# Learning Goals

Outline the importance of production and operations management. Explain the roles of computers and related technologies in production. 2 Identify the factors involved in a 3 plant Íocation decision. Explain the major tasks of produc-4 tion and operations managers. Compare alternative layouts for 5 production facilities. List the steps in the purchasing 6 process. Outline the advantages and disad-7 vantages of maintaining large inventories. Identify the steps in the production 8 control process. Explain the benefits of quality 9 control.

Production and operations Nanagement

PHOTODISC

egardless of where you live, you'll remember the names—Katrina and Rita. They were two of the largest and most devastating hurricanes to ever hit U.S. shores. Lives, homes, and businesses were lost in their floods and high winds.

Offshore in the Gulf of Mexico, the storms pounded oil and natural-gas drilling rigs and platforms, destroying or severely damaging more than 100 of them. Chevron's giant Typhoon platform actually capsized and drifted 70 miles. Two of Global Santa Fe's drilling rigs were found lying in shallow coastal waters, about 80 miles from their original location. About 99 percent of the gulf's daily oil production and 80 percent of its natural-gas production were knocked out during a time when demand was

already extremely high. "The impact on the rigs is something that's never been seen by this country before," said

Will it be more expensive? Yes. Will the end product cost more? You bet," warned Al Reese Jr., CFO of ATP Oil &

Hurricanes and the U.S. Fuel Industry

Daniel Naatz, director of federal resources for the Independent Petroleum Association of America. On land, damaged refineries lost production of about 1.7 million barrels a day of refined products.

Within days, it became apparent that a lack of workers, helicopters, and equipment would deter efforts to evaluate the damage to oil and natural-gas facilities offshore in the gulf, and a timeline for restarting production was nonexistent. "A lot of dock facilities that boats would leave from are gone. [Air transportation] hangars are messed up. Helicopter availability is tight," said Tony Lentini, a spokesperson for oil exploration company Apache. The longer it took to assess the situation, make repairs, and begin producing again, the higher the prices would rise. "Will it be more difficult to drill? Yes. Gas. In addition to lack of workers and equipment, widespread power outages made start-up of the refineries along the coast impossible.

The federal government predicted that average heating-oil and natural-gas bills could climb 50 percent higher than they had the year before. "We think consumers need to know this now so they can take steps to do something about it," noted David Garman, undersecretary of energy. Meanwhile, some experts observed that worldwide demand for oil has grown faster than supply in recent years, thanks in part to developing economies such as China's and consumers' devotion to large cars and trucks. With one-third of the nation's refining capacity located in the Gulf Coast region, all sights are set on finding every drop of liquid gold in the gulf.<sup>1</sup> By producing and marketing desired goods and services, businesses satisfy their commitment to society as a whole. They create what economists call *utility*—the want-satisfying power of a good or service. Businesses can create or enhance four basic kinds of utility: time, place, ownership, and form. A firm's marketing operation generates time, place, and ownership utility by offering goods and services to customers when they want to buy at convenient locations where ownership of the products can be transferred.

Production, by contrast, creates form utility by converting raw materials and other inputs into finished products, as the oil companies described in the opening vignette do. **Production** applies resources such as people and machinery to convert materials into finished goods and services. The task of **production and operations management** is to oversee the application of people and machinery in converting materials into finished goods and services. Figure 11.1 illustrates the production process.

People sometimes use the terms *production* and *man-ufacturing* interchangeably, but doing so ignores an important difference. Production is a broader term that spans both manufacturing and nonmanufacturing industries. For instance, companies in extractive industries

production application of resources such as people and machinery to convert materials into finished goods and services.

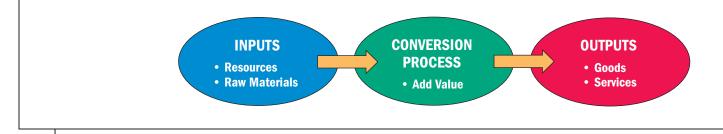
#### production and operations management managing people and machinery in converting materials and resources into finished goods and services.

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11.

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#### The Production Process: Converting Inputs to Outputs



346 Part 3 Management: Empowering People to Achieve Business Objectives

such as fishing, lumber, and mining engage in production, and so do service providers. Services are intangible outputs of production systems. They include outputs as diverse as trash hauling, education, haircuts, tax accounting, dental care, mail delivery, transportation, and lodging. Figure 11.2 lists five examples of production systems for a variety of goods and services.

But whether the production process results in a tangible good or an intangible service, it always converts inputs into outputs. This conversion process may make major changes in raw materials or simply combine already finished parts into new products. A cabinetmaker combines wood, tools, and skill to create finished kitchen cabinets for a new home. A transit system combines buses, trains, and employees to create its output: passenger transportation. Both of these production processes create utility.

This chapter describes the process of producing goods and services. It looks at the importance of production and operations management and discusses the new technologies that are transforming the production function. It then discusses the tasks of the production and operations manager, the importance of quality, and the methods businesses use to ensure high quality.

#### **Typical Production Systems**

Example	Primary Inputs	Transformation	Outputs
Computer Factory	Hard drives, computer memory, computer chips, keyboards, cases, power supply, DVD drives, central circuit board, boards for network and Internet access and graphics, monitors, and sofware	Assembles compon- ents to meet customer orders, including specialized orders for hardware and software	Desktop or laptop computers
Trucking Firm	Trucks, personnel, buildings, fuel, goods to be shipped, packaging supplies, truck parts, utilities	Packages and transports goods from sources to destinations	Delivered goods
Department Store	Buildings, displays, scanners, merchandise, personnel, supplies, utilities	Attracts customers, stores goods, sells products	Merchandise sold
Automobile Body Shop	Damaged autos, paints, supplies, machines, tools, buildings, personnel, utilities	Transforms damaged auto bodies into facsimiles of the originals	Repaired automobile bodies
County Sheriff's Department	Personnel, police equipment, automobiles, office furniture, buildings, utilities	Detects crimes and brings criminals to justice	Lower crime rates and peaceful communities

## STRATEGIC IMPORTANCE OF THE PRODUCTION FUNCTION

Along with marketing and finance, production is a vital business activity. Without a good or service to sell, companies cannot generate money to pay their employees, lenders, and stock-holders. And without the profits from products, firms quickly fail. The production process is just as crucial in nonprofit organizations, such as the Mayo Clinic and Goodwill Industries, because the goods or services they offer justify their existence. Effective production and operations management can lower a firm's costs of production, boost the quality of its goods and services, allow it to respond dependably to customer demands, and enable it to renew itself by providing new products. Let's look at the differences between mass, flexible, and customerdriven production.

## "They Said It"

"We should insist on excellence in our plumbers as much as in our philosophers, because unless we do, neither our water pipes nor our theories will hold water." —John W. Gardner (1912–2002) American writer and public official

#### Chapter 11 Production and Operations Management



Workers on an automobile assembly line use specialization of labor tasks for maximum efficiency.

#### **Mass Production**

From its beginnings as a colonial supplier of raw materials to Europe, the United States evolved into an industrial giant. Much of this remarkable change resulted from **mass production**, a system for manufacturing products in large amounts through effective combinations of employees with specialized skills, mechanization, and standardization. Mass production makes outputs available in large quantities at lower prices than individually crafted items would cost.

Mass production begins with specialization of labor, dividing work into its simplest components so that each worker can concentrate on performing one task. Secondly, by separating jobs into small tasks, managers create conditions for high productivity through mechaniza-

tion, in which machines perform much of the work previously done by people. Standardization, the third element of mass production, involves producing uniform, interchangeable goods and parts. Standardized parts simplify the replacement of defective or wornout components. For instance, if your car's windshield wiper blades wear out, you can easily buy replacements at a local auto parts store such as AutoZone.

