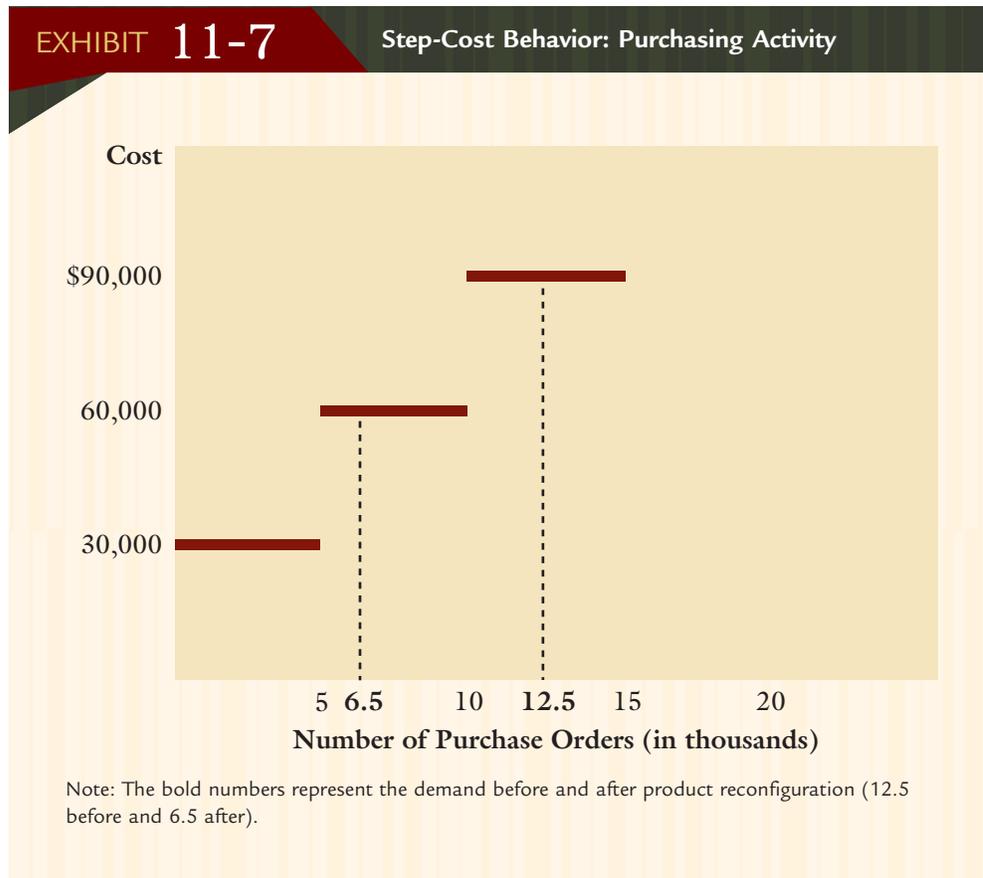
^a(200,000 – 80,000)\$3.

^b(10,000 – 5,000)\$12.

^c[\$30,000 + \$0.50(12,500 – 6,500)].

^d[\$28,000 + \$20(800 – 500)].

4. The resource usage model was introduced in Chapter 3.



units (15,000 – 12,500). Reconfiguring the product reduces the demand from 12,500 orders to 6,500 orders. This increases the unused activity capacity to 8,500 units (15,000 – 6,500). At this point, management has the capability of reducing resource spending on the resources acquired in advance of usage. Since activity capacity is acquired in chunks of 5,000 units, resource spending can be reduced by \$30,000 (the price of one purchasing clerk). Furthermore, since demand decreases, resource spending for the resources acquired as needed is also reduced \$3,000 by the variable component ($\$0.50 \times 6,000$). A similar analysis is carried out for the warranty activity. The activity-based costing model and knowledge of activity cost behavior are powerful and integral components of strategic cost management.

In the example, we implicitly assumed that resource spending on the engineering design activity would remain unchanged. Therefore, there was no cost to exploiting the linkage. Suppose, however, that an increase in resource spending of \$50,000 is needed to exploit the linkages between engineering design and activities downstream in the firm's value chain. Spending \$50,000 to save \$487,000 is certainly sound. Spending on one activity to save on the cost of other activities is a fundamental principle of strategic cost analysis.

Exploiting Supplier Linkages

Although each firm has its own value chain, as was shown in Exhibit 11-1 on p. 490, each firm also belongs to a broader value chain—the *industrial value chain*. The value-chain system also includes value-chain activities that are performed by suppliers and buyers. A firm cannot ignore the interaction between its own value-chain activities and those of its suppliers and buyers. Linkages with activities external to the firm can also be exploited. Exploiting external linkages means managing these linkages so that both the company and the external parties receive an increase in benefits.

Suppliers provide inputs and, as a consequence, can have a significant effect on a user's strategic positioning. For example, assume that a company adopts a *total quality control* approach to differentiate and reduce overall quality costs. **Total quality control** is an approach to managing quality that demands the production of defect-free products. Reducing defects, in turn, reduces the total costs spent on quality activities. Yet, if the components are delivered late and are of low quality, then there is no way the buying company can produce high-quality products and deliver them on time to its customers. To achieve a defect-free state, a company is strongly dependent on its suppliers' ability to provide defect-free parts. Once this linkage is understood, then a company can work closely with its suppliers so that the product being purchased meets its needs. **Honeywell** understands this linkage and has established a supplier review board with the objective of improving business relationships and material quality. Its evaluation and selection of suppliers is based on factors such as product quality, delivery, reliability, continuous improvement, and overall relations. Suppliers are expected to meet certain quality and delivery standards such as 500 parts per million (defect rate), 99 percent on-time delivery, and a 99 percent lot acceptance rate.⁵

Managing Procurement Costs

Clearly, to avoid weakening its strategic position, a firm must carefully choose its suppliers. To encourage purchasing managers to choose suppliers whose quality, reliability, and delivery performance are acceptable, two essential requirements have been identified.⁶ First, a broader view of component costs is needed. Functional-based costing systems typically reward purchasing managers solely on purchase price (e.g., materials price variances). A broader view means that the costs associated with quality, reliability, and late deliveries are added to the purchase costs. Purchasing managers are then required to evaluate suppliers based on total cost, not just purchase price. Second, supplier costs are assigned to products using causal relationships.

Activity-based costing is the key to satisfying both requirements. To satisfy the first requirement, suppliers are defined as a cost object and costs relating to purchase, quality, reliability, and delivery performance are traced to suppliers. In the second case, products are the cost objects, and supplier costs are traced to specific products. By tracing supplier costs to products—rather than averaging them over all products as functional-based costing does—managers can see the effect of large numbers of unique components requiring specialty suppliers versus products with only standard components. Knowing the costs of more complex products helps product designers better evaluate the tradeoffs between functionality and cost as they design new products. Additional functions should provide more benefits (by an increased selling price) than costs. By accurately tracing supplier costs to products, a better understanding of product profitability is produced, and product designers are more capable of choosing among competing product designs.

Activity-Based Supplier Costing

To illustrate activity-based supplier costing, assume that a purchasing manager uses two suppliers, Fielding Electronics and Oro Limited, as the source of two electronic components: Component XYZ and Component YZZ. The purchasing manager prefers to use Fielding because it provides the components at a lower price; however, the second supplier is used as well to ensure a reliable supply of the components. Now consider two activities: *reworking products* and *expediting products*. Reworking products occurs because of component failure or process failure. Expediting products takes place due to late delivery of components or process failure. Component failure and late delivery are

5. As reported at <http://www.honeywell.com> on September 4, 2004.

6. These requirements are discussed in Robin Cooper and Regine Slagmulder, "The Scope of Strategic Cost Management," *Management Accounting* (February 1998): 16–18. Much of the discussion in this section is based on this article.

attributable to suppliers, and process failure costs are attributable to internal processes. Rework costs attributable to component failure are assigned to suppliers using the number of failed components as the driver. The costs of expediting attributable to late deliveries are assigned using the number of late shipments as the driver. Exhibit 11-8 provides the activity cost information and other data needed for supplier costing.

EXHIBIT 11-8		Data for Supplier Costing Example			
I. Activity Costs					
Activity	Component Failure/Late Delivery		Process Failure		
Reworking products	\$200,000		\$40,000		
Expediting products	50,000		10,000		
II. Supplier Data					
	Fielding Electronics		Oro Limited		
	X1Z	Y2Z	X1Z	Y2Z	
Unit purchase price	\$10	\$26	\$12	\$28	
Units purchased	40,000	20,000	5,000	5,000	
Failed units	800	190	5	5	
Late shipments	30	20	0	0	

Using the data from Exhibit 11-8, the activity rates for assigning costs to suppliers are computed as follows:

$$\begin{aligned} \text{Reworking rate} &= \$200,000/1,000^* \\ &= \$200 \text{ per failed component} \end{aligned}$$

$$*(800 + 190 + 5 + 5).$$

$$\begin{aligned} \text{Expediting rate} &= \$50,000/50^* \\ &= \$1,000 \text{ per late delivery} \end{aligned}$$

$$*(30 + 20).$$

Using these rates and the activity data in Exhibit 11-8, the total purchasing cost per unit of each component is computed and shown in Exhibit 11-9. The results show that the “low-cost” supplier actually costs more when the linkages with the internal activities of reworking and expediting are considered. If the purchasing manager is provided all costs, then the choice becomes clear: Oro Limited is the better supplier. It provides a higher-quality product on a timely basis and at a lower overall cost per unit.

Exploiting Customer Linkages

Customers can also have a significant influence on a firm’s strategic position. Choosing marketing segments, of course, is one of the principal elements that define strategic position. For example, selling a medium-level quality product to low-end dealers for a special, low price because of idle capacity could threaten the main channels of distribution for the product. This is true even if the dealers apply their own private labels to the product. Why? Because selling the product to low-end dealers creates a direct competitor for its regular, medium-level dealers. Potential customers of the regular retail outlets could switch to the lower-end outlets because they can buy the same qual-

EXHIBIT 11-9

Supplier Costing

	Fielding Electronics		Oro Limited	
	X1Z	Y2Z	X1Z	Y2Z
Purchase cost:				
\$10 × 40,000	\$400,000			
\$26 × 20,000		\$520,000		
\$12 × 5,000			\$60,000	
\$28 × 5,000				\$140,000
Reworking products:				
\$200 × 800	160,000			
\$200 × 190		38,000		
\$200 × 5			1,000	
\$200 × 5				1,000
Expediting products:				
\$1,000 × 30	30,000			
\$1,000 × 20		20,000		
Total costs	\$590,000	\$578,000	\$61,000	\$141,000
Units	÷ 40,000	÷ 20,000	÷ 5,000	÷ 5,000
Total unit cost	\$ 14.75	\$ 28.90	\$ 12.20	\$ 28.20

ity for a lower price. And what if the regular outlets deduce what has happened? What effect would this have on the company's medium-level differentiation strategy? The long-term damage to the company's profitability may be much greater than any short-run benefit from selling the special order.

Managing Customer Service Costs

A key objective for strategic costing is the identification of a firm's sources of profitability. In a functional-based costing system, selling and general and administrative costs are usually treated as period costs and, if assigned to customers, are typically assigned in proportion to the revenues generated. Thus, the message of functional-based costing is that servicing customers either costs nothing or they all appear to cost the same percentage of their sales revenue. If customer-servicing costs are significant, then failure to assign them at all or to assign them accurately will prevent sales representatives from managing the customer mix effectively. Why? Because sales representatives will not be able to distinguish between customers who place significant demands on servicing resources and those who place virtually no demand on these resources. This lack of knowledge can lead to actions that will weaken a firm's strategic position. To avoid this outcome and encourage actions that strengthen strategic position, customer-related costs should be assigned to customers using activity-based costing. Accurate assignment of customer-related costs allows the firm to classify customers as profitable or unprofitable.

Once customers are identified as profitable or unprofitable, actions can be taken to strengthen the strategic position of the firm. For profitable customers, an organization can undertake efforts to increase satisfaction by offering higher levels of service, lower prices, new services, or some combination of the three. For unprofitable customers, an organization can attempt to deliver the customer services more efficiently (thus, decreasing service costs), increase prices to reflect the cost of the resources being consumed, encourage unprofitable customers to leave (by reducing selling efforts to this segment), or some combination of the three actions.

Activity-Based Customer Costing

An example may help illustrate the importance of customer costing. Suppose that Thompson Company produces precision parts for 11 major buyers. An activity-based costing system is used to assign manufacturing costs to products. The company prices each customer's order by adding order-filling costs to manufacturing costs and then adding a 20 percent markup (to cover any administrative costs plus profits). Order-filling costs total \$606,000 and are currently assigned in proportion to sales volume (measured by number of parts sold). Of the 11 customers, one accounts for 50 percent of sales, with the other 10 accounting for the remainder of sales. The 10 smaller customers purchase parts in roughly equal quantities. Orders placed by the smaller customers are also about the same size. Data concerning Thompson's customer activity are as follows:

	<i>One Large Customer</i>	<i>Ten Smaller Customers</i>
Units purchased	500,000	500,000
Orders placed	2	200
Manufacturing cost	\$3,000,000	\$3,000,000
Order-filling cost allocated*	\$303,000	\$303,000
Order cost per unit	\$0.606	\$0.606

*Order-filling capacity is purchased in blocks of 45, each block costing \$40,400; variable order-filling activity costs are \$2,000 per order. The activity capacity is 225 orders; thus, the total order-filling cost is \$606,000 [(5 × \$40,400) + (\$2,000 × 202)]. This total is allocated in proportion to the units purchased; therefore, the large customer receives half the total cost.

Now assume that this customer complains about the price being charged and threatens to take its business elsewhere. The customer reveals a bid from a Thompson competitor that is \$0.50 per part less than what Thompson charges. Confident that the ABC costing system is assigning manufacturing costs accurately, Thompson investigates the assignment of order-filling cost and discovers that the number of sales orders processed is a much better cost driver than number of parts sold. Thus, activity demand is measured by the number of sales orders, and ordering costs should be assigned to customers using an activity rate of \$3,000 per order (\$606,000/202 orders). Using this rate, the large customer should be charged \$6,000 for order-filling costs. The large customer is being overcharged \$297,000 each year, or about \$0.59 per part (\$297,000/500,000 parts). Actually, the overcharging is compounded by the 20 percent markup, producing a price that is about \$0.71 too high (1.2 × \$0.59). Armed with this information, Thompson's management immediately offers to reduce the price charged to its large customer by at least \$0.50.

Thus, one benefit to the large customer is a price correction. This also benefits Thompson, because the price correction is needed to maintain half of its current business. Thompson, unfortunately, is also facing the difficult task of announcing a price increase for its smaller customers. However, the analysis should go much deeper than accurate cost assignment and fair pricing. Identifying the right cost driver (number of orders processed) reveals a linkage between the order-filling activity and customer behavior. Smaller, frequent orders are imposing costs on Thompson, which are then passed on to all customers through the use of the sales volume allocation. Since the total cost is marked up 20 percent, the price charged is even higher. Decreasing the number of orders will decrease Thompson's order-filling costs. Knowing this, Thompson can offer price discounts for larger orders. For example, doubling the size of the orders of the small customers would cut the number of orders by 50 percent, saving \$280,800 for Thompson [(2 × \$40,400) + (100 × \$2,000)], almost enough to make it unnecessary to increase the selling price to the smaller customers. But there are other possible linkages as well. Larger and less frequent orders will also decrease the demand on other internal activities, such as setting up equipment and materials handling. Reduc-

COST MANAGEMENT

Technology in Action

The modern cost management information system uses a much broader information set than has been traditionally used. It provides information about costs, quality, cycle time, drivers, and outputs. This integrated management accounting framework is built in what is referred to as a data warehousing/business intelligence environment (DW/BI). Using the DW/BI programs, companies can easily calculate supplier costs and customer profitability. A number of companies such as **Barclays Bank**, **Avnet, Inc.**, **BellSouth**, and **Ford** are using DW/BI programs. For example, Barclays Bank uses information from its DW/BI program to segment its customers on the basis of life-time value. This segmentation allows the bank to offer targeted, differentiated services and pricing. **First Union Corporation** (merged with Wachovia in 2001 and is now known as Wachovia Corporation. The post-merger Wachovia is the fourth-largest bank in the United States.) is a good example of how customer profitability information can be used for purposes of offering differentiated serv-

ices and pricing. First Union used a computerized, color-coded information system that revealed information about customer profitability to bank employees who serviced customers. Customers asking for specific services received a yes, maybe, or no answer depending on their color-code ranking. A red code signaled that the customer was losing money for the bank; a green code meant the customer was a source of significant profits for the bank; and a yellow code was for in-between customers. Green-code customers who requested a lower credit card interest rate or a fee waved for a bounced check got a positive answer, customers with a red code almost always received a negative answer, while customers with a yellow code had a chance to negotiate. First Union estimated that this type of approach would increase its annual revenue by \$100 million. About half of this \$100 million was from extra fees and other funds collected from unprofitable customers and from the increased deposits gained by retaining preferred customers targeted to receive more services.