A logical extension of these principles of specialization, mechanization, and standardization led to development of the **assembly line.** This manufacturing technique moves the product along a conveyor belt past a number of workstations, where workers perform specialized tasks such as welding, painting, installing individual parts, and tightening bolts. Henry Ford's application of this concept revolutionized auto assembly. Before the assembly line, it took Ford's workers 12 hours to assemble a Model T car. But with an assembly line, it took just 1.5 hours to make the same car. Not surprisingly, dozens of other industries soon adopted the assembly line technique.

Although mass production has important advantages, it has limitations, too. While mass production is highly efficient for producing large numbers of similar products, it is highly inefficient when producing small batches of different items. This trade-off tempts some companies to focus on efficient production methods rather than on making what customers really want. In addition, the labor specialization associated with mass production can lead to boring jobs, because workers keep repeating the same task. To improve their competitive capabilities, many firms adopt flexible production and customer-driven production systems. These techniques may not replace mass production altogether but may simply improve a company's use of mass production.

#### **Flexible Production**

While mass production efficiently creates large batches of similar items, flexible production can cost-effectively produce smaller batches. Flexible production can take many forms, but it generally involves using information technology to share the details of customer orders, programmable equipment to fulfill the orders, and skilled people to carry out whatever tasks are needed to fill a particular order. This arrangement is useful when combined with lean production methods that use automation and information technology to reduce requirements for workers and inventory. Flexible production also requires a high degree of communication and cooperation among customers and employees throughout the organization.

DaimlerChrysler is switching its U.S. auto plants from mass to flexible production. This change will allow it to move from producing one type of car at each automobile plant to being

assembly line manufacturing technique that carries the product on a conveyor system past several workstations where workers perform specialized tasks.

able to produce three kinds of cars at each plant. Because a typical auto plant can make 200,000 to 240,000 cars a year, auto plants lose money if the sales of the one car they make fall below those levels. For instance, in its first year, the new Dodge Charger sold an average of 7,000 cars a month, or just 84,000 for the year, almost two-thirds fewer cars than the capability of a typical DaimlerChrysler auto plant. However, by using flexible production to make the Dodge Charger, the Chrysler 300, and the Dodge Magnum at the same auto plant, Daimler-Chrysler can continue to sell these small-market cars and make money at that production facility, which is now used to its full capacity.<sup>2</sup>

#### **Customer-Driven Production**

A customer-driven production system evaluates customer demands to link what a manufacturer makes



NikelD shoes are manufactured to customer specifications. Customers can either visit the NikeID Web site to order their shoes electronically or go to a nearby Nike ID lab store. Approximately three weeks later, a unique pair of shoes arrives.

with what customers want to buy. Many firms have implemented this approach with great success. One method is to establish computer links between factories and retailers' scanners, using data about sales as the basis for creating short-term forecasts and designing production schedules to meet those forecasts.

Another approach to customer-driven production systems is simply not to make the product until a customer orders it. For example, a new computer is produced every five seconds at Dell's new Winston-Salem, North Carolina, manufacturing plant, which uses one of the most advanced customer-driven production operations in the computer business. But every one of those different computers-Dell makes each one to customer orders-has already been purchased. Ray Archer, Dell's vice president of Americas manufacturing, said, "If we don't have an order, we don't have a customer."<sup>3</sup> Because Dell doesn't order parts from suppliers until machines are purchased, its computers always have the latest, most advanced components. And because the prices of computer components tend to fall, Dell can immediately pass those lower prices on to its customers, too.

### PRODUCTION PROCESSES

Not surprisingly, the production processes and time required to make an Apple iPod and a gallon of gasoline are different. Production processes use either an analytic or synthetic system, and time requirements call for either a continuous or an intermittent process.

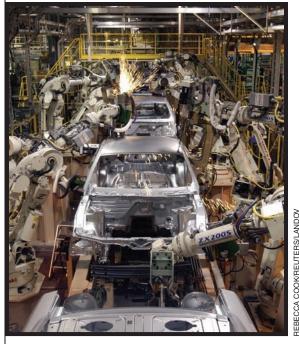
An analytic production system reduces a raw material to its component parts in order to extract one or more marketable products. For example, petroleum refining breaks down crude oil into several marketable products, including gasoline, heating oil, and aviation fuel. When corn is processed further, the resulting marketable products include animal feed and corn sweetener.

By contrast, a synthetic production system is the reverse of an analytic system. It combines a number of raw materials or parts or transforms raw materials to produce finished products. Dell's assembly line produces personal computers by assembling the various components ordered by each customer. Ford's assembly line uses a variety of metal, plastic, and rubber

#### assessment check

- 1. What are the advantages and disadvantages of mass 2. What are the characteristics of flexi-

  - 3. Describe a customer-driven produc-
  - tion system.



Synthetic production systems assemble raw materials and other components into finished products, such as these Ford Mustangs being welded in Flat Rock, Michigan.

components to produce cars and trucks. Other synthetic production systems make drugs, chemicals, computer chips, and canned soup.

A *continuous production process* generates finished products over a lengthy period of time. The steel industry provides a classic example. Its blast furnaces never completely shut down except for malfunctions. Petroleum refineries, chemical plants, and nuclear power facilities also practice continuous production. A shutdown can damage sensitive equipment, with extremely costly results.

An *intermittent production process* generates products in short production runs, shutting down machines frequently or changing their configurations to produce different products. Most services result from intermittent production systems. For instance, accountants, plumbers, and dentists traditionally have not attempted to standardize their services because each service provider confronts different problems that require individual approaches. However, some companies, including Jiffy Lube (auto service) and Terminix (pest control services), offer standardized services as part of a strategy to operate more efficiently and compete with lower prices. In contrast, McDonald's has moved toward a more intermittent production model. The fast-food chain invested millions in new cooking equipment to set up kitchens for preparing sandwiches quickly to order, rather than producing large batches ahead of time and then keeping them warm under heat lamps.

## TECHNOLOGY AND THE PRODUCTION PROCESS

Like other business functions, production has changed dramatically as computers and related technologies have developed. For example, in manufacturing, a "lights out" factory is completely automated. In other words, because of computers, software, robots, and other kinds of integrated technology systems, no workers are needed to make what a "lights out" factory produces. You could literally turn all the lights off, and the factory would keep producing finished products. IBM has a "lights out" factory in East Fishkill, New York, at its most advanced computer chip fabrication (fab) plant. Perry Hartswick, IBM's manager of semiconductor automation and integration, said, "We consider our fab's automation system architecture an example of a true business transformation. We had to take hundreds of very complex inputs, consider them in conjunction with hundreds of operational scenarios, and come up with an architecture that could run our fab in a fully automated mode."<sup>4</sup> Compared with IBM's other fab plants, IBM's fab plant in East Fishkill has 59 percent higher productivity.

In addition to boosting efficiency in the production process, automation and information technology allow firms to redesign their current methods to enhance flexibility. These changes allow a company to design and create new products faster, modify them more rapidly, and meet customers' changing needs more effectively than it could achieve with traditional methods. Important production technologies today include robots, computer-aided design and manufacturing, flexible manufacturing systems, and computer-integrated manufacturing.

**robot** reprogrammable machine capable of performing numerous tasks that require manipulation of materials and tools.

#### Robots

A growing number of manufacturers have freed people from boring, sometimes dangerous assignments by replacing them with robots. A **robot** is a reprogrammable machine capable of

performing a variety of jobs that require manipulation of materials and tools. Robots can repeat the same tasks many times without varying their movements. Many factories use robots today to "palletize" their products for shipping. This means stacking finished products on a wood, plastic, or steel pallet and then shrink-wrapping the items onto the pallet with plastic. Not only do robots lift pallets into place, they also use their gripping "hands" and lifting "arms" to put products into neat rows and layers for shipping. At Ohio-based JTM, a maker of industrial lubricants, a robot places 3,300 twenty-five-pound containers of finished product onto 70 pallets a day. Larry Wilson, JTM's director of operations, said, "In the old facility without the robot, I would have had to add two people to get up to this volume." In the past, said Wilson, "We had people picking up 1,800 or 1,900 pails a day. That's a long day."<sup>5</sup>

Initially, robots were most common in automotive and electronics manufacturing, but growing

numbers of industries, such as JTM's, are adding robots to production lines as improvements in technology make them less expensive and more useful. Firms operate many different types of robots. The simplest kind, a *pick-and-place robot*, moves in only two or three directions as it picks up something from one spot and places it in another. The robot, which "palletizes" Murphy's Oil Soap at JTM, is a pick-and-place robot. So-called *field robots* assist people in nonmanufacturing, often hazardous, environments such as nuclear power plants, the space station, and even battlefields. For instance, police use robots to remotely dispose of suspected bombs. However, the same technology can be used in factories. Using vision systems, infrared sensors, and bumpers on mobile platforms, robots can automatically move parts or finished goods from one place to another, while either following or avoiding people, whichever is necessary to do the job.

#### **Computer-Aided Design and Manufacturing**

A process called **computer-aided design (CAD)** enables engineers to design parts and buildings on computer screens faster and with fewer mistakes than they could achieve working with traditional drafting systems. Using an electronic pen, an engineer can sketch 3-D designs on an electronic drafting board or directly on the screen. The computer then provides tools to make major and minor design changes and to analyze the results for particular characteristics or problems. Engineers can put a new car design through a simulated road test to project its real-world performance. If they find a problem with weight distribution, for example, they can make the necessary changes virtually-without actually test-driving the car. In other words, with advanced CAD software, prototyping is as much "virtual" as it is "hands-on." Actual prototypes or parts aren't built until the engineers are satisfied that the required structural characteristics in their virtual designs have been met.

The process of computer-aided manufacturing (CAM) picks up where the CAD system leaves off. Computer tools enable a manufacturer to analyze the steps that a machine must take to produce a needed product or part. Electronic signals transmitted to processing equipment provide instructions for performing the appropriate production steps in the correct order. Both CAD and CAM technologies are now used together at most modern production facilities.

#### computer-aided design (CAD) system for

interactions between a designer and a computer to create a product, facility, or part that meets predetermined specifications.

#### computer-aided manufacturing (CAM) elec-

tronic tools to analyze CAD output and determine necessary steps to implement the design, followed by electronic transmission of instructions to guide the activities of production equipment.

To help reduce the effects of a shortage of physicians, some hospitals use field

robots to perform patient rounds. The doctor's face is visible on the robot's monitor, and patients can discuss their conditions directly with him or her in real time.

# HIT&MISS

#### Toyota and the Product Life Cycle

Every product goes through stages in its life cycle. A firm will probably make different choices about production in the beginning stages of a product's life than it would later on. Product life-cycle management (PLM) is an approach that companies use to make these decisions. Not surprisingly, enterprise software is available to help managers create, develop, produce, promote, and sell their products. PLM software provides a framework that companies can use to construct new ideas and convert them to tangible products quickly. "PLM is becoming the enabling tool for innovation," predicts Navi Radjou, a consultant with Forrester Research.

Toyota has embraced the concept of PLM, as well as the supporting software. Using PLM software, Toyota can ensure right from the beginning that the design of a new or updated vehicle is directly linked to manufacturing, supply chain, and beyond. Using software called Pro/ENGINEER, Toyota achieved improvements in the design cycle of its powertrains with PLM software that aided in 3-D engineering, analysis, manufacturing planning, and the creation of drawings. Toyota—which is already known for its innovative engineering and manufacturing—has become a true believer in PLM. Toyota president Fujio Cho predicts that PLM will be the mechanism by which the firm's production system is transformed into a digital manufacturing system.

With PLM, Toyota can design quality into a vehicle, build it well, and roll it off the line in record time. Because of its reputation for quality and engineering, Toyota can also command a higher price than some of its competitors can. By using product development software called Value Opportunity Six, Toyoya built and marketed such successes as the Lexus, the Sienna minivan, and the Highlander. The popularity of these models translates to actual dollars; the Lexus RX300 SUV commands a price that is \$17,000 above the average price of an SUV, while the Toyota 4-Runner pulls in \$9,000 above the average.

#### **Questions for Critical Thinking**

- 1. How might a firm such as Heinz or Nikon use PLM software to gain a competitive edge?
- 2. How would PLM software help ensure quality?

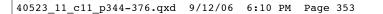
**Sources:** Gene Bylinsky, "Not Your Grandfather's Assembly Line," *Fortune*, accessed July 5, 2006, http://www.fortune .com; Kevin P. Hopkins, "Value Opportunity Six," *Business-Week*, accessed July 5, 2006, http://www.businessweek.com; "Better by Design," *The Economist*, accessed July 5, 2006, http://www.economist.com.

For more on CAD and CAM technologies, see the "Hit & Miss" feature, which explains how Toyota is using product life-cycle management software to develop, produce, promote, and sell its products.

#### Flexible Manufacturing Systems

A **flexible manufacturing system (FMS)** is a production facility that workers can quickly modify to manufacture different products. The typical system consists of computer-controlled machining centers to produce metal parts, robots to handle the parts, and remote-controlled carts to deliver materials. All components are linked by electronic controls that dictate activities at each stage of the manufacturing sequence, even automatically replacing broken or worn-out drill bits and other implements.

Flexible manufacturing systems have been enhanced by powerful new software that allows machine tools to be reprogrammed while they are running. This allows the same machine to make hundreds of different parts without the operator having to shut the machine down each time to load new programs for making different parts. The software also connects to the Internet to receive updates or to control machine tools at other sites. And because the software resides on a company's computer network, engineers can use it to diagnose production problems anytime, from anywhere they can access the network.



### **Computer-Integrated Manufacturing**

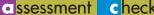
Companies integrate robots, CAD/CAM, FMS, computers, and other technologies to implement computer-integrated manufacturing (CIM), a production system in which computers help workers design products, control machines, handle materials, and control the production function in an integrated fashion. This type of manufacturing does not necessarily imply more automation and fewer people than other alternatives. It does, however, involve a new type of automation organized around the computer. The key to CIM is a centralized computer system running software that integrates and controls separate processes and functions. For example, VistaPrint, an international printing company with state-of-the-art printing factories in the Netherlands and Windsor, Ontario, uses proprietary CIM software to coordinate 300,000 separate printing jobs each month. Each day, VistaPrint gets 10,000 small printing orders from 20 different companies. VistaPrint's software automates the entire printing process from ordering to delivery. With so many small orders, it saves money as the software automatically combines similar small print jobs into one larger job. CIM software automates the product design used by customers, as well as all parts of the printing process; from prepress to plate changing to delivery, it controls the machines that assemble, package, sort, and ship printing orders.<sup>6</sup>

## THE LOCATION DECISION

The decision of where to locate a production facility hinges on transportation, human, and physical factors, as shown in Table 11.1. Transportation factors include proximity to markets and raw materials, along with availability of alternative modes for transporting both inputs and outputs. For instance, automobile assembly plants are located near major rail lines. Inputs—

Factors in the Location De	ecision
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Location Factor	Examples of Affected Businesses
Transportation	
Proximity to markets	Baking companies and manufacturers of other perishable products, dry cleaners, hotels, other services
Proximity to raw materials	Paper mills
Availability of transportation alternatives	Brick manufacturers, retail stores
Physical Factors	
Water supply	Computer chip fabrication plants
Energy	Aluminum, chemical, and fertilizer manufacturers
Hazardous wastes	All businesses
Human Factors	
Labor supply	Auto manufacturers, software developers
Local zoning regulations	Manufacturing and distribution companies
Community living conditions	All businesses

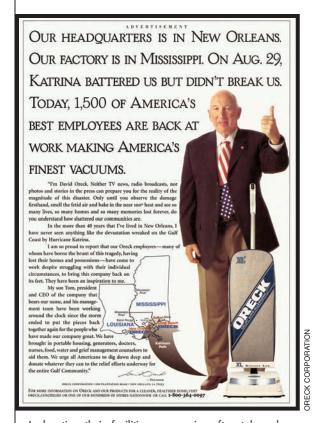


 List some of the reasons businesses invest in robots.
Distinguish among computer-aided design, computer-aided manufacturing, flexible manufacturing, and computer-integrated manufacturing.