Sources: Steve Williams, “Delivering Strategic Business Value,” *Strategic Finance* (August 2004) 40–49, and Rick Brooks, “Alienating Customers Isn’t Always a Bad Idea, Many Firms Discover,” *The Wall Street Journal* (January 7, 1999): A1 and A12.

tion in other activity demands could produce further cost reductions and additional price cuts, making Thompson more competitive. Ultimately, exploiting customer linkages can make both the seller and the buyer better off.

OBJECTIVE 3

Tell what life-cycle cost management is and how it can be used to maximize profits over a product’s life cycle.

Life-Cycle Cost Management

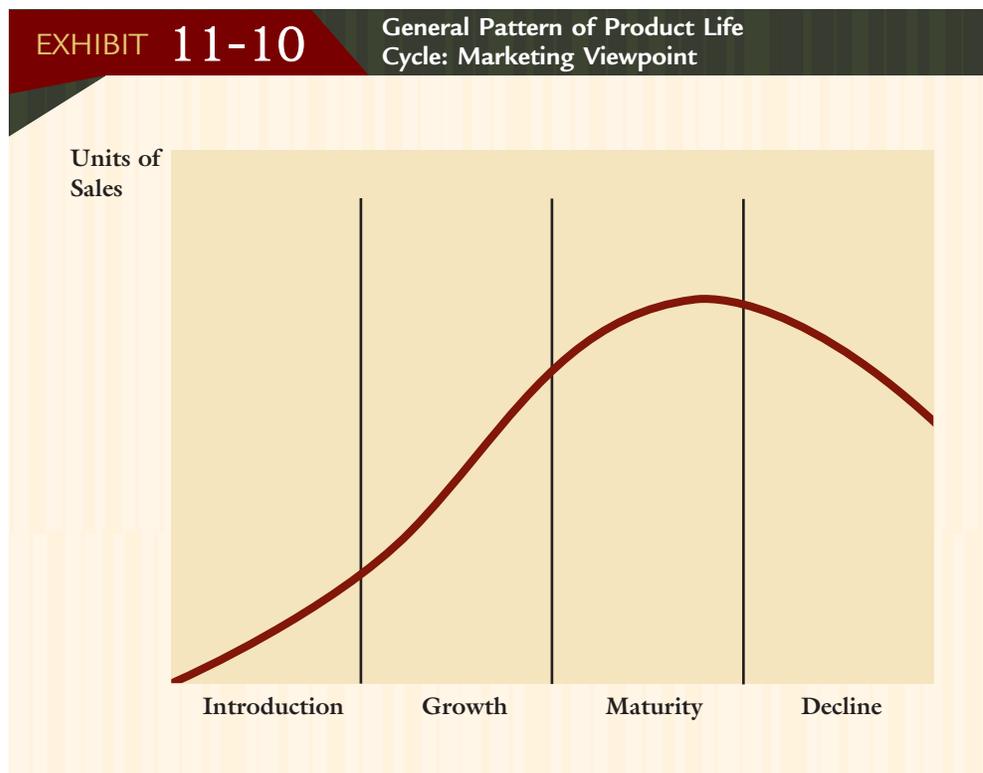
Strategic cost management emphasizes the importance of an external focus and the need to recognize and exploit both internal and external linkages. Life-cycle cost management is a related approach that builds a conceptual framework which facilitates management’s ability to exploit internal and external linkages. To understand what is meant by life-cycle cost management, we first need to understand basic product life-cycle concepts.

Product Life-Cycle Viewpoints

Product life cycle is simply the time a product exists—from conception to abandonment. Usually product life cycle refers to a product class as a whole—such as automobiles—but it can also refer to specific forms (such as station wagons) and to specific brands or models (such as a **Toyota Camry**). Also, by replacing “conception” with “purchase,” we obtain a customer-oriented definition of product life cycle. The producer-oriented definition refers to the life of classes, forms, or brands, whereas the customer-oriented definition refers to the life of a specific unit of product. These producer and customer orientations can be refined by looking at the concepts of revenue-producing life and consumable life. **Revenue-producing life** is the time a product generates revenue for a company. A product begins its revenue-producing life with the sale of the first product. **Consumable life**, on the other hand, is the length of time that a product serves the needs of a customer. Revenue-producing life is clearly of most interest to the producer, while consumable life is of most interest to the customer. Consumable life, however, is also of interest to the producer because it can be used as a competitive tool.

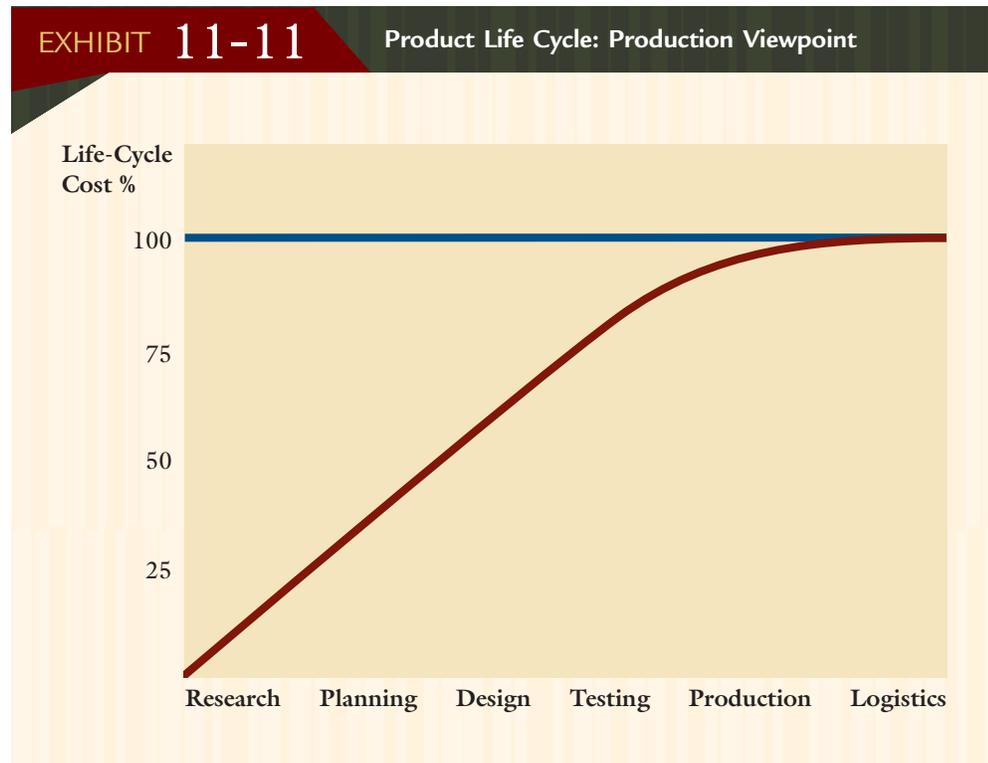
Marketing Viewpoint

The producer of goods or services has two viewpoints concerning product life cycle: the marketing viewpoint and the production viewpoint. The marketing viewpoint describes the general sales pattern of a product as it passes through distinct life-cycle stages. Exhibit 11-10 illustrates the general pattern of the marketing view of product life cycle. The distinct stages identified by the exhibit are introduction, growth, maturity, and decline. The **introduction stage** is characterized by preproduction and startup activities, where the focus is on obtaining a foothold in the market. As the graph indicates, there are no sales for a period of time (the preproduction period) and then slow sales growth as the product is introduced. The **growth stage** is a period of time when sales increase more quickly. The **maturity stage** is a period of time when sales increase more slowly. Eventually, the slope (of the sales curve) in the maturity stage becomes neutral and then turns negative. This **decline stage** is when the product loses market acceptance and sales begin to decrease.



Production Viewpoint

The production viewpoint of the product life cycle defines stages of the life cycle by changes in the type of activities performed: research and development activities, production activities, and logistical activities. The production viewpoint emphasizes life-cycle costs, whereas the market viewpoint emphasizes sales revenue behavior. **Life-cycle costs** are all costs associated with the product for its entire life cycle. These costs include research (product conception), development (planning, design, and testing), production (conversion activities), and logistics support (advertising, distribution, warranty, customer service, product servicing, and so on). The product life cycle and the associated cost commitment curve are illustrated in Exhibit 11-11. Notice that 90 percent or more of the costs associated with a product are *committed* during the development stage of the product's life cycle. Committed means that most of the costs that will be incurred are predetermined—set by the nature of the product design and the processes needed to produce the design.



Consumable Life-Cycle Viewpoint

Like the production life cycle, the consumption life-cycle's stages are related to activities. These activities define four stages: purchasing, operating, maintaining, and disposal. The consumable life-cycle viewpoint emphasizes product performance for a given price. Price refers to the costs of ownership, which include the following elements: purchase cost, operating costs, maintenance costs, and disposal costs. Thus, total customer satisfaction is affected by both the purchase price and post-purchase costs. Because customer satisfaction is affected by post-purchase costs, producers also have a vital interest in managing the level of these costs. How producers can exploit the linkage of post-purchase activities with producer activities is a key element of product life-cycle cost management.

Interactive Viewpoint

All three life-cycle viewpoints offer insights that can be useful to producers of goods and services. In fact, producers cannot afford to ignore any of the three. A comprehensive life-cycle cost management program must pay attention to the variety of viewpoints that exist. This observation produces an integrated, comprehensive definition of life-cycle cost management. **Life-cycle cost management** consists of actions taken that cause a product to be designed, developed, produced, marketed, distributed, operated, maintained, serviced, and disposed of so that life-cycle profits are maximized. Maximizing life-cycle profits means producers must understand and capitalize on the relationships that exist among the three life-cycle viewpoints. Once these relationships are understood, then actions can be implemented that take advantage of revenue enhancement and cost reduction opportunities.

Relationships among Life-Cycle Viewpoints

The marketing viewpoint is concerned with the nature of the sales pattern over the life cycle of the product; it is a *revenue-oriented viewpoint*. The production viewpoint, however, emphasizes the internal activities needed to develop, produce, market, and service

products. The production stages exist to support the sales objectives of the marketing stages. This sales support requires resource expenditure; thus, the production life cycle can be described as a *cost-oriented viewpoint*. The consumption life cycle is concerned with product performance and price (including post-purchase costs). The ability to generate revenues and the level of resource expenditure are both related to product performance and price. The producer must be concerned with what the customer receives and what the customer gives up. Thus, the consumption life cycle can be described as a *customer-value oriented viewpoint*. Exhibit 11-12 illustrates the relationships among the stages of the three viewpoints. The stages of marketing viewpoint are listed as columns; production and consumable life-cycle viewpoints appear as rows. These last two viewpoints are identified by the nature of their attributes: expenses for the production life cycle and customer value for the consumable life cycle. Competition and customer type are included under customer value because they affect the producer's approach to providing customer value.

The relationships described in Exhibit 11-12 are typical but can vary depending on the nature of the product and the industry in which a producer operates. Some expla-

EXHIBIT 11-12		Typical Relationships of Product Life-Cycle Viewpoints		
Marketing Product Life Cycles:				
Attributes	Introduction	Growth	Maturity	Decline
Sales	Low	Rapid growth	Slow growth, peak sales	Declining
Production Life Cycle:				
Attributes	Introduction	Growth	Maturity	Decline
Expenses:				
Product R&D	High	Moderate	Moderate	Low
Plant & equipment	Moderate	High	Moderate	Low
Advertising	Low to moderate	High	Moderate	Low
Service	Moderate to high	Moderate	High	Low
Consumable Life Cycle:				
Attributes	Introduction	Growth	Maturity	Decline
Customer value:				
Customer type	Innovators	Mass market	Mass market, differentiated	Laggards
Performance sensitivity	High	High	High	Moderate
Price sensitivity	Low	Moderate	High	Moderate
Competition	None	Growing	High	Low
Attributes	Introduction	Growth	Maturity	Decline
Profits	Negligible to loss	Peak levels	Moderate to high	Low

nation of the relationships should reveal the potential for producers to exploit them. Relationships can be viewed vertically or horizontally. Consider, for example, the introductory stage, and examine the vertical relationships. In this stage, we would expect losses or negligible profits because of high levels of expenditure in research and development and marketing. Customers at this stage are described as innovators. These are simply the first customers to buy the product. Innovators are venturesome, willing to try something new. They are usually more concerned with the performance of the new product than with its price. This fact, coupled with the lack of competitors, may allow a high price to be charged for the new product. If the barriers to entry in the marketplace are high, then a high price may continue to be charged for some time. However, if competition grows as indicated by the horizontal dimension of the table, and if price sensitivity increases, then the producer will need to rely on further research and development and differentiation to maintain a competitive advantage.

Revenue Enhancement

Revenue-generating approaches depend on marketing life-cycle stages and on customer value effect. Pricing strategy, for example, varies with stages. In the introductory stage, as mentioned earlier, higher prices can be charged because customers are less price sensitive and more interested in performance.

In the maturity stage, customers are highly sensitive to both price and performance. This suggests that adding features, increasing durability, improving maintainability, and offering customized products may all be good strategies to follow. In this stage, differentiation is important. For revenue enhancement to be viable, however, the customer must be willing to pay a premium for any improvement in product performance. Furthermore, this premium must exceed the cost the producer incurs in providing the new product attribute. In the decline stage, revenues may be enhanced by finding new uses and new customers for the product. A good example is the use of **Arm & Hammer**'s baking soda to absorb refrigerator odors in addition to its normal role in baking goods.⁷

Cost Reduction

Cost reduction, not cost control, is the emphasis of life-cycle cost management. Cost reduction strategies should explicitly recognize that actions taken in the early stages of the production life cycle can lower costs for later production and consumption stages. Since 90 percent or more of a product's life-cycle costs are determined during the development stage, it makes sense to emphasize management of activities during this phase of a product's existence. Studies have shown that every dollar spent on preproduction activities saves \$8–\$10 on production and postproduction activities, including customer maintenance, repair, and disposal costs.⁸ Apparently, many opportunities for cost reduction occur before production begins. Managers need to invest more in preproduction assets and dedicate more resources to activities in the early phases of the product life cycle to reduce production, marketing, and post-purchase costs.

Product design and process design afford multiple opportunities for cost reduction by designing to reduce: (1) manufacturing costs, (2) logistical support costs, and (3) post-purchase costs, which include customer time involved in maintenance, repair, and disposal. For these approaches to be successful, managers of producing companies must have a good understanding of activities and cost drivers and know how the activities interact. Manufacturing, logistical, and post-purchase activities are not independent. Some designs may reduce post-purchase costs and increase manufacturing costs. Others may simultaneously reduce production, logistical, and post-purchase costs.

7. Sak Onkvisit and John J. Shaw, "Competition and Product Management: Can the Product Life Cycle Help?" *Business Horizons* (July–August 1986): 51–52.

8. Mark D. Shields and S. Mark Young, "Managing Product Life Cycle Costs: An Organizational Model" and R. L. Engwall, "Cost Management for Defense Contractors," *Cost Accounting for the 90's, Responding to Technological Change* (Montvale, NJ: National Association of Accountants, 1988).

Cost Reduction: An Example

A functional-based costing system usually will not supply the information needed to support life-cycle cost management. Functional-based costing systems emphasize the use of unit-based cost drivers to describe cost behavior, focus on production activities, ignore logistical and post-purchase activities, and expense research and development and other nonmanufacturing costs as they are incurred. Functional-based costing systems never collect a complete history of a product's costs over its life cycle. Essentially, the GAAP-driven costing system does not support the demands of life-cycle costing. An activity-based costing system, however, produces information about activities, including both preproduction and postproduction activities, and cost drivers.

To illustrate the importance of knowing activity information, consider Gray Company, a company that produces industrial power tools. Gray currently uses a functional-based costing system, which assumes that all conversion costs are driven by direct labor hours. Because of competitive forces, management has instructed its design engineers to develop new product and process designs for existing products to reduce manufacturing costs. (The products targeted for design improvements are estimated to be entering the final growth stage of their marketing life cycle.) If, however, manufacturing costs are driven by factors other than direct labor hours, then design actions may produce costs much different than expected. For example, suppose that engineers are considering two new product designs for one of its power tools. Both designs reduce direct materials and direct labor content over the current model. The anticipated effects of the two designs on manufacturing, logistical, and post-purchase activities follow, for both the functional-based costing system and an ABC system.