Table

11.1

Chapter 11 Production and Operations Management 353



In locating their facilities, companies often take advantage of convenient transportation, such as a seaport or rail lines in New Orleans, to obtain raw materials or parts and ship finished products. But Oreck found that its employees were a distinct advantage after Hurricane Katrina hit. Despite their personal tragedies or difficulties, Oreck employees returned to their jobs to help the company get back on its feet within weeks.

such as engines, plastics, and metal parts-arrive by rail, and the finished vehicles are shipped out by rail. Shopping malls are often located adjacent to major streets and freeways in urban and suburban areas, because most customers arrive by car.

Physical variables involve such issues as weather, water supplies, available energy, and options for disposing of hazardous waste. Theme parks, such as Walt Disney World, are often located in warm climates so they can be open, and attract visitors, year-round. A firm that wants to locate near a community often must prepare an environmental impact study that analyzes how a proposed plant would affect the quality of life in the surrounding area. Regulatory agencies typically require these studies to cover topics such as the impact on transportation facilities; energy requirements; water and sewage treatment needs; natural plant life and wildlife; and water, air, and noise pollution.

Human factors include an area's labor supply, local regulations, and living conditions. Management considers local labor costs, as well as the availability of workers with needed qualifications. For instance, software makers and other computer-related firms concentrate in areas with the technical talent they need, including Silicon Valley in and around San Jose, California; Boston; and Austin, Texas. Likewise, Toyota built a new automobile assembly plant in Ontario, Canada, instead of Georgia because Ontario had more highly skilled workers.<sup>7</sup> By contrast, some labor-intensive industries have located plants in rural areas with readily available labor pools and limited high-wage alternatives. And some firms with headquarters in the United States and other industrialized countries have moved production offshore in search of low wages. Apparel is a classic example. But no matter what business you're in, studies show that labor productivity, the availability of skilled labor, and labor costs are the three most important factors in deciding where to locate a new office or facility.8

In the United States, this trend, coupled with automation, has shrunk manufacturing's share of the nation's gross domestic product. However, manufacturing continues to be an important

#### a ssessment check

- 1. What is the purpose of an environmental impact study, and how does it influence the location 2. What human factors are relevant to
  - the location decision?

segment of the U.S. economy, with total output greater than it ever has been. During the past ten years, U.S. manufacturing output grew much faster than the number of people employed by manufacturing companies, largely because of increases in productivity that allow fewer workers to produce more. However, many foreign companies locate facilities in the United States precisely because U.S. workers are extremely productive. Output per hour has risen steadily and is higher than most other industrialized nations.

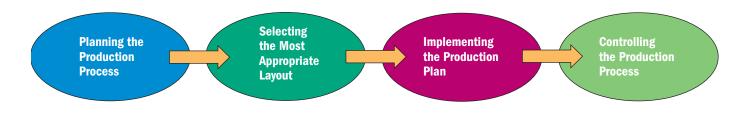
## THE JOB OF PRODUCTION MANAGERS

Production and operations managers oversee the work of people and machinery to convert inputs (materials and resources) into finished goods and services. As Figure 11.3 shows, these managers perform four major tasks. First, they plan the overall production process. Next, they determine the best layout for the firm's facilities. Then they implement the production plan. Finally, they control the manufacturing process to maintain the highest possible quality. Part



Tasks of Production Managers

#### PRODUCTION MANAGEMENT TASKS



of the control process involves continuous evaluation of results. If problems occur, managers return to the first step and make adjustments.

#### **Planning the Production Process**

Production planning begins by choosing what goods or services to offer to customers. This decision is the essence of every company's reason for operating. Other decisions such as machinery purchases, pricing decisions, and selection of retail outlets all grow out of product planning. But with product planning, it's not enough to plan products that satisfy customers. Products must satisfy customers *and* be produced as efficiently and inexpensively as possible.

So while marketing research studies determine consumer reactions to proposed products and estimate potential sales and profitability levels, production departments focus on planning the production process when they (1) convert original product ideas into final specifications and (2) design the most efficient facilities to produce those products.

Earlier in the chapter, you learned that DaimlerChrysler is switching from mass production, in which it makes one kind of car in each production facility, to flexible production, in which it makes three different cars in the same production facility. Toyota has been using flexible production in its North American auto plants for some time but still finds the complexity of making multiple cars in the same factory "daunting." At Toyota's Georgetown, Kentucky, plant, where it builds the Toyota Camry and Toyota Avalon, workers had just a few seconds to choose from 24 kinds of visors or 9 kinds of seat belts, depending on which version of the Camry or Avalon was coming down the assembly line. But after redesigning its production processes to reduce workers' choices, increase quality, and lower costs, Toyota has simplified its process by placing the right "parts kits" in each vehicle so that workers don't have to waste time deciding which parts to use.<sup>9</sup>

#### **Determining the Facility Layout**

Once managers have established the activities needed in their firm's production process, they can determine the best layout for the facility. This decision requires them to consider all phases of production and the necessary inputs at each step. Figure 11.4 shows three common layout designs: process, product, and fixed-position layouts. It also shows a customer-oriented layout typical of service providers' production systems.

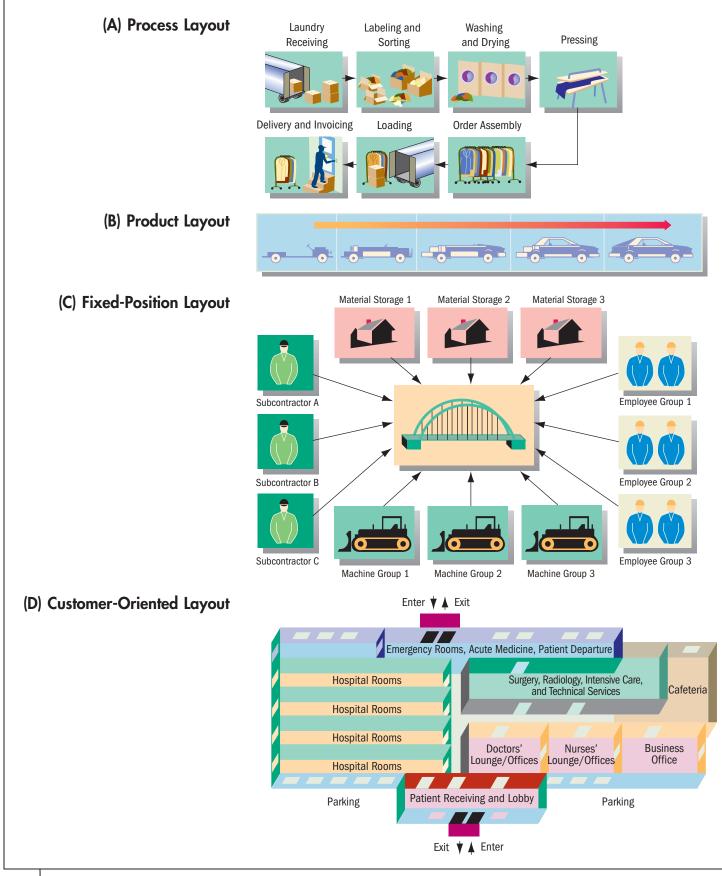
A process layout groups machinery and equipment according to their functions. The work in process moves around the plant to reach different workstations. A process layout often facilitates production of a variety of nonstandard items in relatively small batches. Honda also uses a version of a process layout to build its Civic. The company organizes into several workstations, or

#### assessment check

What is the key responsibility of production managers?
List the four major tasks of production and operations managers.