Cost Behavior

Functional-based system:

Variable conversion activity rate: \$40 per direct labor hour

Material usage rate: \$8 per part

ABC system:

Labor usage: \$10 per direct labor hour

Material usage (direct materials): \$8 per part

Machining: \$28 per machine hour

Purchasing activity: \$60 per purchase order

Setup activity: \$1,000 per setup hour

Warranty activity: \$200 per returned unit (usually requires extensive rework)

Customer repair cost: \$10 per repair hour

Activity and Resource Information (annual estimates)

	<i>Design A</i>	<i>Design B</i>
Units produced	10,000	10,000
Direct material usage	100,000 parts	60,000 parts
Labor usage	50,000 hours	80,000 hours
Machine hours	25,000	20,000
Purchase orders	300	200
Setup hours	200	100
Returned units	400	75
Repair time (customer)	800	150

The cost analysis for each design under both the functional-based costing and ABC systems is shown in Exhibit 11-13. The functional-based system computes the unit product cost using only manufacturing costs. The results of the functional-based

EXHIBIT 11-13**Cost Analysis: Competing Product Designs****A. Traditional Costing System**

	Design A	Design B
Direct materials ^a	\$ 800,000	\$ 480,000
Conversion cost ^b	<u>2,000,000</u>	<u>3,200,000</u>
Total manufacturing costs	\$2,800,000	\$3,680,000
Units produced	÷ 10,000	÷ 10,000
Unit cost.	<u>\$ 280</u>	<u>\$ 368</u>

^a\$8 × 100,000; \$8 × 60,000.^b\$40 × 50,000; \$40 × 80,000.**B. ABC System**

	Design A	Design B
Direct materials	\$ 800,000	\$ 480,000
Direct labor ^a	500,000	800,000
Machining ^b	700,000	560,000
Purchasing ^c	18,000	12,000
Setups ^c	200,000	100,000
Warranty ^c	<u>80,000</u>	<u>15,000</u>
Total product costs	\$2,298,000	\$1,967,000
Units produced	÷ 10,000	÷ 10,000
Unit cost.	<u>\$ 230*</u>	<u>\$ 197*</u>
Postpurchase costs	<u>\$ 80,000</u>	<u>\$ 15,000</u>

^a\$10 × 50,000; \$10 × 80,000.^b\$28 × 25,000; \$28 × 20,000.^c\$60 × 300; \$60 × 200; \$1,000 × 200; \$1,000 × 100; \$200 × 400; \$200 × 75.

*Rounded to the nearest dollar.

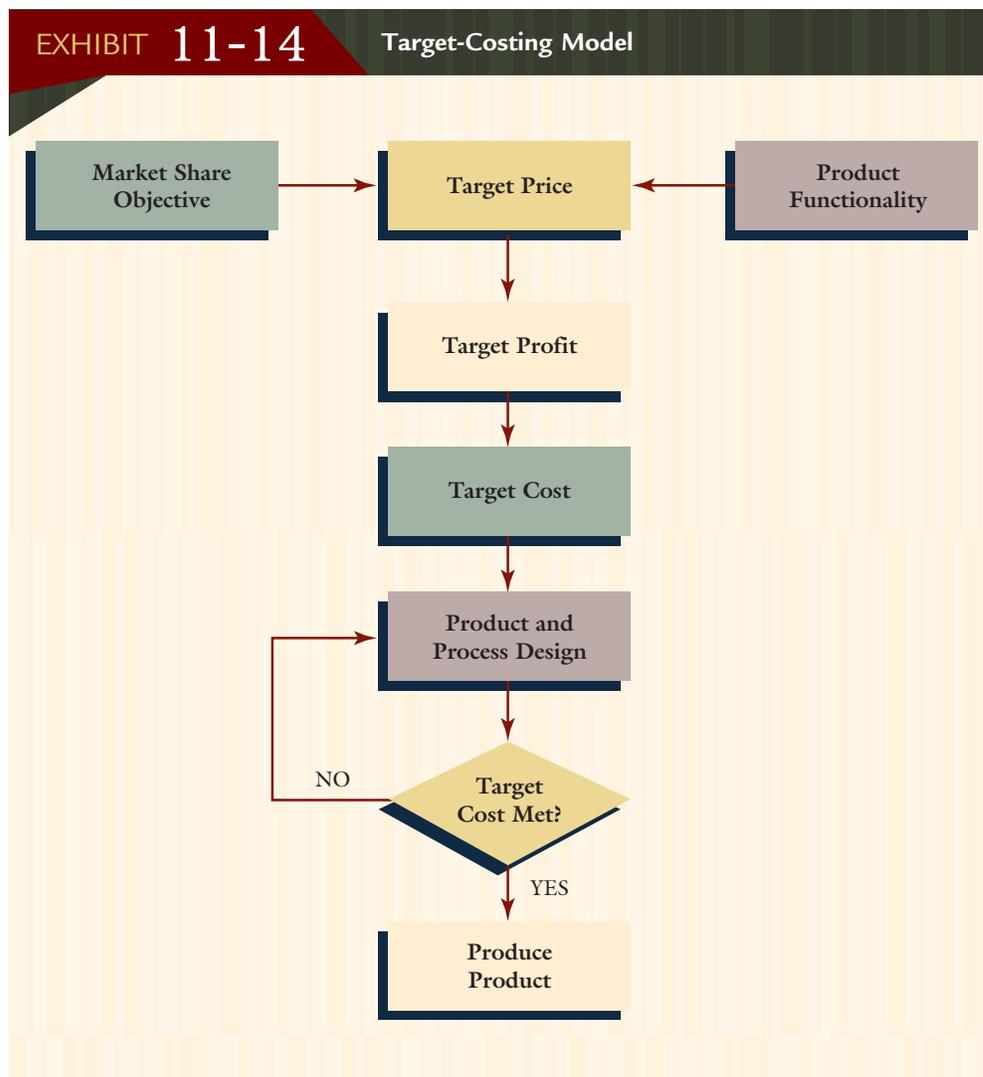
analysis favor Design A. Thus, Gray would choose Design A over Design B. The ABC analysis reveals a much different picture. Relative to Design A, Design B simultaneously reduces the costs of manufacturing, logistical, and post-purchase activities. Ignoring post-purchase costs, the cost advantage is \$331,000 per year for Design B. With post-purchase costs included, the advantage jumps to \$396,000. Notice that the customer repair hours per unit produced for Design A are 0.08 (800/10,000), but they are only 0.015 (150/10,000) for Design B. This indicates that Design B has a higher level of serviceability than does Design A and, thus, more customer value.

Role of Target Costing

Life-cycle cost management emphasizes cost reduction, not cost control. Target costing becomes a particularly useful tool for establishing cost reduction goals during the design stage. A **target cost** is the difference between the sales price needed to capture a predetermined market share and the desired per-unit profit. The sales price reflects the product specifications or functions valued by the customer (referred to as *product functionality*). If the target cost is less than what is currently achievable, then management

must find cost reductions that move the actual cost toward the target cost. Finding those cost reductions is the principal challenge of target costing.

Three cost reduction methods are typically used: (1) reverse engineering, (2) value analysis, and (3) process improvement. In reverse engineering, the competitors' products are closely analyzed (a "tear down" analysis) in an attempt to discover more design features that create cost reductions. Value analysis attempts to assess the value placed on various product functions by customers. If the price customers are willing to pay for a particular function is less than its cost, the function is a candidate for elimination. Another possibility is to find ways to reduce the cost of providing the function, e.g., using common components. Both reverse engineering and value analysis focus on product design to achieve cost reductions. The processes used to produce and market the product are also sources of potential cost reductions. Thus, redesigning processes to improve their efficiency can also contribute to achieving the needed cost reductions. The target-costing model is summarized in Exhibit 11-14.



A simple example can be used to illustrate the concepts described by Exhibit 11-14. Assume that a company is considering the production of a new trencher. Current product specifications and the targeted market share call for a sales price of \$250,000. The required profit is \$50,000 per unit. The target cost is computed as follows:

$$\begin{aligned}\text{Target cost} &= \$250,000 - \$50,000 \\ &= \$200,000\end{aligned}$$

It is estimated that the current product and process designs will produce a cost of \$225,000 per unit. Thus, the cost reduction needed to achieve the target cost and desired profit is \$25,000 (\$225,000 – \$200,000). A tear down analysis of a competitor's trencher revealed a design improvement that promised to save \$5,000 per unit. When compared with the \$25,000 reduction needed, additional effort was still necessary. A marketing study of customer reactions to product functions revealed that the extra trenching speed in the new design was relatively unimportant. Changing the design to reflect a lower trenching speed saved \$10,000. The company's supplier also proposed the use of a standardized component, reducing costs by another \$5,000. Finally, the design team was able to change the process design and reduce the test time by 50 percent. This saved \$6,000 per unit. The last change reached the threshold value, and production for the new model was approved.

Target costs are a type of currently attainable standard. But they are conceptually different from traditional standards. What sets them apart is the motivating force. Traditional standards are internally motivated and set, based on concepts of efficiency developed by industrial engineers and production managers. Target costs, on the other hand, are externally driven, generated by an analysis of markets and competitors.

Supplier and Firm Interaction

The example just given indicated that one source of cost reduction came from a supplier suggestion. During the design stage, target costing requires a close interaction between the firm and its suppliers. This interaction should produce lower cost solutions than would be possible if the design teams acted in isolation.⁹ Joint design efforts require cooperative relationships. Incentives for such relationships come from a willingness to search for mutually beneficial solutions.

Short Life Cycles

Although life-cycle cost management is important for all manufacturing firms, it is particularly important for firms that have products with short life cycles. Products must recover all life-cycle costs and provide an acceptable profit. If a firm's products have long life cycles, profit performance can be increased by such actions as redesigning, changing prices, reducing costs, and altering the product mix. In contrast, firms that have products with short life cycles usually do not have time to react in this way so their approach must be proactive. Thus, for short life cycles, good life-cycle planning is critical, and prices must be set properly to recover all the life-cycle costs and provide a good return. Activity-based costing can be used to encourage good life-cycle planning. By careful selection of cost drivers, design engineers can be motivated to choose cost-minimizing designs.

OBJECTIVE 4

Identify the basic features of JIT purchasing and manufacturing.

Just-in-Time (JIT) Manufacturing and Purchasing

JIT manufacturing and purchasing systems offer a prominent example of how managers can use the strategic concepts discussed earlier in the chapter to bring about significant changes within an organization. Firms that implement JIT are pursuing a cost reduction strategy by redefining the structural and procedural activities performed within an organization. Cost reduction is supportive of either a cost leadership or differentiation strategy. Cost reduction is directly related to cost leadership. Successful differentiation depends on offering greater value; yet, this value added must be more than the cost of providing it. JIT can help add value by reducing waste. Successful implementation of

9. Robin Cooper and Regine Slagmulder, "Cost Management Beyond the Boundaries of the Firm," *Management Accounting* (March 1998): 18–20.

JIT has brought about significant improvements, such as better quality, increased productivity, reduced lead times, major reductions in inventories, reduced setup times, lower manufacturing costs, and increased production rates. For example, **Oregon Cutting Systems**, a manufacturer of cutting chain (for chain saws), timber-harvesting equipment, and sporting equipment—within a period of three to five years—reduced defects by 80 percent, waste by 50 percent, setup times from hours to minutes (one punch press had setup time reduced from three hours to 4.5 minutes), lead times from 21 days to three days, and manufacturing costs by 35 percent.¹⁰ JIT techniques have also been implemented by the following companies with similar results:

Wal-Mart	Chrysler	Intel
General Motors	Hewlett-Packard	Borg-Warner
Toys “R” Us	Harley-Davidson	Westinghouse
Ford	Motorola	John Deere
General Electric	AT&T	Mercury Marine
Black & Decker	Xerox	

Adopting a JIT manufacturing system has a significant effect on the nature of the cost management accounting system. Installing a JIT system affects the traceability of costs, enhances product costing accuracy, diminishes the need for allocation of service-center costs, changes the behavior and relative importance of direct labor costs, impacts job-order and process-costing systems, decreases the reliance on standards and variance analysis, and decreases the importance of inventory tracking systems. To understand and appreciate these effects, we need a fundamental understanding of what JIT manufacturing is and how it differs from traditional manufacturing.

JIT manufacturing is a demand-pull system. The objective of **JIT manufacturing** is to eliminate waste by producing a product only when it is needed and only in the quantities demanded by customers. Demand pulls products through the manufacturing process. Each operation produces only what is necessary to satisfy the demand of the succeeding operation. No production takes place until a signal from a succeeding process indicates a need to produce. Parts and materials arrive just in time to be used in production. JIT assumes that all costs other than direct materials are driven by time and space drivers. JIT then focuses on eliminating waste by compressing time and space.

Inventory Effects

Usually, the push-through system produces significantly higher levels of finished goods inventory than does a JIT system. JIT manufacturing relies on the exploitation of a customer linkage. Specifically, production is tied to customer demand. This linkage extends back through the value chain and also affects how a manufacturer deals with suppliers. **JIT purchasing** requires suppliers to deliver parts and materials just in time to be used in production. Thus, supplier linkages are also vital. Supply of parts must be linked to production, which is linked to demand. One effect of successful exploitation of these linkages is to reduce all inventories to much lower levels. Since 1980, inventories in the United States have fallen from 26 to 15 percent of the gross domestic product; furthermore, JIT is saving U.S. automakers more than \$1 billion annually in inventory carrying costs.¹¹

Traditionally, inventories of raw materials and parts are carried so that a firm can take advantage of quantity discounts and hedge against future price increases of the items purchased. The objective is to lower the cost of inventory. JIT achieves the same objective without carrying inventories. The JIT solution is to exploit supplier linkages

10. Jack C. Bailes and Ilene K. Kleinsorge, “Cutting Waste with JIT,” *Management Accounting* (May 1992): 28–32.

11. Art Raymond, “Is JIT Dead?” *FDM; Des Plaines* (January 2002): 30–32.

by negotiating long-term contracts with a few chosen suppliers located as close to the production facility as possible and by establishing more extensive supplier involvement. Suppliers are not selected on the basis of price alone.

Performance—the quality of the component and the ability to deliver as needed—and commitment to JIT purchasing are vital considerations. Every effort is made to establish a partners-in-profits relationship with suppliers. Suppliers need to be convinced that their well-being is intimately tied to the well-being of the buyer.

To help reduce the uncertainty in demand for the supplier and establish the mutual confidence and trust needed in such a relationship, JIT manufacturers emphasize long-term contracts. Other benefits of long-term contracts exist. They stipulate prices and acceptable quality levels. Long-term contracts also reduce dramatically the number of orders placed, which helps to drive down the ordering and receiving costs. Another effect of long-term contracting is a reduction in the cost of parts and materials—usually in the range of 5 percent to 20 percent less than what was paid in a traditional setting. The need to develop close supplier relationships often drives the supplier base down dramatically. For example, **Mercedes-Benz U.S. International** factory in Vance, Alabama, saved time and money by streamlining its supplier list from 1,000 to 100 primary suppliers. In exchange for annual 5 percent price cuts, the chosen suppliers have multiyear contracts (as opposed to the yearly bidding process practiced at other Mercedes' plants) and can adapt off-the-shelf parts to Mercedes' needs. The end result is lower costs for both Mercedes and its suppliers.¹² Suppliers also benefit. The long-term contract ensures a reasonably stable demand for their products. A smaller supplier base typically means increased sales for the selected suppliers. Thus, both buyers and suppliers benefit, a common outcome when external linkages are recognized and exploited.

By reducing the number of suppliers and working closely with those that remain, the quality of the incoming materials can be improved significantly—a crucial outcome for the success of JIT. As the quality of incoming materials increases, some quality-related costs can be avoided or reduced. For example, the need to inspect incoming materials disappears, and rework requirements decline.

Plant Layout

The type and efficiency of plant layout is another executional cost driver that is managed differently under JIT manufacturing. (See Exhibit 11-2 on p. 491 for a review of executional cost drivers.) In traditional job and batch manufacturing, products are moved from one group of identical machines to another. Typically, machines with identical functions are located together in an area referred to as a *department* or *process*. Workers who specialize in the operation of a specific machine are located in each department. Thus, the executional cost driver for a traditional setting is departmental structure. JIT replaces this traditional plant layout with a pattern of manufacturing cells. The executional cost driver for a JIT setting is cell structure. Cell structure is chosen over departmental structure because it increases the ability of the organization to “execute” successfully. Some of the efficiencies cited earlier for Oregon Cutting Systems (OCS), such as reduced lead times and lower manufacturing costs, are a direct result of the cellular structure. The cellular manufacturing design can also affect structural activities, such as plant size and number of plants, because it typically requires less space. OCS, for example, cut its space requirement by 40 percent. Space savings like this can reduce the demand to build new plants and will affect the size of new plants when they are needed.

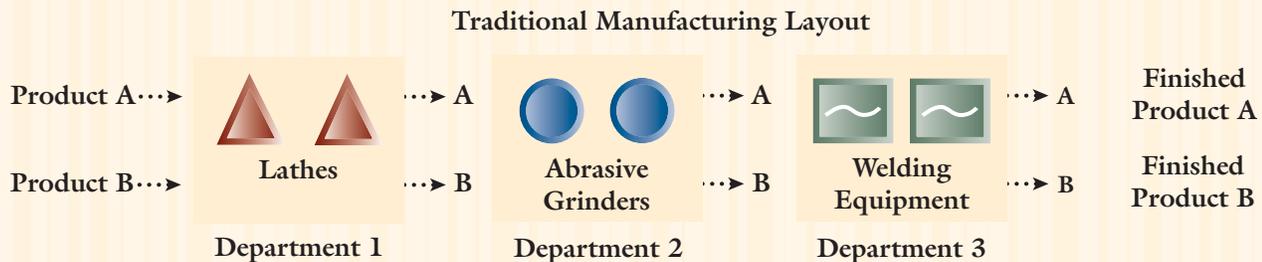
Manufacturing cells contain machines that are grouped in families, usually in a semicircle. The machines are arranged so that they can be used to perform a variety of

12. David Woodruff and Karen Lowry Miller, “Mercedes’ Maverick in Alabama,” *Business Week* (September 11, 1995): 64-65.

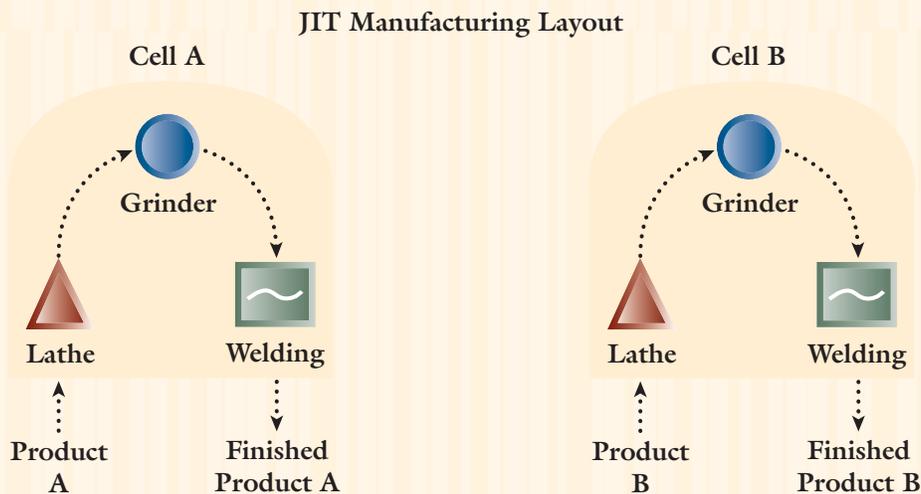
operations in sequence. Each cell is set up to produce a particular product or product family. Products move from one machine to another from start to finish. Workers are assigned to cells and are trained to operate all machines within the cell. In other words, labor in a JIT environment is multiskilled, not specialized. Each manufacturing cell is essentially a minifactory; in fact, cells are often referred to as a *factory within a factory*. A comparison of the JIT's plant layout with the traditional pattern is shown in Exhibit 11-15.

EXHIBIT 11-15

Plant Layout Pattern: Traditional versus JIT



Each product passes through departments that specialize in one process. Departments process multiple products.



Notice that each product passes through its own cell. All machines necessary to process each product are placed within the cell. Each cell is dedicated to the production of one product or one subassembly.

Grouping of Employees

Another major structural difference between JIT and traditional organizations relates to how employees are grouped. As just indicated, each cell is viewed as a minifactory; thus, each cell requires easy and quick access to support services, which means that centralized service departments must be scaled down and their personnel reassigned to work directly with manufacturing cells. For example, with respect to raw materials, JIT calls for multiple stock points, each one located near where the material will be used. There is no need for a central store location—in fact, such an arrangement actually hin-

ders efficient production. A purchasing agent can be assigned to each cell to handle material requirements. Similarly, other service personnel, such as manufacturing and quality engineers, can be assigned to cells.

Other support services may be relocated to the cell by training cell workers to perform the services. For example, in addition to direct production work, cell workers may perform setup duties, move partially completed goods from station to station within the cell, perform preventive maintenance and minor repairs, conduct quality inspections, and perform janitorial tasks. This multiple task capability is directly related to the pull-through production approach. Producing on demand means that production workers (formerly direct laborers) may often have “free” time. This nonproduction time can be used to perform some of the other support activities.

Employee Empowerment

A major procedural difference between traditional and JIT environments is the degree of participation allowed workers in the management of the organization. According to the JIT view, increasing the degree of participation (the executional cost driver) increases productivity and overall cost efficiency. Workers are allowed a say in how the plant operates. For example, workers are allowed to shut down production to identify and correct problems. Managers seek workers’ input and use their suggestions to improve production processes. Workers are often involved in interviewing and hiring other employees, sometimes even prospective bosses. The reason? If the “chemistry is right,” then the workforce will be more efficient, and they will work together better.

Employee empowerment, a procedural activity, also affects other structural and procedural activities. The management structure must change in response to greater employee involvement. Because workers assume greater responsibilities, fewer managers are needed, and the organizational structure becomes flatter. Flatter structures speed up and increase the quality of information exchange. The style of management needed in the JIT firm also changes. Managers in the JIT environment need to act as facilitators more than as supervisors. Their role is to develop people and their skills so that they can make value-adding contributions.

Total Quality Control

JIT necessarily carries with it a much stronger emphasis on managing quality. A defective part brings production to a grinding halt. Poor quality simply cannot be tolerated in a manufacturing environment that operates without inventories. Simply put, JIT cannot be implemented without a commitment to total quality control (TQC). TQC is essentially a never-ending quest for perfect quality: the striving for a defect-free product design and manufacturing process. This approach to managing quality is diametrically opposed to the traditional doctrine, called **acceptable quality level (AQL)**. AQL permits or allows defects to occur provided they do not exceed a predetermined level.

The major differences between JIT manufacturing and traditional manufacturing are summarized in Exhibit 11-16 on the following page. These differences will be referred to and discussed in greater detail as the implications of JIT manufacturing for cost management are examined.

OBJECTIVE 5

Describe the effect JIT has on cost traceability and product costing.

JIT and Its Effect on the Cost Management System

The numerous changes in structural and procedural activities that we have described for a JIT system also change traditional cost management practices. Both the cost

EXHIBIT 11-16**Comparison of JIT Approaches with Traditional Manufacturing and Purchasing**

JIT	Traditional
1. Pull-through system	1. Push-through system
2. Insignificant inventories	2. Significant inventories
3. Small supplier base	3. Large supplier base
4. Long-term supplier contracts	4. Short-term supplier contracts
5. Cellular structure	5. Departmental structure
6. Multiskilled labor	6. Specialized labor
7. Decentralized services	7. Centralized services
8. High employee involvement	8. Low employee involvement
9. Facilitating management style	9. Supervisory management style
10. Total quality control	10. Acceptable quality level
11. Buyers' market	11. Sellers' market
12. Value-chain focus	12. Value-added focus

accounting and operational control systems are affected. In general, the organizational changes simplify the cost management accounting system and simultaneously increase the accuracy of the cost information being produced.

Traceability of Overhead Costs

Costing systems use three methods to assign costs to individual products: direct tracing, driver tracing, and allocation. Of the three methods, the most accurate is direct tracing; for this reason, it is preferred over the other two methods. In a JIT environment, many overhead costs assigned to products using either driver tracing or allocation are now directly attributable to products. Cellular manufacturing, multiskilled labor, and decentralized service activities are the major features of JIT responsible for this change in traceability.

In a departmental structure, many different products may be subjected to a process located in a single department (e.g., grinding). After completion of the process, the products are then transferred to other processes located in different departments (e.g., assembly, painting, and so on). Although a different set of processes is usually required for each product, most processes are applicable to more than one product. For example, 30 different products may need grinding. Because more than one product is processed in a department, the costs of that department are common to all products passing through it, and therefore the costs must be assigned to products using activity drivers or allocation. In a manufacturing-cell structure, however, all processes necessary for the production of each product or major subassembly are collected in one area called a cell. Thus, the costs of operating that cell can be assigned to the cell's product or subassembly using direct tracing. (However, if a family of products uses a cell, then we must resort to drivers and allocation to assign costs.)

Equipment formerly located in other departments, for example, is now reassigned to cells, where it may be dedicated to the production of a single product or subassembly. In this case, depreciation is now a directly attributable product cost. Multiskilled workers and decentralized services add to the effect. Workers in the cell are trained to set up the equipment in the cell, maintain it, and operate it. Additionally, cell workers may also be used to move a partially finished part from one machine to the next or to perform maintenance, setups, and materials handling. These support functions were previously done by a different set of laborers for all product lines. Additionally, people with spe-

cialized skills (e.g., industrial engineers and production schedulers) are assigned directly to manufacturing cells. Because of multitask assignments and redeployment of other support personnel, many support costs can now be assigned to a product using direct tracing. Exhibit 11-17 compares the traceability of some selected costs in a traditional manufacturing environment with their traceability in the JIT environment (assuming single-product cells). Comparisons are based on the three cost assignment methods.

EXHIBIT 11-17		Product Cost Assignment: Traditional versus JIT Manufacturing	
Manufacturing Cost	Traditional Environment	JIT Environment	
Direct labor	Direct tracing	Direct tracing	
Direct materials	Direct tracing	Direct tracing	
Materials handling	Driver tracing	Direct tracing	
Repairs and maintenance	Driver tracing	Direct tracing	
Energy	Driver tracing	Direct tracing	
Operating supplies	Driver tracing	Direct tracing	
Supervision (department)	Allocation	Direct tracing	
Insurance and taxes	Allocation	Allocation	
Plant depreciation	Allocation	Allocation	
Equipment depreciation	Driver tracing	Direct tracing	
Custodial services	Allocation	Direct tracing	
Cafeteria services	Driver tracing	Driver tracing	

Product Costing

One consequence of increasing directly attributable costs is to increase the accuracy of product costing. Directly attributable costs are associated (usually by physical observation) with the product and can safely be said to belong to it. Other costs, however, are common to several products and must be assigned to these products using activity drivers and allocation. Because of cost and convenience, activity drivers that are less than perfectly correlated with the consumption of overhead activities may be chosen. JIT manufacturing reduces the need for this difficult assessment by converting many common costs to directly attributable costs. Note, however, that the driving force behind these changes is not the cost management system itself but the changes in the structural and procedural activities brought about by implementing a JIT system. While activity-based costing offers significant improvement in product costing accuracy, focusing offers even more potential improvement.

Exhibit 11-17 illustrates that JIT does not convert all costs into directly traceable costs. Even with JIT in place, some overhead activities remain common to the manufacturing cells. These remaining support activities are mostly facility-level activities. In a JIT system, the batch size is one unit of product. Thus, all batch-level activities convert into unit-level activities. Additionally, many of the batch-level activities are reduced or eliminated. For example, materials handling may be significantly reduced because of the reorganization from a departmental structure to a cellular structure. Similarly, for single-product cells, there is no setup activity. Even for cells that produce a family of products, setup times would be minimal. Furthermore, it is likely that the need to use activity drivers for the cost of product-level activities is significantly diminished because of decentralizing these support activities to the cell level. Is there, then, a role for ABC in a JIT firm?

Although JIT diminishes the value of ABC for tracing manufacturing costs to individual products, an activity-based costing system has much broader application than just tracing manufacturing costs to products. For many strategic and tactical decisions, the product cost definition needs to include nonmanufacturing costs. For example, value-line and operational product costing is an invaluable tool for strategic costing analysis and for life-cycle cost management. Also, including post-purchase costs as part of the product cost definition provides valuable insights. Thus, knowing and understanding general and administrative, research, development, marketing, customer service, and post-purchase activities and their cost drivers is essential for sound cost analysis. Furthermore, as we have already seen, using ABC to assign costs accurately to suppliers and customers is an essential part of strategic cost management.

JIT's Effect on Job-Order and Process-Costing Systems

In implementing JIT in a job-order setting, the firm should first separate its repetitive business from its unique orders. Manufacturing cells can then be established to deal with the repetitive business. For those products where demand is insufficient to justify its own manufacturing cell, groups of dissimilar machines can be set up in a cell to make families of products or parts that require the same manufacturing sequence.

With this reorganization of the manufacturing layout, job orders are no longer needed to accumulate product costs. Instead, costs can be accumulated at the cellular level. Additionally, because lot sizes are now too small (as a result of reducing work-in-process and finished goods inventories), it is impractical to have job orders for each job. Add to this the short lead time of products occurring because of the time and space compression features of JIT (virtually no setup time and cellular structures), and it becomes difficult to track each piece moving through the cell. In effect, the job environment has taken on the nature of a process-costing system.

JIT simplifies process costing. A key feature of JIT is lower inventories. Assuming that JIT is successful in reducing work in process (Oregon Cutting Systems, for example, reduced work in process by 85 percent), the need to compute equivalent units vanishes. Calculating product costs follows the simple pattern of collecting costs for a cell for a period of time and dividing the costs by the units produced for that period.

Backflush Costing

The JIT system also offers the opportunity to simplify the accounting for manufacturing cost flows. Given low inventories, it may not be desirable to spend resources tracking the cost flows through all the inventory accounts. In a traditional system, there was a work-in-process account for each department so that manufacturing costs could be traced as work proceeded through the factory. Under JIT, there are no departments, a 14-day lead time (for example) has been decreased to four hours, and it would be absurd to trace costs from station to station within a cell. After all, if production cycle time is in minutes or hours, and goods are shipped immediately upon completion, then all of each day's manufacturing costs flow to Cost of Goods Sold. Recognizing this outcome leads to a simplified approach of accounting for manufacturing cost flows. This simplified approach, called **backflush costing**, uses trigger points to determine when manufacturing costs are assigned to key inventory and temporary accounts.

Varying the number and location of trigger points creates several types of backflush costing. Trigger points are simply events that prompt ("trigger") the accounting recognition of certain manufacturing costs. There are four variations, depending on the definition of the trigger points (which, in turn, depends on how fully the firm has implemented JIT):

1. The purchase of raw materials (trigger point 1) and the completion of the goods (trigger point 2).

2. The purchase of raw materials (trigger point 1) and the sale of goods (trigger point 2).
3. The completion of goods (only trigger point).
4. The sale of goods (only trigger point).

Variations 1 and 2

For Variations 1 and 2, the first trigger point is the purchase of raw materials. When materials are purchased in a JIT system, they are immediately placed into process. Raw Materials and In Process Inventory (RIP) is debited, and Accounts Payable is credited. The RIP inventory account is used only for tracking the cost of raw materials. There is no separate materials inventory account and no work-in-process inventory account. Combining direct labor and overhead into one category is a second feature of backflush costing. As firms implement JIT and become automated, the traditional direct labor cost category disappears. Multiskilled workers perform setup activities, machine-loading activities, maintenance, and materials handling, etc. As labor becomes multifunctional, the ability to track and report direct labor separately becomes impossible. Consequently, backflush costing usually combines direct labor costs with overhead costs in a temporary account called *Conversion Cost Control*. This account accumulates the *actual* conversion costs on the debit side and the applied conversion costs on the credit side. Any difference between the actual conversion costs and the applied conversion costs is closed to Cost of Goods Sold.

In the first variant of backflush costing, the completion of goods triggers the recognition of the manufacturing costs used to produce the goods (the second trigger point). At this point, conversion cost application is recognized by debiting Finished Goods Inventory and crediting Conversion Cost Control; the cost of direct materials is recognized by debiting Finished Goods Inventory and crediting the RIP inventory account. Therefore, the costs of manufacturing are “flushed” out of the system after the goods are completed.

In the second variant of backflush costing, the second trigger point is defined by the point when goods are sold rather than when they are completed. For this variant, the costs of manufacturing are flushed out of the system *after* the goods are sold. Thus, the application of conversion cost and the transfer of direct materials cost are accomplished by debiting Cost of Goods Sold and crediting Conversion Cost Control and RIP Inventory, respectively. Other entries are the same as Variation 1.

Variations 3 and 4

Under Variations 3 and 4, there is only one trigger point. Both variations recognize actual conversion costs by debiting Conversion Cost Control and crediting various accounts (such as Accumulated Depreciation). Neither variation makes any entry for the purchase of raw materials. For Variation 3, when the goods are completed, all costs, including direct materials cost, are flushed out of the system. This is done by debiting Finished Goods Inventory for the cost of all manufacturing inputs and crediting Accounts Payable for the cost of direct materials and Conversion Cost Control for the application of conversion costs. For Variation 4, the costs are flushed out of the system when the goods are sold. Thus, Cost of Goods Sold is debited, and Accounts Payable and Conversion Cost Control are credited. Of the four variations, only Variation 4 avoids all inventory accounts and, thus, would be the approach used for a pure JIT firm.

Example: Backflush Variations Illustrated and Compared with Traditional Cost Flow Accounting

To illustrate backflush costing and compare it with the traditional approach, assume that a JIT company had the following transactions during June:

1. Purchased raw materials on account for \$160,000.
2. Placed all materials received into production.
3. Incurred actual direct labor costs of \$25,000.

4. Incurred actual overhead costs of \$225,000.
5. Applied conversion costs of \$235,000.
6. Completed all work for the month.
7. Sold all completed work.
8. Computed the difference between actual and applied costs.

The journal entries for Variation 1 of backflush costing and the traditional system are compared in Exhibit 11-18.

EXHIBIT 11-18

Cost Flows: Traditional Compared with JIT

Transaction	Traditional Journal Entries		Backflush Journal Entries: Variation One	
1. Purchase of raw materials.	Materials Inventory	160,000	Raw Materials and in Process Inventory	160,000
	Accounts Payable		Accounts Payable	160,000
2. Materials issued to production.	Work-in-Process Inventory	160,000	No entry	
	Materials Inventory			160,000
3. Direct labor cost incurred.	Work-in-Process Inventory	25,000	Combined with overhead: See next entry.	
	Wages Payable			25,000
4. Overhead cost incurred.	Overhead Control	225,000	Conversion Cost Control	250,000
	Accounts Payable		Wages Payable	25,000
		225,000	Accounts Payable	225,000
5. Application of overhead.	Work-in-Process Inventory	210,000	No entry	
	Overhead Control			210,000
6. Completion of goods.	Finished Goods Inventory	395,000	Finished Goods Inventory	395,000
	Work-in-Process Inventory		Raw Materials and in Process Inventory	160,000
		395,000	Conversion Cost Control	235,000
7. Goods are sold.	Cost of Goods Sold	395,000	Cost of Goods Sold	395,000
	Finished Goods Inventory		Finished Goods Inventory	395,000
8. Variance is recognized.	Cost of Goods Sold	15,000	Cost of Goods Sold	15,000
	Overhead Control		Conversion Cost Control	15,000
		15,000		15,000

Variation 2 replaces the entries of Variation 1 for Transactions 6 and 7 in Exhibit 11-18 with the following entry:

Cost of Goods Sold	395,000	
Conversion Cost Control		235,000
Raw Materials and In Process Inventory		160,000

All other entries follow those of Variation 1.