Figure



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"zones," grouping activities related to the interior, chassis, and wiring and tubing. At the end of each zone, workers perform an inspection before sending the car to the next zone. Nonstandard activities, such as preparing tanks for natural gas-powered vehicles, take place in a subassembly area.<sup>10</sup>

A product layout sets up production equipment along a product-flow line, and the work in process moves along this line past workstations. This type of layout efficiently produces large numbers of similar items, but it may prove inflexible and able to accommodate only a few product variations. Although product layouts date back at least to the Model T assembly line, companies are refining this approach with modern touches. In Saarlouis, Germany, the Ford Focus assembly plant uses a conveyor belt to move workers along the assembly line, rather than having them trudge from car to car. The resulting productivity increase allowed the company to trans-



Boeing's Everett, Washington, assembly line now tows huge planes along a track during assembly to make production more efficient.

fer workers from the assembly line to other jobs. Based on the success of this idea, Ford has since installed similar conveyor belts in other factories.<sup>11</sup>

A fixed-position layout places the product in one spot, and workers, materials, and equipment come to it. This approach suits production of very large, bulky, heavy, or fragile products. An example is building a bridge. Airplanes were also traditionally assembled using the fixed-position layout approach. Alan Mulally, head of Boeing's commercial aircraft division, said, "We always thought airplanes were different because they had four million parts. Well, airplanes aren't different. This is manufacturing."<sup>12</sup> So Boeing modified its Everett, Washington, production facility to be more like an automobile factory. Now giant jetliners move, although at the rate of one foot an hour, from workstation to workstation, as the aircraft is assembled. This approach saves both time and money. For instance, workers used to spend up to two hours per shift walking around the huge plant gathering tools, parts, and other materials.<sup>13</sup>

Service organizations also must decide on appropriate layouts for their production processes. A service firm should arrange its facilities to enhance the interactions between customers and its services—also called customer-oriented layout. If you think of patients as inputs, a hospital implements a form of the process layout. In other service organizations, direct contact with the recipient of services is a less significant part of production. For example, much of a law or accounting firm's work takes place away from clients. Access to colleagues and the Internet, as well as a quiet environment, is often vital for such processes.

#### Implementing the Production Plan

After planning the manufacturing process and determining the best layout, a firm's production managers begin to implement the production plan. This activity involves (1) deciding whether to make, buy, or lease components; (2) selecting the best suppliers for materials; and (3) controlling inventory to keep enough, but not too much, on hand.

**Make, Buy, or Lease Decision** One of the fundamental issues facing every producer is the make, buy, or lease decision-choosing whether to manufacture a needed product or component

#### **O**ssessment check

1. Differentiate between the three most common layout designs: process, product, and fixed-position. 2. Describe a customer-oriented layout that is typically used by service

providers.

in house, purchase it from an outside supplier, or lease it. This decision is critical in many contemporary business situations.

Several factors affect the make, buy, or lease decision, including the costs of leasing or purchasing parts from vendors compared with the costs of producing them in house. The decision sometimes hinges on the availability of outside suppliers that can dependably meet a firm's standards for quality and quantity. The need for confidentiality sometimes affects the decision, as does the short- or long-term duration of the firm's need for supplies.

Even when the firm decides to purchase from outside vendors, production managers should maintain access to multiple supply sources. An alternative supplier ensures that the firm can obtain needed materials despite strikes, quality-assurance problems, or other situations that may affect inputs. Of course, not everything can be outsourced. In particular, companies are advised not to outsource the core or central parts of their businesses. For example, Toyota, which produces the most reliable cars in the world, designs all of its autos and runs all of its manufacturing facilities. Following this general rule, it would be a mistake for Toyota to outsource the design and assembly of its cars. Using this same reasoning, would it be advisable for airlines to outsource their maintenance? See the "Solving an Ethical Controversy" feature for more on this issue.

**Selection of Suppliers** Once a company decides what inputs to purchase, it must choose the best vendors for its needs. To make this choice, production managers compare the quality, prices, dependability of delivery, and services offered by competing companies. Different suppliers may offer virtually identical quality levels and prices, so the final decision often rests on factors such as the firm's experience with each supplier, speed of delivery, warranties on purchases, and other services.

For a major purchase, negotiations between the purchaser and potential vendors may stretch over several weeks or even months, and the buying decision may rest with a number of colleagues who must say yes before the final decision is made. The choice of a supplier for an industrial drill press, for example, may require a joint decision by the production, engineering, purchasing, and quality-control departments. These departments often must reconcile their different views to settle on a purchasing decision.

The Internet has given buyers powerful tools for finding and comparing suppliers. Buyers can log on to business exchanges to compare specifications, prices, and availability. Ariba Spend Management, at <a href="http://freemarkets.com">http://freemarkets.com</a>, offers organizations software and other tools that allow them to source \$35 billion worth of goods and services from suppliers around the world.

Ariba Spend Management claims that it saves customers more than \$12 billion per year.<sup>14</sup>

#### assessment check

 What factors affect the make, buy, or lease decision?
What factors should firms consider when selecting vendors? Firms often purchase raw materials and component parts on long-term contracts. If a manufacturer requires a continuous supply of materials, a one-year or two-year contract with a vendor helps ensure availability. Today, many firms are building long-term relationships with suppliers and slashing the number of companies with which they do business. At the same time, they are asking their vendors to expand their roles in the production process.

**Inventory Control** Production and operations managers' responsibility for **inventory control** requires them to balance the need to keep stocks on hand to meet demand against the costs of carrying inventory. Among the expenses involved in storing inventory are warehousing costs, taxes, insurance, and maintenance. Firms waste money if they hold more inventory than they need. On the other hand, having too little inventory on hand means a shortage of raw materials, parts, or goods for sale that often leads to delays and unhappy customers. Firms lose business when they consistently miss promised delivery dates or turn away orders. There-

#### SHOULD AIRLINES OUTSOURCE THEIR MAINTENANCE?

#### Every firm makes certain decisions about which tasks it must fulfill itself and which can—or should—be purchased from an outside supplier.

This is true in the airline industry, in which airlines must decide whether they can best serve customers and monitor quality by performing their own maintenance on passenger jets or outsource the job to other companies that are maintenance specialists. But the ultimate question is which method benefits passengers and their safety the most.

Should airlines outsource their maintenance?

#### PRO

 It is much more cost-effective for airlines to hire outside specialists. In an industry that is suffering tremendous economic losses, the savings may be passed along to customers and could mean the difference between staying in business and going under. 2. Outside maintenance experts can perform the job more efficiently and objectively, increasing the safety of passengers.

#### CON

- Airlines can control safety and maintenance standards much more closely if they have their own workers perform such work.
- The Federal Aviation Administration (FAA) is unable to monitor safety as closely when maintenance is outsourced.

#### Summary

Airlines have contracted out maintenance tasks for many years, yet the debate continues. Some reports note potential problems with air carriers that try to adhere to short gate turnaround times, maintenance work that is done overnight, and the growth of discount airlines and the shortage of FAA inspectors. Currently, US Airways outsources 60 percent of its maintenance; United Airlines, 54 percent; American, 42 percent; and Delta, 35 percent.