Variation 3 differs from the entries in Exhibit 11-18 for Transactions 1 and 6. There is no entry for Transaction 1 (there is no RIP inventory account). Additionally, Variation 3 replaces the entry for Transaction 6 with the following:

Finished Goods Inventory	395,000	
Accounts Payable		160,000
Conversion Cost Control		235,000

All other entries are the same as those shown for Variation 1.

Variation 4 also has no entry for Transaction 1 and replaces the entries for Transactions 6 and 7 in Exhibit 11-18 with the following:

Cost of Goods Sold	395,000	
Accounts Payable		160,000
Conversion Cost Control		235,000

All other entries are the same. Variation 4 has three entries compared with eight for the traditional, non-JIT firm.

SUMMARY

Obtaining a competitive advantage so that long-term survival is ensured is the goal of strategic cost management. Different strategies create different bundles of activities. By assigning costs to activities, the costs of different strategies can be assessed. There are three generic or general strategies: cost leadership, differentiation, and focusing. The particular mix and relative emphasis of these three strategies define a firm's strategic position. The objective of strategic cost management is to reduce costs while simultaneously strengthening a firm's strategic position. Knowledge of organizational and operational activities and their associated cost drivers is fundamental to strategic cost analysis. Knowledge of the firm's value chain and the industrial value chain is also critical. Value-chain analysis relies on identifying and exploiting internal and external linkages. Good cost management of supplier and customer linkages requires an understanding of what suppliers cost and how much it costs to service customers. Activity-based assignments to suppliers and customers provide the accurate cost information needed.

Life-cycle cost management is related to strategic cost analysis and, in fact, could be called a type of strategic cost analysis. Life-cycle cost management requires an understanding of the three types of life-cycle viewpoints: the marketing viewpoint, the production viewpoint, and the consumable life viewpoint. By considering the interrelationships among the three viewpoints, insights are developed that help managers maximize life-cycle profits. Target costing plays an essential role in life-cycle cost management by providing a methodology for reducing costs in the design stage by considering and exploiting both customer and supplier linkages.

JIT purchasing and manufacturing offer a totally different set of structural and procedural activities from those of the traditional organization. The differences between JIT and traditional organizational structures can be used to illustrate the types of organizational activities and cost drivers that can be managed so a competitive advantage can be created and sustained. JIT also impacts the cost management system by changing the traceability of costs, increasing product costing accuracy, and in general, offering a simpler cost accounting system.

REVIEW PROBLEMS AND SOLUTIONS

1 STRATEGIC COST MANAGEMENT, TARGET COSTING

Assume that a firm has the following activities and associated cost behaviors:

<i>Activities</i>	<i>Cost Behavior</i>
Assembling components	\$10 per direct labor hour
Setting up equipment	Variable: \$100 per setup Step-fixed: \$30,000 per step, 1 step = 10 setups
Receiving goods	Step-fixed: \$40,000 per step, 1 step = 2,000 hours

Activities with step-cost behavior are being fully utilized by existing products. Thus, any new product demands will increase resource spending on these activities.

Two designs are being considered for a new product: Design I and Design II. The following information is provided about each design (1,000 units of the product will be produced):

<i>Activity Driver</i>	<i>Design I</i>	<i>Design II</i>
Direct labor hours	3,000	2,000
Number of setups	10	20
Receiving hours	2,000	4,000

The company has recently developed a cost equation for manufacturing costs using direct labor hours as the driver. The equation has $R^2 = 0.60$ and is as follows:

$$Y = \$150,000 + \$20X$$

Required:

- Suppose that Design Engineering is told that only direct labor hours drive manufacturing costs (based on the direct labor cost equation). Compute the cost of each design. Which design would be chosen based on this unit-based cost assumption?
- Now compute the cost of each design using all driver and activity information. Which design will now be chosen? Are there any other implications associated with the use of the more complete activity information set?
- Consider the following statement: "Strategic cost analysis should exploit internal linkages." What does this mean? Explain, using the results of Requirements 1 and 2.
- An outside consultant indicated that target costing ought to be used in the design stage. Explain what target costing is, and describe how it requires an understanding of both supplier and customer linkages.
- What other information would be useful to have concerning the two designs? Explain.

SOLUTION

- Design I: $\$20 \times 3,000 = \$60,000 + \$150,000 = \$210,000$
Design II: $\$20 \times 2,000 = \$40,000 + \$150,000 = \$190,000$
The unit-based analysis would lead to the selection of Design II.

- Design I:

Assembling components ($\$10 \times 3,000$)	\$ 30,000
Setting up equipment [$(10 \times \$100) + (1 \times \$30,000)$]	31,000
Receiving goods ($1 \times \$40,000$)	<u>40,000</u>
Total	<u>\$101,000</u>

Design II:

Assembling components ($\$10 \times 2,000$)	\$ 20,000
Setting up equipment [$(20 \times \$100) + (2 \times \$30,000)$]	62,000
Receiving goods ($2 \times \$40,000$)	<u>80,000</u>
Total	<u>\$162,000</u>

Design I has the lowest total cost. Notice also the difference in expected total manufacturing costs. The direct labor driver approach produces a much higher cost for both designs. This difference in cost could produce significant differences in pricing strategies.

- Exploiting internal linkages means taking advantage of the relationships among the activities that exist within a firm's segment of the value chain. To do this, we must know what the activities are and how they are related. Activity costs and drivers are an essential part of this analysis. Using only unit-based drivers for design decisions, as in Requirement 1, ignores the effect that different designs have on non-unit-based activities. The results of Requirement 2 illustrate a significant difference between two designs—relative to the unit-based analysis. The traditional costing system simply is not rich enough to supply the information needed for a thorough analysis of linkages.
- Target costing specifies the unit cost required to achieve a given share of the market for a product with certain functional specifications. This target cost is then compared with the expected unit cost. If the expected unit cost is greater than the target cost, then actions are taken to reduce the costs to the desired level. Three general methods of cost reduction are used: (1) tear down engineering, (2) value analysis, and (3) process improvement. Tear down engineering dismantles competitors' products to search for more efficient product designs. Value engineering evaluates customer reactions to proposed functions and determines whether or not they are worth the cost to produce. Process improvement seeks to improve the efficiency of the process that will be used to produce the new product. The first two methods are concerned with improving product design, while the third is concerned with improving process design. Involving both customers and suppliers in the process has the objective of producing lower costs than would be obtained if the design team worked in isolation. Suppliers, for example, may suggest alternative designs that will reduce the cost of the components that go into the product. Customers, of course, can indicate whether or not they value a particular design feature and, if so, how much they would be willing to pay for it.
- Linkages also extend to the rest of the firm's internal value-chain activities. It would be useful to know how design choices affect, and are affected by, logistical activities. Furthermore, external linkages would also help. For example, it would be interesting to know how post-purchase activities and costs are affected by the two designs.

2 BACKFLUSH COSTING

Foster Company has implemented a JIT system and is considering the use of backflush costing. Foster had the following transactions for the first quarter of the current fiscal year. (Conversion cost variances are recognized quarterly.)

- Purchased raw materials on account for \$400,000.
- Placed all materials received into production.
- Incurred actual direct labor costs of \$60,000.
- Incurred actual overhead costs of \$400,000.

5. Applied conversion costs of \$470,000.
6. Completed all work for the month.
7. Sold all completed work.
8. Computed the difference between actual and applied costs.

Required:

Prepare journal entries for Variations 2 and 4 of backflush costing.

SOLUTION

<i>Transaction</i>	<i>Backflush Journal Entries: Variation 2</i>		
1. Purchase of raw materials.	Raw Materials and in Process Inventory	400,000	
	Accounts Payable		400,000
2. Overhead cost incurred.	Conversion Cost Control	460,000	
	Wages Payable		60,000
	Accounts Payable		400,000
3. Goods are sold.	Cost of Goods Sold	870,000	
	Raw Materials and in Process Inventory		400,000
	Conversion Cost Control		470,000
4. Variance is recognized.	Conversion Cost Control	10,000	
	Cost of Goods Sold		10,000
<i>Transaction</i>	<i>Backflush Journal Entries: Variation 4</i>		
1. Overhead cost incurred.	Conversion Cost Control	460,000	
	Wages Payable		60,000
	Accounts Payable		400,000
2. Goods are sold.	Cost of Goods Sold	870,000	
	Accounts Payable		400,000
	Conversion Cost Control		470,000
3. Variance is recognized.	Conversion Cost Control	10,000	
	Cost of Goods Sold		10,000

KEY TERMS

Acceptable quality level (AQL) 513	Growth stage 502
Backflush costing 516	Industrial value chain 489
Competitive advantage 487	Internal linkages 489
Consumable life 501	Introduction stage 502
Cost leadership strategy 488	JIT manufacturing 510
Customer value 487	JIT purchasing 510
Decline stage 502	Life-cycle cost management 503
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Product life cycle	501	Target cost	507
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QUESTIONS FOR WRITING AND DISCUSSION

1. What does it mean to obtain a competitive advantage? What role does the cost management system play in helping to achieve this goal?
2. What is customer value? How is customer value related to a cost leadership strategy? To a differentiation strategy? To strategic positioning?
3. Explain what internal and external linkages are.
4. What are organizational and operational activities? Organizational cost drivers? Operational cost drivers?
5. What is the difference between a structural cost driver and an executional cost driver? Provide examples of each.
6. What is value-chain analysis? What role does it play in strategic cost analysis?
7. What is an industrial value chain? Explain why a firm's strategies are tied to what happens in the rest of the value chain. Using total quality control as an example, explain how the success of this quality management approach is dependent on supplier linkages.
8. What are the three viewpoints of product life cycle? How do they differ?
9. What are the four stages of the marketing life cycle?
10. What are life-cycle costs? How do these costs relate to the production life cycle?
11. What are the four stages of the consumption life cycle? What are post-purchase costs? Explain why a producer may want to know post-purchase costs.
12. "Life-cycle cost reduction is best achieved during the development stage of the production life cycle." Do you agree or disagree? Explain.
13. What is target costing? What role does it have in life-cycle cost management?
14. Explain why JIT with dedicated cellular manufacturing increases product costing accuracy.
15. Explain how backflush costing works.

EXERCISES

11-1 COMPETITIVE ADVANTAGE: BASIC CONCEPTS

- LO1** Jason Iba has decided to purchase a personal computer. He has narrowed his choices to two: Brand A and Brand B. Both brands have the same processing speed, the same hard disk capacity, 3.5-inch disk and CD-ROM drives, and the same basic software support package. Both come from companies with good reputations. The selling price for each is identical. After some review, Jason discovers that the cost of operating and maintaining Brand A over a 3-year period is estimated to be \$200. For Brand B, the operating and maintenance cost is \$600. The sales agent for Brand A emphasized the lower operating and maintenance cost. She claimed that it was lower than any other PC brand. The sales agent for Brand B, however, emphasized the service reputation of the product. He provided Jason with a copy of an article appearing in a PC magazine that rated

service performance of various PC brands. Brand B was rated number one. Based on all the information, Jason decided to buy Brand B.

Required:

1. What is the total product purchased by Jason?
2. Is the Brand A company pursuing a cost leadership or differentiation strategy? The Brand B company? Explain.
3. When asked why he purchased Brand B, Jason replied, “I think Brand B offered more value than Brand A.” What are the possible sources of this greater value? If Jason’s reaction represents the majority opinion, what suggestions could you offer to help improve the strategic position of Brand A?

11-2 STRATEGIC POSITIONING

LO1 San Jose Goodwill Bank has been experiencing significant competition from nonbanking financial service providers such as mutual funds. As a result, interest rates were lower, and the bank found it more difficult to maintain or increase deposits. Profits had declined for the past two years. Concerned about the situation, the bank’s executive managers commissioned a consulting group to assess the profitability of the bank’s products and customers. The consulting group implemented an ABC system that traced costs to both products and customers. An ABC customer profitability analysis rated the customers on a scale of one to five, with one being the most lucrative. Customers in the number one category earned an average profit of \$1,500 per year for the bank, while customers in the fifth category were costing the bank an average of \$500 per year. The consulting group also conducted a marketing survey and discovered that the higher-end customers were leaving for banks that offered a broader range of financial products. Armed with the financial and marketing information provided by the consulting group, the banking executives decided to implement the following:

1. Broaden the markets to include investment and insurance products. The goal was to become a complete financial services provider to stop the loss of the higher-end customers. The broadening would also reduce the dependence of the bank on interest-based revenue. (Investment and insurance products produce fee-based revenues.)
2. Alter the customer mix by targeting only the upper three customer segments.
3. Set the bank apart from competitors by offering special, high-quality services to targeted customers:¹³
 - a. The upper segment of customers will be classified as “Premier One” and will be issued a gold card. When presenting the card to a concierge at the door, the customer will be taken to a special teller window with no line, or to the desk of a specially trained bank officer.
 - b. For the highest-end customers, no-questions asked refunds on fees that they think they shouldn’t pay (categories one and two). Middle-end customers can negotiate. Low-end customers must pay the fees (categories four and five).
 - c. Provide secret, toll-free “VIP” numbers to customers in the Premier One category. In this way, they will have immediate access to a bank official for any inquiry they may have.
 - d. Impose a \$4 teller fee for lower-end customers (categories four and five).
4. Improve operating efficiency by increasing productivity and eliminating costs that produce no revenues.

13. Many of these services are actually being offered by banks. See Rick Brooks, “Alienating Customers Isn’t Always a Bad Idea, Many Firms Discover,” *The Wall Street Journal* (January 7, 1999): A1 and A12.

Required:

1. Describe the strategic positioning of San Jose Goodwill Bank in terms of the three general strategies: cost leadership, differentiation, and focusing. Of the three, which one(s) are apparently receiving the most emphasis?
2. Describe the role of cost management in defining the strategic position of the bank. What role do you think cost management will play as the bank attempts to establish and enhance its strategic position?

11-3 DRIVER CLASSIFICATION

LO1 Classify the following cost drivers as structural, executional, or operational.

- a. Number of plants
- b. Number of moves
- c. Degree of employee involvement
- d. Capacity utilization
- e. Number of product lines
- f. Number of distribution channels
- g. Engineering hours
- h. Direct labor hours
- i. Scope
- j. Product configuration
- k. Quality management approach
- l. Number of receiving orders
- m. Number of defective units
- n. Employee experience
- o. Types of process technologies
- p. Number of purchase orders
- q. Type and efficiency of layout
- r. Scale
- s. Number of functional departments
- t. Number of planning meetings

11-4 OPERATIONAL AND ORGANIZATIONAL ACTIVITIES

LO1 McConkie Company has decided to pursue a cost leadership strategy. This decision is prompted, in part, by increased competition from foreign firms. McConkie's management is confident that costs can be reduced by more efficient management of the firm's operational activities. Improving operational activity efficiency, however, often requires some strategic changes in organizational activities. McConkie currently uses a very traditional manufacturing approach. Plants are organized along departmental lines. Management follows a typical pyramid structure. Labor is specialized and located in departments. Quality management follows a conventional acceptable quality level approach. (Batches of products are accepted if the number of defective units is below some predetermined level.) Materials are purchased from a large number of suppliers, and sizable inventories of materials, work in process, and finished goods are maintained. The company produces many different products that use a variety of different parts, many of which are purchased from suppliers.

Required:

Given this brief description of the firm and its setting, for each of the following operational activities and their associated drivers, suggest some strategic changes in organizational activities (and drivers) that might reduce the cost of performing the indicated operational activity. Explain your reasoning.

<i>Operational Activity</i>	<i>Operational Cost Driver</i>
Inspecting products	Number of inspection hours
Moving materials	Distance moved
Reworking products	Number of defective units
Setting up equipment	Setup time
Purchasing parts	Number of different parts
Storing goods and materials	Days in inventory
Expediting orders	Number of late orders
Warranty work	Number of bad units sold

11-5 EXTERNAL LINKAGES, ACTIVITY-BASED SUPPLIER COSTING

LO2



Aldredge Company manufactures dental equipment. Aldredge produces all the components necessary for the production of its product except for one. This component is purchased from two local suppliers: Grayson Machining and Lambert, Inc. Grayson sells the component for \$144 per unit, while Lambert sells the same component for \$129. Because of the lower price, Aldredge purchases 80 percent of its components from Lambert. Aldredge purchases the remaining 20 percent from Grayson to ensure an alternative source. The total annual demand is 1,000,000 components.

Grayson's sales manager is pushing Aldredge to purchase more of its units, arguing that its component is of much higher quality and so should prove to be less costly than Lambert's lower-quality component. Grayson has sufficient capacity to supply all the components needed and is asking for a long-term contract. With a 5-year contract for 800,000 or more units, Grayson will sell the component for \$135 per unit with a contractual provision for an annual product-specific inflationary adjustment. Aldredge's purchasing manager is intrigued by the offer and wonders if the higher-quality component actually does cost less than the lower-quality Lambert component. To help assess the cost effect of the two components, the following data were collected for quality-related activities and suppliers:

I. Activity data:

<i>Activity</i>	<i>Cost</i>
Inspecting components (sampling only)	\$ 1,200,000
Expediting work (due to late delivery)	960,000
Reworking products (due to failed component)	6,844,500
Warranty work (due to failed component)	21,600,000

II. Supplier data:

	<i>Grayson</i>	<i>Lambert</i>
Unit purchase price	\$144	\$129
Units purchased	200,000	800,000
Expediting orders	10	90
Sampling hours*	20	980
Rework hours	90	1,410
Warranty hours	200	3,800

*The quality control department indicates that sampling inspection for the Grayson component has been reduced because the reject rate is so low.

Required:

1. Calculate the cost per component for each supplier, taking into consideration the costs of the quality-related activities and using the current prices and sales volume. Given this information, what do you think the purchasing manager ought to do? Explain.
2. Suppose the quality control department estimates that the company loses \$4,500,000 in sales per year because of the reputation effect of defective units attributable to failed components. What information would you like to have to assign this cost to each supplier? Suppose that you had to assign the cost of lost sales to each supplier using one of the drivers already listed. Which would you choose? Using this driver, calculate the change in the cost of the Lambert component attributable to lost sales.

11-6 EXTERNAL LINKAGES, CUSTOMER COSTING, CUSTOMER PROFITABILITY

LO2 Dino Company sells machine parts to industrial equipment manufacturers for an average price of \$0.75 per part. There are two types of customers: those who place small, frequent orders and those who place larger, less frequent orders. Each time an order is placed and processed, a setup is required. Scheduling is also needed to coordinate the many different orders that come in and place demands on the plant's manufacturing resources. Dino also inspects a sample of the products each time a batch is produced to ensure that the customer's specifications have been met. Inspection takes essentially the same time regardless of the type of part being produced. Dino's cost accounting department has provided the following budgeted data for customer-related activities and costs (the amounts expected for the coming year):

	<i>Frequently Ordering Customers</i>	<i>Less Frequently Ordering Customers</i>
Sales orders	10,000	1,000
Average order size	1,000	10,000
Number of setups	12,500	2,500
Scheduling hours	17,500	2,500
Inspections	12,500	2,500
Average unit cost*	\$0.40	\$0.40

*This cost does not include the cost of the following "customer-related" activities:

Customer-related activity costs:	
Processing sales orders	\$1,100,000
Scheduling production	600,000
Setting up equipment	1,800,000
Inspecting batches	<u>2,400,000</u>
Total	<u>\$5,900,000</u>

Required:

1. Assign the customer-related activity costs to each category of customers in proportion to the sales revenue earned by each customer type. Calculate the profitability of each customer type. Discuss the problems with this measure of customer profitability.
2. Assign the customer-related activity costs to each customer type using activity rates. Now calculate the profitability of each customer category. As a manager, how would you use this information?

11-7 PRODUCT LIFE CYCLE

LO3 The following series of statements or phrases are associated with product life-cycle viewpoints. Identify whether each one is associated with the marketing, production, or customer viewpoint. Where possible, identify the particular characteristic being described. If the statement or phrase fits more than one viewpoint, label it as interactive. Explain the interaction.

- a. Sales are increasing at an increasing rate.
- b. The cost of maintaining the product after it is purchased.
- c. The product is losing market acceptance and sales are beginning to decrease.
- d. A design is chosen to minimize post-purchase costs.
- e. Ninety percent or more of the costs are committed during the development stage.
- f. The length of time that the product serves the needs of a customer.
- g. All the costs associated with a product for its entire life cycle.
- h. The time in which a product generates revenue for a company.
- i. Profits tend to reach peak levels during this stage.
- j. Customers have the lowest price sensitivity during this stage.
- k. Describes the general sales pattern of a product as it passes through distinct life-cycle stages.
- l. The concern is with product performance and price.
- m. Actions taken so that life-cycle profits are maximized.
- n. Emphasizes internal activities that are needed to develop, produce, market, and service products.

11-8 JIT AND TRACEABILITY OF COSTS

LO5 Assume that a company has recently switched to JIT manufacturing. Each manufacturing cell produces a single product or major subassembly. Cell workers have been trained to perform a variety of tasks. Additionally, many services have been decentralized. Costs are assigned to products using direct tracing, driver tracing, and allocation. For each cost listed, indicate the most likely product cost assignment method used *before* JIT and *after* JIT. Set up a table with three columns: Cost Item, Before JIT, and After JIT. You may assume that direct tracing is used whenever possible, followed by driver tracing, with allocation being the method of last resort.

- a. Inspection costs
- b. Power to heat, light, and cool plant
- c. Minor repairs on production equipment
- d. Salary of production supervisor (department/cell)
- e. Oil to lubricate machinery
- f. Salary of plant supervisor
- g. Costs to set up machinery
- h. Salaries of janitors
- i. Power to operate production equipment
- j. Taxes on plant and equipment
- k. Depreciation on production equipment
- l. Raw materials
- m. Salary of industrial engineer
- n. Parts for machinery
- o. Pencils and paper clips for production supervisor (department/cell)
- p. Insurance on plant and equipment
- q. Overtime wages for cell workers
- r. Plant depreciation
- s. Materials handling
- t. Preventive maintenance

11-9 JIT FEATURES AND PRODUCT COSTING ACCURACY

LO4, LOS



Prior to installing a JIT system, Pohlson Company, a producer of bicycle parts, used maintenance hours to assign maintenance costs to its three products (wheels, seats, and handle bars). The maintenance costs totaled \$1,960,000 per year. The maintenance hours used by each product and the quantity of each product produced are as follows:

	<i>Maintenance Hours</i>	<i>Quantity Produced</i>
Wheels	60,000	52,500
Seats	60,000	52,500
Handle bars	80,000	70,000

After installing JIT, three manufacturing cells were created, and cell workers were trained to perform preventive maintenance and minor repairs. A full-time maintenance person was also assigned to each cell. Maintenance costs for the three cells still totaled \$1,960,000; however, these costs are now traceable to each cell as follows:

Cell, wheels	\$532,000
Cell, seats	588,000
Cell, handle bars	840,000

Required:

1. Compute the pre-JIT maintenance cost per unit for each product.
2. Compute the maintenance cost per unit for each product after installing JIT.
3. Explain why the JIT maintenance cost per unit is more accurate than the pre-JIT cost.

11-10 BACKFLUSH COSTING VERSUS TRADITIONAL: VARIATION 1

LOS



Kaylin Company has installed a JIT purchasing and manufacturing system and is using backflush accounting for its cost flows. It currently uses the purchase of materials as the first trigger point and the completion of goods as the second trigger point. During the month of May, Kaylin had the following transactions:

Raw materials purchased	\$810,000
Direct labor cost	135,000
Overhead cost	675,000
Conversion cost applied	877,500*

*\$135,000 labor plus \$742,500 overhead.

There were no beginning or ending inventories. All goods produced were sold with a 60 percent markup. Any variance is closed to Cost of Goods Sold. (Variances are recognized monthly.)

Required:

1. Prepare the journal entries that would have been made using a traditional accounting approach for cost flows.
2. Prepare the journal entries for the month using backflush costing.

11-11 BACKFLUSH COSTING: VARIATION 2

LOS

Refer to Exercise 11-10.

Required:

Prepare the journal entries for the month of May using backflush costing, assuming that Kaylin uses the sale of goods as the second trigger point instead of the completion of goods.

11-12 BACKFLUSH COSTING VERSUS TRADITIONAL: VARIATIONS 3 AND 4

LO5 Refer to Exercise 11-10.

Required:

1. Prepare the journal entries for the month of May using backflush costing, assuming that Kaylin uses the completion of goods as the only trigger point.
2. Prepare the journal entries for the month of May using backflush costing, assuming that Kaylin uses the sale of goods as the only trigger point.

11-13 COST ASSIGNMENT AND JIT

LO4, LO5 Caltor Company produces two types of space heaters (regular and super). Both pass through two producing departments: fabrication and assembly. It also has a materials handling department that is responsible for moving materials and goods to and between departments. Budgeted data for the three departments are as follows:

	<i>Materials Handling</i>	<i>Fabrication</i>	<i>Assembly</i>
Overhead	\$160,000	\$240,000	\$68,000
Number of moves	—	30,000	10,000
Direct labor hours	—	24,000	12,000

In the fabrication department, the regular model requires one hour of direct labor and the super model, two hours. In the assembly department, the regular model requires 0.5 hour of direct labor and the super model, one hour. Expected production: regular model, 8,000 units; super model, 8,000 units.

Immediately after preparing the budgeted data, a consultant suggests that two manufacturing cells be created: one for the manufacture of the regular model and the other for the manufacture of the super model. Raw materials would be delivered to each cell, and goods would be shipped immediately to customers upon completion. The total direct overhead costs estimated for each cell would be \$76,000 for the regular cell and \$240,000 for the super cell.

Required:

1. Allocate the materials handling costs to each department, and compute the overhead cost per unit for each heater. (Overhead rates use direct labor hours.)
2. Compute the overhead cost per unit if manufacturing cells are created. Which unit overhead cost do you think is more accurate—the one computed with a departmental structure, or the one computed using a cell structure? Explain.
3. Note that the total overhead costs for the cell structure are lower. Explain why.

PROBLEMS

11-14 INTERNAL LINKAGES, COST MANAGEMENT, AND STRATEGIC DECISION MAKING

LO2 Evans, Inc., has a functional-based costing system. Evans's Miami plant produces 10 different electronic products. The demand for each product is about the same. Although they differ in complexity, each product uses about the same labor time and materials.

The plant has used direct labor hours for years to assign overhead to products. To help design engineers understand the assumed cost relationships, the cost accounting department developed the following cost equation. (The equation describes the relationship between total manufacturing costs and direct labor hours; the equation is supported by a coefficient of determination of 60 percent.)

$$Y = \$5,000,000 + \$30X, \text{ where } X = \text{direct labor hours}$$

The variable rate of \$30 is broken down as follows:

Direct labor	\$ 9
Variable overhead	5
Direct materials	16

Because of competitive pressures, product engineering was given the charge to re-design products to reduce the total cost of manufacturing. Using the above cost relationships, product engineering adopted the strategy of redesigning to reduce direct labor content. As each design was completed, an engineering change order was cut, triggering a series of events such as design approval, vendor selection, bill of materials update, redrawing of schematic, test runs, changes in setup procedures, development of new inspection procedures, and so on.

After one year of design changes, the normal volume of direct labor was reduced from 250,000 hours to 200,000 hours, with the same number of products being produced. Although each product differs in its labor content, the redesign efforts reduced the labor content for all products. On average, the labor content per unit of product dropped from 1.25 hours per unit to one hour per unit. Fixed overhead, however, increased from \$5,000,000 to \$6,600,000 per year.

Suppose that a consultant was hired to explain the increase in fixed overhead costs. The consultant's study revealed that the \$30 per hour rate captured the unit-level variable costs; however, the cost behavior of other activities was quite different. For example, setting up equipment is a step-fixed cost, where each step is 2,000 setup hours, costing \$90,000. The study also revealed that the cost of receiving goods is a function of the number of different components. This activity has a variable cost of \$2,000 per component type and a fixed cost that follows a step-cost pattern. The step is defined by 20 components with a cost of \$50,000 per step. Assume also that the consultant indicated that the design adopted by the engineers increased the demand for setups from 20,000 setup hours to 40,000 setup hours and the number of different components from 100 to 250. The demand for other non-unit-level activities remained unchanged. The consultant also recommended that management take a look at a rejected design for its products. This rejected design increased direct labor content from 250,000 hours to 260,000 hours, decreased the demand for setups from 20,000 hours to 10,000 hours, and decreased the demand for purchasing from 100 component types to 75 component types, while the demand for all other activities remained unchanged.

Required:

1. Using normal volume, compute the manufacturing cost per labor hour before the year of design changes. What is the cost per unit of an "average" product?
2. Using normal volume after the one year of design changes, compute the manufacturing cost per hour. What is the cost per unit of an "average" product?
3. Before considering the consultant's study, what do you think is the most likely explanation for the failure of the design changes to reduce manufacturing costs? Now use the information from the consultant's study to explain the increase in the average cost per unit of product. What changes would you suggest to improve Evans's efforts to reduce costs?
4. Explain why the consultant recommended a second look at a rejected design. Provide computational support. What does this tell you about the strategic importance of cost management?

11-15 EXTERNAL LINKAGES, ACTIVITY-BASED SUPPLIER COSTING

LO2 Amado, Inc., manufactures riding lawn mowers. Amado uses JIT manufacturing and carries insignificant levels of inventory. Amado manufactures everything needed for the riding lawn mowers except for the engines. Several sizes of mowers are produced. The most popular line is the small mower line. The engines for the small mower line are purchased from two sources: Rivera Engines and Bach Machining. The Rivera engine is the more expensive of the two sources and has a price of \$300. The Bach engine is \$270 per unit. Amado produces and sells 13,200 units of the small mower. Of the 13,200 engines purchased, 2,400 are purchased from Rivera Engines, and 10,800 are purchased from Bach Machining. Although Bill Jackson, production manager, prefers the Rivera engine, Carlos Lopez, purchasing manager, maintains that the price difference is too great to buy more than the 2,400 units currently purchased. Carlos, however, does want to maintain a significant connection with Rivera just in case the less expensive source cannot supply the needed quantities. Even though Bill understands the price argument, he has argued in many meetings that the quality of the Rivera engine is worth the price difference. Carlos remains unconvinced.

Sam Miller, controller, has recently overseen the implementation of an activity-based costing system. He has indicated that an ABC analysis would shed some light on the conflict between production and purchasing. To support this position, the following data have been collected:

I. Activity cost data:

Testing engines ^a	\$240,000
Reworking products ^b	400,000
Expediting orders ^c	300,000
Repairing engines ^d	540,000

^aAll units are tested after assembly, and a certain percentage are rejected because of engine failure.

^bDefective engines are removed, replaced (supplier will replace any failed engine), and retested before being sold to customers. Engine failure often causes collateral damage, and other parts need to be remanufactured and replaced before the unit is again functional.

^cDue to late or failed delivery of engines.

^dRepair work is for units under warranty and almost invariably is due to engine failure. Repair usually means replacing the engine. This cost plus labor, transportation, and other costs make warranty work very expensive.

II. Supplier data:

	<i>Bach</i>	<i>Rivera</i>
Engines replaced by source	990	10
Rework hours	4,900	100
Late or failed shipments	99	1
Warranty repairs (by source)	1,220	30

Upon hearing of the proposed ABC analysis, Bill and Carlos were both supportive. Carlos, however, noted that even if the analysis revealed that the Rivera engine was actually less expensive, it would be unwise to completely abandon Bach. He argued that Rivera may be hard pressed to meet the entire demand. Its productive capacity was not sufficient to handle the kind of increased demand that would be imposed. Additionally, having only one supplier was simply too risky.

Required:

1. Calculate the total supplier cost (acquisition cost plus supplier-related activity costs). Convert this to a per-engine cost to find out how much the company is paying for the engines. Which of the two suppliers is the low-cost supplier? Explain why this is a better measure of engine cost than the usual purchase costs assigned to the engines.
2. Consider the supplier cost information obtained in Requirement 1. Suppose further that Rivera can supply only a total of 6,000 units. What actions would you advise Amado to undertake with its suppliers? Comment on the strategic value of activity-based supplier costing.

11-16 EXTERNAL LINKAGES, ACTIVITY-BASED CUSTOMER COSTING, AND STRATEGIC DECISION MAKING

LO2 Moss Manufacturing produces several types of bolts. The products are produced in batches according to customer order. Although there are a variety of bolts, they can be grouped into three product families. The number of units sold is the same for each family. The selling prices for the three families range from \$0.50 to \$0.80 per unit. Because the product families are used in different kinds of products, customers also can be grouped into three categories, corresponding to the product family they purchase. Historically, the costs of order entry, processing, and handling were expensed and not traced to individual products. These costs are not trivial and totaled \$6,300,000 for the most recent year. Furthermore, these costs had been increasing over time. Recently, the company had begun to emphasize a cost reduction strategy; however, any cost reduction decisions had to contribute to the creation of a competitive advantage.

Because of the magnitude and growth of order-filling costs, management decided to explore the causes of these costs. They discovered that order-filling costs were driven by the number of customer orders processed. Further investigation revealed the following cost behavior:

Step-fixed cost component: \$70,000 per step; 2,000 orders define a step*
 Variable cost component: \$28 per order

*Moss currently has sufficient steps to process 100,000 orders.