Sources: Laura Meckler, "Airline Turmoil Poses Safety Issues," Wall Street Journal, accessed July 5, 2006, http:// online.wsj.com; Russell Grantham, "Delta CEO Looks to Rebuild Ties with Workers," Atlanta Journal-Constitution, accessed July 5, 2006, http://www.ajc .com; Susan Carey and Alex Frangos, "New Destination: Airlines, Facing Cost Pressure, Outsource Crucial Safety Tasks," Wall Street Journal, accessed July 5, 2006, http://online.wsj.com.

fore, managers must balance this threat against the cost of holding inventory to set acceptable stocking levels.

Efficient inventory control can save a great deal of money. In one common technique, many firms maintain **perpetual inventory** systems to continuously monitor the amounts and locations of their stocks. Such inventory control systems typically rely on computers, and many automatically generate orders at the appropriate times. Many supermarkets link their scanning devices to perpetual inventory systems that reorder needed merchandise without human interaction. As the system records a shopper's purchase, it reduces the inventory count stored in the computer. Once inventory on hand drops to a predetermined level, the system automatically reorders the merchandise.

Some companies go further and hand over their inventory control functions to suppliers. This concept is known as *vendor-managed inventory*. Best Buy, the consumer electronics retailer, is switching its vendors to a vendor-managed inventory system. For instance, instead of shipping DVDs and CDs to Best Buy's Franklin, Indiana, music and video distribution center, music and video vendors are now expected to ship their product directly to Best Buy stores. Two things must happen for that to occur. First, vendors must directly link their electronic ordering systems to Best Buy's store-level data so that only stores that need more inventory get it. Second, the vendors must make their products shelf-ready by affixing Best Buy stickers, codes, and pricing to their DVDs and CDs.<sup>15</sup>

#### just-in-time (JIT) system management philosophy aimed at improving profits and return on

investment by minimizing costs and eliminating waste through cutting inventory on hand.

#### materials requirement planning (MRP) computerbased production planning system by which a firm can ensure that it has needed parts and materials available at the right time and place in the correct amounts.

assessment Check

- What balance must managers seek when controlling inventory? 2. Explain perpetual inventory and
- vendor-managed inventory. 3. What is a just-in-time inventory system, and what are some of its

- advantages? 4. What is MRP used for?

Just-in-Time Systems A just-in-time (JIT) system implements a broad management philosophy that reaches beyond the narrow activity of inventory control to influence the entire system of production and operations management. A JIT system seeks to eliminate all sources of waste—anything that does not add value—in operations activities by providing the right part at the right place at just the right time—right before it is needed in production.

Production using JIT shifts much of the responsibility for carrying inventory to vendors, which operate on forecasts and keep stocks on hand to respond to manufacturers' needs. Suppliers that cannot keep enough high-quality parts on hand are often assessed steep penalties by purchasers. Navistar International, which makes trucks, assesses fines that can run tens of thousands of dollars per minute. Why? Because running out of parts effectively shuts down the entire product line. Consequently, in an emergency, some firms even bring in parts by helicopter, because it's still cheaper than paying the fine.<sup>16</sup>

Another risk of using JIT systems is what happens if manufacturers underestimate demand for a product. Strong demand will begin to overtax JIT systems, as suppliers and their customers struggle to keep up with orders with no inventory cushion to tide them over.

Materials Requirement Planning Besides efficiency, effective inventory control requires careful planning to ensure the firm has all the inputs it needs to make its products. How do production and operations managers coordinate all of this information? They rely on materials

requirement planning (MRP), a computer-based production planning system that lets a firm ensure that it has all the parts and materials it needs to produce its output at the right time and place and in the right amounts.

Production managers use MRP programs to create schedules that identify the specific parts and materials required to produce an item. These schedules specify the exact quantities needed and the dates on which to order those quantities from suppliers so that they are delivered at the correct time in the production cycle. A small company might get by without an MRP system. If a firm makes a simple product with few components, a telephone call may ensure overnight delivery of crucial parts. For a complex product, however, such as a car or a Joint Strike Fighter aircraft, MRP becomes an invaluable tool.

#### **Controlling the Production Process**

The final task of production and operations managers is controlling the production process to maintain the highest possible quality. Production control creates a well-defined set of procedures for coordinating people, materials, and machinery to provide maximum production efficiency. Suppose that a watch factory must produce 80,000 watches during October. Production control managers break down this total into a daily production assignment of 4,000 watches for each of the month's 20 working days. Next, they determine the number of workers, raw materials, parts, and machines the plant needs to meet the production schedule. Similarly, a manager in a service business such as a restaurant must estimate how many dinners the outlet will serve each day and then determine how many people are needed to prepare and serve the food, as well as what food to purchase.

Figure 11.5 illustrates production control as a five-step process composed of planning, routing, scheduling, dispatching, and follow-up. These steps are part of the firm's overall emphasis on total quality management.

**Production Planning** The phase of production control called **production planning** determines the amount of resources (including raw materials and other components) an organization needs to produce a certain output. The production planning process develops a bill of

#### Steps in Production Control



materials that lists all needed parts and materials. By comparing information about needed parts and materials with the firm's perpetual inventory data, purchasing personnel can identify necessary purchases. Employees or automated systems establish delivery schedules to provide needed parts and materials when required during the production process. Production planning also ensures the availability of needed machines and personnel. Although material inputs contribute to service-production systems, production planning for services tends to emphasize human resources more than materials.

**Routing** Another phase of production control, called **routing**, determines the sequence of work throughout the facility and specifies who will perform each aspect of the work at what location. Routing choices depend on two factors: the nature of the good or service and the facility layouts discussed earlier in the chapter—product, process, fixed-position, or customeroriented.

Observing production activities can improve routing decisions. At the Fenton, Michigan, factory of TRW Chassis Systems, a team of employees charged with improving work processes on an assembly line discovered that one worker's job consisted of simply moving parts from the end of a conveyor line to a test stand. The team moved the test stand, placing it next to the end of the assembly line so that the tester could unload the items. The unnecessary worker moved to another—probably more gratifying—job in a different part of the plant.<sup>17</sup>

**Scheduling** In the **scheduling** phase of production control, managers develop timetables that specify how long each operation in the production process takes and when workers should perform it. Efficient scheduling ensures that production will meet delivery schedules and make efficient use of resources.

Scheduling is an extremely important activity for a manufacturer of a complex product with many parts or production stages. Think of all the component parts needed to make a computerized tomography (CT) or magnetic resonance imaging (MRI) scanner or other complex hospital equipment. Scheduling must make each one available in the right place at the right time and in the right amounts to ensure a smooth production process.

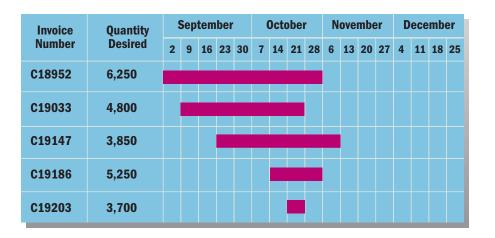
Scheduling practices vary considerably in service-related organizations. Printing shops or hair stylists may use relatively unsophisticated scheduling systems, resorting to such devices as "first come, first served" rules, appointment schedules, or take-a-number systems. They may call in part-time workers and use standby equipment to handle demand fluctuations. On the other hand, hospitals typically implement sophisticated scheduling systems similar to those of manufacturers.

Production managers use a number of analytical methods for scheduling. One of the oldest methods, the *Gantt chart*, tracks projected and actual work progress over time. Gantt charts like the one in Figure 11.6 remain popular because they show at a glance the status of a particular project. However, they are most effective for scheduling relatively simple projects. In a technical field such as production management, people often use specialized terms such as *Gantt charts* and *just-in-time inventory*. Use of technical jargon may improve communication, but

scheduling development of timetables that specify how long each operation in the production process takes and when workers should perform it. Figure

11.5

#### Sample Gantt Chart

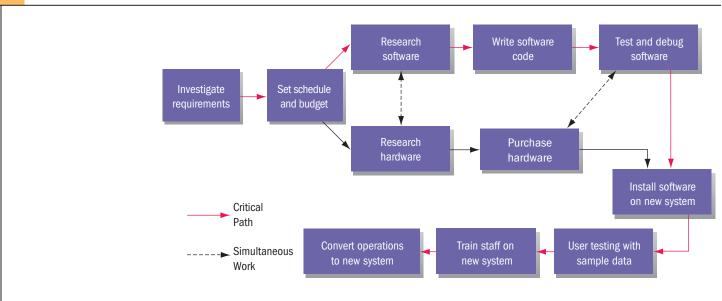


sometimes it doesn't. The "Business Etiquette" feature discusses when and when not to use technical jargon in business situations.

A complex project might require a **PERT** (**Program Evaluation and Review Technique**) chart, which seeks to minimize delays by coordinating all aspects of the production process. First developed for the military, PERT has been modified for industry. The simplified PERT diagram in Figure 11.7 summarizes the schedule for obtaining a new computer system for a business. The red line indicates the **critical path**—the sequence of operations that requires the longest time for completion. The dotted line shows work that can be done simultaneously.

In practice, a PERT network may consist of thousands of events and cover months of time. Complex computer programs help production managers develop such a network and find the critical path among the maze of events and activities. The construction of a huge sky-

#### PERT Diagram for Obtaining a New Computer System



362 Part 3 Management: Empowering People to Achieve Business Objectives



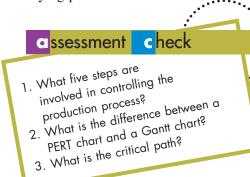
Figure

11.7

scraper requires complex production planning of this nature.

**Dispatching** The phase of production control in which the manager instructs each department on what work to do and the time allowed for its completion is called **dispatching.** The dispatcher authorizes performance, provides instructions, and lists job priorities. Dispatching may be the responsibility of a manager or a self-managed work team.

**Follow-Up** Because even the best plans sometimes go awry, production managers need to be aware of problems that arise. **Follow-up** is the phase of production control in which employees and their supervisors spot problems in the production process and determine needed changes. Problems take many forms: machinery malfunctions, delayed shipments, and employee absenteeism can all affect production. The production control system must detect and report these delays to managers or work teams so they can adjust schedules and correct the underlying problems.



## IMPORTANCE OF QUALITY

Although "quality" can be defined several ways, perhaps the most common definition of quality is a good or service free of deficiencies. Quality matters because fixing deficient products is costly. If Seagate makes a defective computer hard drive, it has to either fix the drive or replace it to keep a customer happy. If an airline books

## (b)usiness (e)tiquette

#### When—and When Not to Use Technical Jargon

The business world is filled with technical jargon. Just flip through this chapter. What's CAD? What is a PERT diagram used for? What is a critical path? If you are like most people, you recoil from technical jargon when you aren't sure what it means. Worse yet, it may have negative effects on a business conversation because it can cloud the meaning of a message. You can quickly lose a listener who is trying to decipher what you mean. On the other hand, jargon can serve as a kind of shorthand in a conversation between two people who understand clearly what is being said. In general, it's best to use common sense-and err on the side of clarity. Here are a few tips on when-and when not-to use technical jargon.

When to use technical jargon:

- Use an abbreviation without explanation if you are certain everyone with whom you are communicating knows it. Only use a term such as *CAD*, which stands for *computer-aided design*, if you are communicating with people who work in the special field and already know what computer-aided design is.
- Use a technical term such as *perpetual inventory* if necessary, but surround it with conventional phrases and concrete words to help listeners. Keep technical terms to a minimum so that the necessary ones have impact.

When not to use technical jargon:

- Avoid technical jargon when communicating with an audience outside your industry. This includes consumers who are customers. Instead of referring to an "output device" on a computer, simply say "printer."
- Avoid jargon when you are speaking or writing to someone from another country or who speaks a different language.
- Don't use acronyms that are specific to your own organization when you are communicating externally. Everyone who works for Midwest Engineering might refer to the firm as ME, but it's best to use the full name elsewhere. However, exceptions can be made for firms like IBM and GE because they are so well known.
- Don't use an abbreviation if its common interpretation is something other than what you intend. Most businesspeople understand PC to be a personal computer, so it's best not to use it to refer to Private Council or Principal Control.

**Sources:** Michael Bernhardt, "Seven Sins to Avoid with Your Next Public Speaking Engagement," accessed July 5, 2006, http://www.refresher .com/!sevensins.html; Nancy Halligan, Technical Writing, accessed July 5, 2006, http://www.technicalwriting-course.com/avoid-jargon .html; Joe Fleischer, "You Don't Need a Hero," *Call Center Magazine*, accessed July 5, 2006, http:// www.callcentermagazine.com.

## "They Said It"

"Always give the customer quality, value, selection, and service." —Fred G. Meyer (1886–1978) American merchant

> **benchmarking** process of determining other companies' standards and best practices.

**quality control** measuring goods and services against established quality standards. too many passengers for a flight, thus overselling its service, it has to offer vouchers worth several hundred dollars to encourage passengers to give up their seats and take a later flight.

For most companies, the costs of poor quality can amount to 20 percent of sales revenue, if not more. Some typical costs of poor quality include downtime, repair costs, rework, and employee turnover. Production and operations managers must set up systems to track and reduce such costs.

One process that companies use to ensure that they produce high-quality products from the start is **benchmarking**—determining how well other companies (and not just competitors) perform business functions or tasks. In other words, benchmarking is the process of determining other companies' standards and best practices. Automobile companies routinely purchase each other's cars and then take them completely apart to examine and compare the design, components, and materials used to make even the smallest part. They then make improvements to match or exceed the quality found in their competitors' cars. But benchmarking is helpful for service organizations, too. David Clayden, director of information technology for the Salvation Army in the United Kingdom, sums up why his organization and others should use benchmarking: "We use benchmarking to demarcate where we are underperforming, where we are effective, and where we have deficiencies."<sup>18</sup>

### **Quality Control**

**Quality control** involves measuring output against established quality standards. Firms need such checks to spot defective products and to avoid delivering inferior shipments to customers. Standards should be set high enough to meet customer expectations. A 90 or 95 percent success rate might seem to be a good number, but consider what your phone service or ATM network would be like if it operated for that share of time. Every year, it would be out of service for 438 hours (5 percent of the year) to 875 hours (10 percent).

Manufacturing firms can monitor quality levels through visual inspections, electronic sensors, robots, and X-rays. For service businesses surveys can provide quality-control information. Negative feedback from customers or a high rejection rate on a product or component sends a danger signal that production is not achieving quality standards.

Because the typical factory can spend up to half its operating budget identifying and fixing mistakes, companies cannot rely solely on inspections to achieve its quality goals. Instead, quality-driven production managers identify all processes involved in producing goods and services and work to maximize their efficiency. The causes of problems in the processes must be found and eliminated. If a company concentrates its efforts on improving processes, it can minimize production mistakes and make defect-free products.