The expected customer orders for the year total 140,000. The expected usage of the order-filling activity and the average size of an order by product family are as follows:

	<i>Family A</i>	<i>Family B</i>	<i>Family C</i>
Number of orders	70,000	42,000	28,000
Average order size	600	1,000	1,500

As a result of the cost behavior analysis, the marketing manager recommended the imposition of a charge per customer order. The president of the company concurred. The charge was implemented by adding the cost per order to the price of each order (computed using the projected ordering costs and expected orders). This ordering cost was then reduced as the size of the order increased and eliminated as the order size reached 2,000 units. (The marketing manager indicated that any penalties imposed for orders greater than this size would lose sales from some of the smaller customers.) Within a short period of communicating this new price information to customers, the average order size for all three product families increased to 2,000 units.

Required:

1. Moss traditionally has expensed order-filling costs (following GAAP guidelines). Under this approach, how much cost is assigned to customers? Do you agree with this practice? Explain.
2. Consider the following claim: By expensing the order-filling costs, all products were undercosted; furthermore, products ordered in small batches are significantly undercosted. Explain, with supporting computations where possible. Explain how this analysis also reveals the costs of various customer categories.
3. Calculate the reduction in order-filling costs produced by the change in pricing strategy. (Assume that resource spending is reduced as much as possible and that the total units sold remain unchanged.) Explain how exploiting customer linkages produced this cost reduction. Moss also noticed that other activity costs, such as those for setups, scheduling, and materials handling costs, were reduced significantly as a result of this new policy. Explain this outcome, and discuss its implications.
4. Suppose that one of the customers complains about the new pricing policy. This buyer is a lean, JIT firm that relies on small frequent orders. In fact, this customer accounted for 30 percent of the Family A orders. How should Moss deal with this customer?
5. One of Moss's goals is to reduce costs so that a competitive advantage might be created. Describe how the management of Moss might use this outcome to help create a competitive advantage.

11-17 INTERNAL AND EXTERNAL LINKAGES, STRATEGIC COST MANAGEMENT

LO2 Maxwell Company produces a variety of kitchen appliances, including cooking ranges and dishwashers. Over the past several years, competition has intensified. In order to maintain—and perhaps increase—its market share, Maxwell's management decided that the overall quality of its products had to be increased. Furthermore, costs needed to be reduced so that the selling prices of its products could be reduced. After some investigation, Maxwell concluded that many of its problems could be traced to the unreliability of the parts that were purchased from outside suppliers. Many of these components failed to work as intended, causing performance problems. Over the years, the company had increased its inspection activity of the final products. If a problem could be detected internally, then it was usually possible to rework the appliance so that the desired performance was achieved. Management also had increased its warranty coverage; warranty work had been increasing over the years.

David Haight, president of Maxwell Company, called a meeting with his executive committee. Lee Linsenmeyer, chief engineer, Kit Applegate, controller, and Jeannie Mitchell, purchasing manager, were all in attendance. How to improve the company's competitive position was the meeting's topic. The conversation of the meeting was recorded as follows:

DAVID: We need to find a way to improve the quality of our products and at the same time reduce costs. Lee, you said that you have done some research in this area. Would you share your findings?

LEE: As you know, a major source of our quality problems relates to the poor quality of the parts we acquire from the outside. We have a lot of different parts, and this adds to the complexity of the problem. What I thought would be helpful would be to redesign our products so that they can use as many interchangeable parts as possible. This will cut down the number of different parts, make it easier to inspect, and cheaper to repair when it comes to warranty work. My engineering staff has already come up with some new designs that will do this for us.

JEANNIE: I like this idea. It will simplify the purchasing activity significantly. With fewer parts, I can envision some significant savings for my area. Lee has shown me the designs so I know exactly what parts would be needed. I also have a suggestion. We need to embark on a supplier evaluation program. We have too many suppliers. By reducing the number of different parts, we will need fewer suppliers. And we really don't need to use all the suppliers that produce the parts demanded by the new designs. We should pick suppliers that will work with us and provide the quality of parts that we need. I have done some preliminary research and have identified five suppliers that seem willing to work with us and assure us of the quality we need. Lee may need to send some of his engineers into their plants to make sure that they can do what they are claiming.

DAVID: This sounds promising. Kit, can you look over the proposals and their estimates and give us some idea if this approach will save us any money? And if so, how much can we expect to save?

KIT: Actually, I am ahead of the game here. Lee and Jeannie have both been in contact with me and have provided me with some estimates on how these actions would affect different activities. I have prepared a handout that includes an activity table revealing what I think are the key activities affected. I have also assembled some tentative information about activity costs. The table gives the current demand and the expected demand after the changes are implemented. With this information, we should be able to assess the expected cost savings.

Handout				
<i>Activities</i>	<i>Activity Driver</i>	<i>Capacity</i>	<i>Current Demand</i>	<i>Expected Demand</i>
Purchasing parts	Number of different parts	2,000	2,000	500
Inspecting products	Inspection hours	50,000	50,000	25,000
Reworking products	Number reworked	As needed	62,500	25,000
Warranty repair	Number of defective products	10,000	9,000	3,500

Additionally, the following activity cost data are provided:

Purchasing parts: Variable activity cost: \$30 per part number; 20 salaried clerks, each earning a \$45,000 annual salary. Each clerk is capable of processing orders associated with 100 part numbers.

Inspecting parts: Twenty-five inspectors, each earning a salary of \$40,000 per year. Each inspector is capable of 2,000 hours of inspection.

Reworking products: Variable activity cost: \$25 per unit reworked (labor and parts).

Warranty: Twenty repair agents, each paid a salary of \$35,000 per year. Each repair agent is capable of repairing 500 units per year. Variable activity costs: \$15 per product repaired.

Required:

1. Compute the total savings possible as reflected by Kit's handout. Assume that resource spending is reduced where possible.
2. Explain how redesign and supplier evaluation are linked to the savings computed in Requirement 1. Discuss the importance of recognizing and exploiting internal and external linkages.
3. Identify the organizational and operational activities involved in the strategy being considered by Maxwell Company. What is the relationship between organizational and operational activities?

11-18 EXTERNAL LINKAGES AND STRATEGIC COST MANAGEMENT

LO1, LO2

Pawnee Works makes machine parts for manufacturers of industrial equipment. Over the years, Pawnee has been a steady and reliable supplier of quality parts to medium and small machine manufacturers. Michael Murray, owner of Pawnee Works, once again was disappointed in the year-end income statement. Profits had again failed to meet expectations. The performance was particularly puzzling given that the shop was operating at 100 percent capacity and had been for two years—ever since it had landed a *Fortune 500* firm as a regular customer. This firm currently supplies 40 percent of the business—a figure that had grown over the two years. Convinced that something was wrong, Michael called Brooke Harker, a partner in a large regional CPA firm. Brooke agreed to look into the matter.

A short time later, Brooke made an appointment to meet with Michael. Their conversation was recorded as follows:

BROOKE: Michael, I think I have pinpointed your problem. I think your main difficulty is poor pricing—you're undercharging your major customer. The firm is getting high-precision machined parts for much less than the cost to you. And I bet that you have been losing some of your smaller customers. You may want to rethink your strategic position. You are a small player in the industrial machine industry. This *Fortune 500* customer has 40 percent of the industrial machine market. Over the years, you have carved out a good reputation among small- and medium-size manufacturers. Right?

MICHAEL: Well, you're right. Over the years, our customers have not been giants. But we saw this business with the *Fortune 500* company as an opportunity to play in the big leagues. We thought it might mean the opportunity to expand the size of our operation. And we have expanded—at least we have added employees and some specialized engineering equipment. My engineering and programming costs have skyrocketed—resource increases we needed, though, to meet the specs of this larger customer. Profits have increased slightly, but nothing like I expected. You're also right about losing some of our smaller customers. Many have complained that the price of their jobs has increased. They have all indicated that they like the work we do and that we are conveniently located, but they argue that they simply cannot afford to keep paying the price we require. The small customers we have kept are also complaining and threatening to go elsewhere. I doubt we'll be able to hold onto their business for much longer—unless a change is made. So far, though, the business we have lost has been replaced with more orders from our large customer. I expect we could do even more business for the large customer. But how can the large buyer be getting the great deal you've described? It has the same markup as our regular jobs—full manufacturing cost plus 25 percent.

BROOKE: I have prepared a report illustrating the total overhead costs for a typical quarter. This report details your major activities and their associated costs. It also provides a comparison of a typical job for your small customers and the typical job for your large customer. Part of the problem is that your accounting system does not react to certain external events. It fails to show the effect of the large customer's activities on your activities and those that relate to your other customers. Given that you assign overhead costs using machine hours, I think you'll find it quite revealing.

MICHAEL: I'll have my controller examine the report for me. You know, if you are right about underpricing the large customer, I have a big problem. I'm not sure that I can increase the price of the parts without losing this big guy's business. After all, it can go to a dozen machine shops like mine and get the work done. A price increase may not work. Then I'd be faced with the loss of 40 percent of my jobs. I suppose, though, that I might be able to regain most of the business with the small customers. In fact, I am positive that we could get most of that business back. I wonder if that's what I ought to do.

Report Regional CPA Firm

I. Major Activities and Their Costs

<i>Activity</i>	<i>Total Activity Costs</i>	<i>Cost Behavior*</i>
Setups	\$209,000	Variable
Engineering	151,200	Step-fixed, step = 105 hours
NC programming	130,400	Variable
Machining	100,000	Variable
Rework	101,400	Variable
Inspecting	23,000	Step-fixed, step = 230 hours
Sales support	80,000	Step-fixed, step = 23 orders
Total	<u>\$795,000</u>	

*Behavior is defined with respect to individual cost drivers. The costs given are total costs for the quarter's activities. Thus, for step-fixed costs, the reported activity cost is for all steps being used by the activity; the cost per step is the total cost divided by the number of steps being used.

II. Job Profiles

<i>Resources Used</i>	<i>Small Customer Job</i>	<i>Fortune 500 Job</i>
Setup hours	3	10
Engineering hours	2	6
Programming hours	1	8
Defective units	20	10
Inspection hours	2	2
Machine hours	2,000	200
Prime costs	\$14,000	\$1,600
Other data:		
Job size	1,000 parts	100 parts
Quarterly jobs (orders)	15	100
Overhead rate	\$14.30 per machine hour	\$14.30 per machine hour

Note: All activities are being fully utilized each quarter. (There is no unused activity capacity.)

Required:

- Without any calculation, explain why the machining company is losing money. Discuss the strategic insights provided by knowledge of activities, their costs, and customer linkages. Comment on the observation made by Brooke that the current accounting system fails to reflect external events. What changes would be needed to correct this deficiency (if true)?
- Compute the unit price currently being charged each customer type (using machine hours to assign overhead costs).
- Compute the unit price that would be charged each customer assuming that overhead is assigned using an ABC approach. Was the CPA right? Is the large customer paying less than the cost of producing the unit? How is this conclusion affected if the sales support activity is traced to jobs? (Use orders—jobs—as the cost driver.)
- Compute the quarterly profit that is currently being earned and the amount that would be earned if Pawnee Works sold only to small customers (a small customer strategy). For the second income statement, use ABC for cost assignments. For the second income statement, the large customer is replaced with 10 smaller customers with the same characteristics as the 15 currently buying parts from Pawnee. Assume that any opportunities to reduce resource spending and usage will be reflected in the profit associated with a small customer strategy. Also,

only the cost of activity usage is assigned to jobs. Any cost of unused activity is reported as a separate item on the income statement. Report sales support as a period expense.

5. What change in strategy would you recommend? In making this recommendation, consider the firm's value-chain framework.

11-19 LIFE-CYCLE COST MANAGEMENT AND TARGET COSTING

LO3 Nico Parts, Inc., produces electronic products with short life cycles (of less than two years). Development has to be rapid, and the profitability of the products is tied strongly to the ability to find designs that will keep production and logistics costs low. Recently, management has also decided that post-purchase costs are important in design decisions. Last month, a proposal for a new product was presented to management. The total market was projected at 200,000 units (for the 2-year period). The proposed selling price was \$130 per unit. At this price, market share was expected to be 25 percent. The manufacturing and logistics costs were estimated to be \$120 per unit.

Upon reviewing the projected figures, Brian Metcalf, president of Nico, called in his chief design engineer, Mark Williams, and his marketing manager, Cathy McCourt. The following conversation was recorded.

BRIAN: Mark, as you know, we agreed that a profit of \$15 per unit is needed for this new product. Also, as I look at the projected market share, 25 percent isn't acceptable. Total profits need to be increased. Cathy, what suggestions do you have?

CATHY: Simple. Decrease the selling price to \$125 and we expand our market share to 35 percent. To increase total profits, however, we need some cost reductions as well.

BRIAN: You're right. However, keep in mind that I do not want to earn a profit that is less than \$15 per unit.

MARK: Does that \$15 per unit factor in preproduction costs? You know we have already spent \$100,000 on developing this product. To lower costs will require more expenditure on development.

BRIAN: Good point. No, the projected cost of \$120 does not include the \$100,000 we have already spent. I do want a design that will provide a \$15-per-unit profit, including consideration of preproduction costs.

CATHY: I might mention that post-purchase costs are important as well. The current design will impose about \$10 per unit for using, maintaining, and disposing our product. That's about the same as our competitors. If we can reduce that cost to about \$5 per unit by designing a better product, we could probably capture about 50 percent of the market. I have just completed a marketing survey at Mark's request and have found out that the current design has two features not valued by potential customers. These two features have a projected cost of \$6 per unit. However, the price consumers are willing to pay for the product is the same with or without the features.

Required:

1. Calculate the target cost associated with the initial 25 percent market share. Does the initial design meet this target? Now calculate the *total* life-cycle profit that the current (initial) design offers (including preproduction costs).
2. Assume that the two features that are apparently not valued by consumers will be eliminated. Also assume that the selling price is lowered to \$125.
 - a. Calculate the target cost for the \$125 price and 35 percent market share.
 - b. How much more cost reduction is needed?
 - c. What are the total life-cycle profits now projected for the new product?

- d. Describe the three general approaches that Nico can take to reduce the projected cost to this new target. Of the three approaches, which is likely to produce the most reduction?
3. Suppose that the engineering department has two new designs: Design A and Design B. Both designs eliminate the two nonvalued features. Both designs also reduce production and logistics costs by an *additional* \$8 per unit. Design A, however, leaves post-purchase costs at \$10 per unit, while Design B reduces post-purchase costs to \$4 per unit. Developing and testing Design A costs an additional \$150,000, while Design B costs an additional \$300,000. Calculate the total life-cycle profits under each design. Which would you choose? Explain. What if the design you chose cost an additional \$500,000 instead of \$150,000 or \$300,000? Would this have changed your decision?
4. Refer to Requirement 3. For every extra dollar spent on preproduction activities, how much benefit was generated? What does this say about the importance of knowing the linkages between preproduction activities and later activities?

11-20 LIFE-CYCLE COST MANAGEMENT

LO3 Jolene Askew, manager of Feagan Company, has committed her company to a strategically sound cost reduction program. Emphasizing life-cycle cost management is a major part of this effort. Jolene is convinced that production costs can be reduced by paying more attention to the relationships between design and manufacturing. Design engineers need to know what causes manufacturing costs. She instructed her controller to develop a manufacturing cost formula for a newly proposed product. Marketing had already projected sales of 25,000 units for the new product. (The life cycle was estimated to be 18 months. The company expected to have 50 percent of the market and priced their product to achieve this goal.) The projected selling price was \$20 per unit. The following cost formula was developed:

$$Y = \$200,000 + \$10X_1$$

where

X_1 = Machine hours (The product is expected to use one machine hour for every unit produced.)

Upon seeing the cost formula, Jolene quickly calculated the projected gross profit to be \$50,000. This produced a gross profit of \$2 per unit, well below the targeted gross profit of \$4 per unit. Jolene then sent a memo to the engineering department, instructing them to search for a new design that would lower the costs of production by at least \$50,000 so that the target profit could be met.

Within two days, the engineering department proposed a new design that would reduce unit-variable cost from \$10 per machine hour to \$8 per machine hour (Design Z). The chief engineer, upon reviewing the design, questioned the validity of the controller's cost formula. He suggested a more careful assessment of the proposed design's effect on activities other than machining. Based on this suggestion, the following revised cost formula was developed. This cost formula reflected the cost relationships of the most recent design (Design Z).

$$Y = \$140,000 + \$8X_1 + \$5,000X_2 + \$2,000X_3$$

where

X_1 = Units sold

X_2 = Number of batches

X_3 = Number of engineering change orders

Based on scheduling and inventory considerations, the product would be produced in batches of 1,000; thus, 25 batches would be needed over the product's life cycle.

Furthermore, based on past experience, the product would likely generate about 20 engineering change orders.

This new insight into the linkage of the product with its underlying activities led to a different design (Design W). This second design also lowered the unit-level cost by \$2 per unit but decreased the number of design support requirements from 20 orders to 10 orders. Attention was also given to the setup activity, and the design engineer assigned to the product created a design that reduced setup time and lowered variable setup costs from \$5,000 to \$3,000 per setup. Furthermore, Design W also creates excess activity capacity for the setup activity, and resource spending for setup activity capacity can be decreased by \$40,000, reducing the fixed cost component in the equation by this amount.

Design W was recommended and accepted. As prototypes of the design were tested, an additional benefit emerged. Based on test results, the post-purchase costs dropped from an estimated \$0.70 per unit sold to \$0.40 per unit sold. Using this information, the marketing department revised the projected market share upward from 50 percent to 60 percent (with no price decrease).

Required:

1. Calculate the expected gross profit per unit for Design Z using the controller's original cost formula. According to this outcome, does Design Z reach the targeted unit profit? Repeat, using the engineer's revised cost formula. Explain why Design Z failed to meet the targeted profit. What does this say about the use of functional-based costing for life-cycle cost management?
2. Calculate the expected profit per unit using Design W. Comment on the value of activity information for life-cycle cost management.
3. The benefit of the post-purchase cost reduction of Design W was discovered in testing. What direct benefit did it create for Feagan Company (in dollars)? Reducing post-purchase costs was not a specific design objective. Should it have been? Are there any other design objectives that should have been considered?

11-21 JIT, TRACEABILITY OF COSTS, PRODUCT COSTING ACCURACY, JIT EFFECTS ON COST ACCOUNTING SYSTEMS

LO4, LO5 Homer Manufacturing produces different models of 22-calibre rifles. The manufacturing costs assigned to its economy model rifle before and after installing JIT are given in the following table. Cell workers do all maintenance and are also responsible for moving materials, cell janitorial work, and inspecting products. Janitorial work outside the cells is still handled by the janitorial department.

In both the pre- and post-JIT setting, 10,000 units of the economy model are manufactured. In the JIT setting, manufacturing cells are used to produce each product. The management of Homer Manufacturing reported a significant decrease in manufacturing costs for all of its rifles after JIT was installed. It also reported less inventory-related costs and a significant decrease in lead times. Accounting costs also decreased because Homer switched from a job-order costing system to a process-costing system.

	<i>Before</i>	<i>After</i>
Direct materials	\$ 60,000	\$ 55,000
Direct labor	40,000	50,000
Maintenance	50,000	30,000
Inspection	30,000	10,000
Rework	60,000	9,000
Power	10,000	6,000

(continued)

	<i>Before</i>	<i>After</i>
Depreciation	12,500	10,000
Materials handling	8,000	2,000
Engineering	80,000	50,000*
Setups	15,000	0
Janitorial	40,000	20,000
Building and grounds	11,800	12,400
Supplies	4,000	3,000
Supervision (plant)	10,000	8,000
Cell supervision	—	35,000
Cost accounting	40,000	25,000
Departmental supervision	18,000	—
Total	<u>\$489,300</u>	<u>\$325,400</u>

*Salary of engineer assigned to the cell.

Required:

1. Compute the unit cost of the product before and after JIT.
2. Explain why the JIT unit cost is more accurate. Also explain what JIT features may have produced a decrease in production costs. Use as many specific cost items as possible to illustrate your explanation.
3. Explain why Homer Manufacturing switched from a job-order costing system to a process-costing system after JIT was implemented.
4. Classify the costs in the JIT environment according to how they are assigned to the cell: direct tracing, driver tracing, or allocation. Which cost assignment method is most common? What does this imply regarding product costing accuracy?

11-22 JIT AND PRODUCT COSTING

LO4, LO5



Mott Company recently implemented a JIT manufacturing system. After one year of operation, Heidi Burrows, president of the company, wanted to compare product cost under the JIT system with product cost under the old system. Mott's two products are weed eaters and lawn edgers. The unit prime costs under the old system are as follows:

	<i>Eaters</i>	<i>Edgers</i>
Direct materials	\$12	\$45
Direct labor	4	30

Under the old manufacturing system, the company operated three service centers and two production departments. Overhead was applied using departmental overhead rates. The direct overhead costs associated with each department for the year preceding the installation of JIT are as follows:

Maintenance	\$110,000
Materials handling	90,000
Building and grounds	150,000
Machining	280,000
Assembly	<u>175,000</u>
Total	<u>\$805,000</u>

Under the old system, the overhead costs of the service departments were allocated directly to the producing departments and then to the products passing through them. (Both products passed through each producing department.) The overhead rate for the

machining department was based on machine hours, and the overhead rate for assembly was based on direct labor hours. During the last year of operations for the old system, the machining department used 80,000 machine hours, and the assembly department used 20,000 direct labor hours. Each weed eater required one machine hour in machining and 0.25 direct labor hour in assembly. Each lawn edger required two machine hours in machining and 0.5 hour in assembly. Bases for allocation of the service costs are as follows:

	<i>Machine Hours</i>	<i>Number of Material Moves</i>	<i>Square Feet of Space</i>
Machining	80,000	90,000	80,000
Assembly	<u>20,000</u>	<u>60,000</u>	<u>40,000</u>
Total	<u>100,000</u>	<u>150,000</u>	<u>120,000</u>

Upon implementing JIT, a manufacturing cell for each product was created to replace the departmental structure. Each cell occupied 40,000 square feet. Maintenance and materials handling were both decentralized to the cell level. Essentially, cell workers were trained to operate the machines in each cell, assemble the components, maintain the machines, and move the partially completed units from one point to the next within the cell. During the first year of the JIT system, the company produced and sold 20,000 weed eaters and 30,000 lawn edgers. This output was identical to that for the last year of operations under the old system. The following costs have been assigned to the manufacturing cells:

	<i>Eater Cell</i>	<i>Edger Cell</i>
Direct materials	\$185,000	\$1,140,000
Direct labor	66,000	660,000
Direct overhead	99,000	350,500
Allocated overhead*	<u>75,000</u>	<u>75,000</u>
Total	<u>\$425,000</u>	<u>\$2,225,500</u>

*Building and grounds are allocated on the basis of square footage.

Required:

1. Compute the unit cost for each product under the old manufacturing system.
2. Compute the unit cost for each product under the JIT system.
3. Which of the unit costs is more accurate? Explain. Include in your explanation a discussion of how the computational approaches differ.
4. Calculate the decrease in overhead costs under JIT, and provide some possible reasons that explain the decrease.

11-23 BACKFLUSH COSTING, CONVERSION RATE

LO4, LO5

Morgan Company has implemented a JIT flexible manufacturing system. Michael Anderson, controller of the company, has decided to reduce the accounting requirements given the expectation of lower inventories. For one thing, he has decided to treat direct labor cost as a part of overhead and to discontinue the detailed direct labor accounting of the past. The company has created two manufacturing cells, each capable of producing a family of products: the Small engine cell and the battery cell. The output of both cells is sold to a sister division and to customers who use the batteries and engines for repair activity. Product-level overhead costs outside the cells are assigned to each cell using appropriate drivers. Facility-level costs are allocated to each cell on the basis of square footage. The budgeted direct labor and overhead costs are as follows:

	<i>Engine Cell</i>	<i>Battery Cell</i>
Direct labor costs	\$ 180,000	\$ 90,000
Direct overhead	720,000	360,000
Product sustaining	270,000	108,000
Facility level	<u>180,000</u>	<u>90,000</u>
Total conversion cost	<u>\$1,350,000</u>	<u>\$648,000</u>

The predetermined conversion cost rate is based on available production hours in each cell. The engine cell has 45,000 hours available for production, and the battery cell has 27,000 hours. Conversion costs are applied to the units produced by multiplying the conversion rate by the actual time required to produce the units. The engine cell produced 81,000 units, taking 0.5 hour to produce one unit of product (on average). The battery cell produced 90,000 units, taking 0.25 hour to produce one unit of product (on average).

Other actual results for the year are as follows:

Direct materials purchased and issued	\$1,530,000
Direct labor costs	270,000
Overhead	1,890,000

All units produced were sold. Any conversion cost variance is closed to Cost of Goods Sold.

Required:

1. Calculate the predetermined conversion cost rates for each cell.
2. Prepare journal entries using backflush accounting. Assume two trigger points, with completion of goods as the second trigger point.
3. Repeat Requirement 2, assuming that the second trigger point is the sale of the goods.
4. Explain why there is no need to have a work-in-process inventory account.
5. Two variants of backflush costing were presented in which each used two trigger points, with the second trigger point differing. Suppose that the only trigger point for recognizing manufacturing costs occurs when the goods are sold. How would the entries be listed here? When would this backflush variant be considered appropriate?

11-24 JIT, CREATION OF MANUFACTURING CELLS, BEHAVIORAL CONSIDERATIONS, IMPACT ON COSTING PRACTICES

LO4, LO5 Reddy Heaters, Inc., produces insert heaters that can be used for various applications, ranging from coffeepots to submarines. Because of the wide variety of insert heaters produced, Reddy uses a job-order costing system. Product lines are differentiated by the size of the heater. In the early stages of the company's history, sales were strong and profits steadily increased. In recent years, however, profits have been declining, and the company has been losing market share. Alarmed by the deteriorating financial position of the company, President Doug Young requested a special study to identify the problems. Sheri Butler, the head of the internal audit department, was put in charge of the study. After two months of investigation, Sheri was ready to report her findings.

SHERI: Doug, I think we have some real concerns that need to be addressed. Production is down, employee morale is low, and the number of defective units that we have to scrap is way up. In fact, over the past several years, our scrap rate has increased from 9 percent to 15 percent of total production. And scrap is expensive. We don't detect defective units until the end of the process. By that time, we lose everything. The nature of the product simply doesn't permit rework.

DOUG: I have a feeling that the increased scrap rate is related to the morale problem you've encountered. Do you have any feel for why morale is low?

SHERI: I get the feeling that boredom is a factor. Many employees don't feel challenged by their work. Also, with the decline in performance, they are receiving more pressure from their supervisors, which simply aggravates the problem.

DOUG: What other problems have you detected?

SHERI: Well, much of our market share has been lost to foreign competitors. The time it takes us to process an order, from time of receipt to delivery, has increased from 20 to 30 days. Some of the customers we have lost have switched to Japanese suppliers, from whom they receive heaters in less than 15 days. Added to this delay in our delivery is an increase in the number of complaints about poorly performing heaters. Our quality has definitely taken a nosedive over the past several years.

DOUG: It's amazing that it has taken us this long to spot these problems. It's incredible to me that the Japanese can deliver a part faster than we can, even in our more efficient days. I wonder what their secret is.

SHERI: I investigated that very issue. It appears that they can produce and deliver their heaters rapidly because they use a JIT purchasing and manufacturing system.

DOUG: Can we use this system to increase our competitive ability?

SHERI: I think so, but we'll need to hire a consultant to tell us how to do it. Also, it might be a good idea to try it out on only one of our major product lines. I suggest the small heater line. It is having the most problems and has been showing a loss for the past two years. If JIT can restore this line to a competitive mode, then it'll work for the other lines as well.

Within a week, Reddy Heaters hired the services of a large CPA firm. The firm sent Kim Burnham, one of its managers, to do the initial background work. After spending some time at the plant, Kim wrote up the following description of the small heater production process:

The various departments are scattered throughout the factory. Labor is specialized and trained to operate the machines in the respective departments. Additionally, the company has a centralized stores area that provides the raw materials for production, a centralized maintenance department that has responsibility for maintaining all production equipment, and a group of laborers responsible for moving the partially completed units from department to department.

Under the current method of production, small heaters pass through several departments, where each department has a collection of similar machines. The first department cuts a metal pipe into one of three lengths: three, four, or five inches long. The cut pipe is then taken to the laser department, where the part number is printed on the pipe. In a second department, ceramic cylinders—cut to smaller lengths than the pipe—are wrapped with a fine wire (using a wrapping machine). The pipe and the wrapped ceramic cylinders are then taken to the welding department, where the wrapped ceramic cylinders are placed inside the pipe, centered, and filled with a substance that prevents electricity from reaching the metal pipe. Finally, the ends of the pipe are welded shut with two wire leads protruding from one end. This completed heater is then transferred to the testing department, which uses special equipment to see if the heater functions properly.

The small heaters are produced in batches of 300. It takes 50 hours to cut 300 metal pipes and prepare 300 ceramic cylinders (1/6 hr. per unit, both processes occurring at the same time). After 50 hours of production time, the 300 metal pipes are transported to the laser department (20 minutes transport time), and the 300 ceramic cylinders are transported to the welding department (20 minutes trans-

port time). In the laser department, it takes 50 hours to imprint the part number (1/6 hr. per pipe). The 300 metal pipes are then transported to the welding department. In the welding department, the ceramic and metal pipes are joined and welded. The welding process takes 50 hours (1/6 hr. per pipe). Finally, the 300 units are transported (20 minutes) to the testing department. Each unit requires 1/6 hour for testing, or a total of 50 hours for the 300 units. From start to finish, the total production time for the 300 units is as follows:

Cutting and ceramic	50 hrs.
Laser	50
Welding	50
Testing	50
Moving	<u>1</u>
Total time	<u>201 hrs.</u>

Notice that laser must wait 50 hours before it can begin imprinting. Similarly, welding must wait 100 hours before it can begin working on the batch, and finally, testing must wait 150 hours before it can begin working on the batch.

Based on the information gathered, Kim estimated that the production time for 300 units could be cut from 201 hours to about 50 hours by creating a small heater manufacturing cell.

Required:

1. One of the first actions taken by Reddy Heaters was to organize a manufacturing cell for the small heater line. Describe how you would organize the manufacturing cell. How does it differ from the traditional arrangement? Will any training costs be associated with the transition to JIT? Explain.
2. Explain, with computational support, how the production time for 300 units can be reduced to about 50 hours. If this is a true reduction in production time, what implications does it have for Reddy's competitive position?
3. Describe the organizational and operational activities that must be managed to bring about the reduction in production time. What are the cost drivers associated with these activities? For operational drivers, indicate the expected effect on activity costs.
4. Initially, the employees resented the change to JIT. After a small period of time, however, morale improved significantly. Explain why the change to JIT increased employee morale.
5. Within a few months, Reddy was able to offer a lower price for its small heaters. Additionally, the number of complaints about the performance of the small heaters declined sharply. By the end of the second year, the product line was reporting profits greater than had ever been achieved. Discuss the JIT features that may have made the lower price and higher profits possible.
6. Within a year of the JIT installation, Reddy's controller remarked, "We have a much better idea than ever before of what it is costing us to produce these small insert heaters." Offer some justification for the controller's statement.
7. Discuss the impact that JIT has on other management accounting practices.

11-25 COLLABORATIVE LEARNING EXERCISE

Don Homer, cost accounting manager for Tibbings, Inc., was having dinner with Spencer Gee, a friend since college days. The two had attended the same university and belonged to the same fraternity. Upon graduation, they had taken positions with two competitors whose headquarters were located in the same city. Two years ago, the top

management of Tibbings had implemented a life-cycle cost management program. Since then, Don had worked closely with design engineering, providing information about activities and their costs. He, in turn, became very well informed about the new product development projects. Spencer was also an accountant and had recently been promoted to assistant controller. Eventually, the conversation turned to work topics.

SPENCER: How are things going at work?

DON: Very well. Our new life-cycle cost management approach has made a real difference in our profitability. The latest two products have each earned significantly more than in the past.

SPENCER: Interesting. How many new products are coming out this year?

DON: We have three new ones coming out—two of which should provide some significant challenges for your company.

SPENCER: The last two certainly did. Our competing products earned 30 percent less profit—all because of yours. I don't know how you did it, but the customers seemed to like yours better.

DON: We gathered information on the cost of maintaining and using the products and then made a real effort to design the new products so that they reduced these costs. We also looked at design so that production costs were lowered. This way, we could sell the products for less and still make the same per-unit profit. It worked. Our total profits went up by about \$40,000 on each product.

SPENCER: What about these three new ones? Are they coming out soon? Are you planning on selling them for less than you usually do as well?

DON: As I understand it, they should all be on the market within two weeks. And yes, we will sell for less than normal. They cost less. Linking design to downstream activities has been a real benefit.

SPENCER: Well, maybe we need to do something similar. Our competing products will probably come out later than yours as well. That's not good for us. Oh well. Let's talk about something more pleasant. We get enough of work during the week.

Required:

Read the ethical problem, and decide on your evaluation of the ethical conduct of Don and Spencer. (This can be done as a homework assignment or as an in-class assignment.) Form groups of three or four students. Each group member should write on a slip of paper the word TALK. This piece of paper is the Talking Chip. The Talking Chip is the ticket that allows a group member to speak. Group discussion begins with a volunteer. After making his/her contribution, this person places the Talking Chip down in full view of the other members. Another person of the group then contributes and subsequently places the Talking Chip down in full view. This continues until all members have contributed. Once all members have contributed, the talking chips can be retrieved, and a second round of discussion can begin.

11-26 CYBER RESEARCH CASE

LO2 Supply chain management can be a major source of cost savings for manufacturing and service firms. A firm can reduce its costs by understanding the linkages it has with its suppliers and customers. A major factor in assessing and understanding these linkages is the measurement of costs across the supply chain. Activity-based costing is now assuming a major role in this measurement requirement. The role of ABC in supply chain management needs to be explored carefully.

Required:

Using Internet resources, answer the following questions. (In addition to a general search, you might try <http://www.bettermanagement.com>, and check out its library resources.)

1. What is supply chain management?
2. Why has supply chain management become such an important topic?
3. Are businesses actually measuring and using supply chain costs?
4. Why is ABC considered important in supply chain management?