General Electric, Ford, DuPont, Nokia, and Sony are just five of the growing number of major manufacturers using the Six Sigma concept to achieve quality goals. *Six Sigma* means a company tries to make error-free products 99.9997 percent of the time—a tiny 3.4 errors per million opportunities. The goal of Six Sigma programs is for companies to eliminate virtually all defects in output, processes, and transactions. While Six Sigma has obvious benefits and applications in manufacturing settings, it can be equally helpful in service organizations. Acosta is a Jacksonville, Florida–based sales and marketing agency that helps consumer goods companies such as Nestlé, Clorox, and Heinz get their products into supermarkets and convenience stores. Basically, Acosta's company representatives act as sales representatives and travel to stores to persuade managers to carry their clients' products. With 5,500 cars for its representatives, the company was spending \$15,500 per vehicle each year, or more than \$85 million a year. But by using Six Sigma techniques and charting the number of stores visited by each representative, the distances between those stores, and the sales made from each trip, Acosta was able to reduce its fleet to just 2,500 cars, saving millions in the process.<sup>19</sup> The

# HIT&MISS

#### It's No Mystery: Quality at Bank of America

At Bank of America, achieving quality goals may boil down to one word: *listen*. It's a simple concept that has been around in business for a long time. But companies often do more talking than listening to their customers. Bank of America, in contrast, is all ears.

Several years ago, Bank of America adopted the Six Sigma approach to quality, meaning that it will attempt to provide top-quality, error-free service 99.9997 percent of the time. Manufacturers such as Ford and GE have adopted the approach, but Bank of America was the first major financial institution to do so. "It's often harder to measure some of the attributes of financial services," comments senior vice president James Buchanan. "It's not as tangible a product." But the firm has found some ways that do work.

Bank of America sends "mystery shoppers" to its banking centers to make sure employees greet customers warmly, connect with them, and process their requests efficiently. In addition, the firm surveys 10,000 existing customers quarterly by phone, and it calls about 90,000 customers who have recently visited a branch to find out about their experience with the bank. Both methods of collecting information require listening. "It's a great learning tool and a building block for us to deliver better processes," says senior vice president Randall King.

These and other initiatives require training. So far, about 10,000 Bank of America employees have been trained in different aspects of the Six Sigma quality initiative. In just a few years, different programs have resulted in a \$6.6 million reduction in losses from identity theft and a \$10 million increase in revenue from tellers referring customers to additional bank products. In addition, one survey revealed that the number of customers who considered themselves "highly satisfied" with Bank of America's services rose from 43 percent to slightly more than 53 percent since the quality initiative. At Bank of America, someone is always listening.

#### **Questions for Critical Thinking**

- 1. How might Bank of America use benchmarking as part of its quality initiative?
- 2. Do you think it is possible to achieve virtually errorfree service, or is the attempt doomed to fail? Explain your view.

**Sources:** Liam McGee, "Sweating the Small Stuff: How Six Sigma Enables the Future," Bank of America, accessed July 5, 2006, http://www.bankofamerica.com/newsroom/ speeches; Chris Costanzo, "Business Management: BofA Tackles Six Sigma," American Banker-Bond Buyer, accessed July 5, 2006, http://www.us-banker.com; "Bank of America— Hoshin Kanri & Six Sigma," Six Sigma Companies, accessed July 5, 2006, http://www.sixsigmacompanies.com.

"Hit & Miss" feature explains how Bank of America is using Six Sigma to minimize mistakes and provide better service to its customers.

#### **ISO Standards**

For many goods, an important measure of quality is to meet the standards of the **International Organization for Standardization**, known as **ISO** for short—not an acronym but a shorter name derived from the Greek word *isos*, meaning "equal." Established in Europe in 1947, ISO includes representatives from more than 146 nations. Its mission is to promote the development of standardized products to facilitate trade and cooperation across national borders. ISO standards govern everything from the format of banking and telephone cards to freight containers to paper sizes to metric screw threads. The U.S. member body of ISO is the American National Standards Institute.

The ISO 9000 family series of standards sets requirements for quality processes; these standards define how a company should ensure that its products meet customers' requirements. The ISO 14000 series sets standards for operations that minimize harm to the environment.

International Organization for Standardization (ISO) organization whose mission is to promote the development of standardized products to facilitate trade and cooperation across national borders.

#### **o**ssessment check

1. What are some ways in which a company can monitor the quality level of its output? 2. What does Six Sigma mean? 3. List some of the benefits of acquir-

ing ISO 9000 certification.

ISO accredits organizations in member countries to evaluate performance against these standards. To receive an ISO 9000 family certification, a company must undergo an on-site audit. The audit ensures that documented quality procedures are in place and that all employees understand and follow the procedures. Production managers meet these requirements through an ongoing process involving periodic recertification.

Nearly half a million ISO 9000 family certificates have been awarded to companies around the world. Their numbers are growing rapidly, with the fastest growth occurring in China, Italy, and Japan. Over half the certificates have been awarded in Europe. Why should companies achieve ISO 9000

certification? Because studies clearly show that customers prefer to buy from companies that are ISO 9000 certified. Companies, in turn, believe that being ISO 9000 certified helps them keep customers who might otherwise leave to work with an ISO 9000-certified corporation.<sup>20</sup>

## WHAT'S AHEAD

Maintaining high quality is an important element of satisfying customers. Product quality and customer satisfaction are also objectives of the business function of marketing. The next part consists of three chapters that explore the many activities involved in customer-driven marketing. These activities include product development, distribution, promotion, and pricing.

#### **Summary of Learning Goals**

#### Outline the importance of production and operations management.

Production and operations management is a vital business function. Without a quality good or service, a company cannot create profits, and it soon fails. The production process is also crucial in a not-for-profit organization, because the good or service it produces justifies the organization's existence. Production and operations management plays an important strategic role by lowering the costs of production, boosting output quality, and allowing the firm to respond flexibly and dependably to customers' demands.

#### Assessment Check Answers

#### 1.1 What are the advantages and disadvantages of mass production?

Mass production leads to high productivity, mechanization, and standardization, all of which make outputs available in large quantities at lower prices than individually crafted items would cost. The disadvantages are inefficiency when making small batches of items and specialized tasks leading to boring, repetitive jobs.

#### 1.2 What are the characteristics of flexible production?

Flexible production is characterized by cost-effective production of small batches, use of information technology to share the details of customer orders, programmable equipment to fulfill the orders, and skilled people to carry out whatever tasks are needed to fill a particular order.

1.3 Describe a customer-driven production system. Customer-driven production systems directly link what manufacturers make with what customers want to buy. One way to do this is to establish computer links between factories and retailers' scanners. Another is to not make a product until a customer orders it.

#### Explain the roles of computers and related technologies in production.

Computer-driven automation allows companies to design, create, and modify products rapidly and produce them in ways that effectively meet customers' changing needs. Important design and production technologies include robots, computer-aided design (CAD), computer-aided manufacturing (CAM), and computer-integrated manufacturing (CIM).

#### Assessment Check Answers

## 2.1 List some of the reasons businesses invest in robots.

Businesses use robots to free people from boring, sometimes dangerous assignments and to move heavy items from one place to another in a factory.

# 2.2 Distinguish among computer-aided design, computer-aided manufacturing, flexible manufacturing, and computer-integrated manufacturing.

Computer-aided design (CAD) enables engineers to design parts and buildings on computer screens faster and with fewer mistakes than they could achieve working with traditional drafting systems. Computeraided manufacturing (CAM) uses the CAD specifications to determine the steps that machines must take to produce products or parts. CAD and CAM are typically used together. Computer-integrated manufacturing (CIM) is a system in which companies integrate robots, CAD/CAM, FMS, computers, and other technologies to design products, control machines, handle materials, and control the production function in an integrated fashion.

#### 3 Identify the factors involved in a plant location decision.

Criteria for choosing the best site for a production facility fall into three categories: transportation, human, and physical factors. Transportation factors include proximity to markets and raw materials, along with availability of transportation alternatives. Physical variables involve such issues as water supply, available energy, and options for disposing of hazardous wastes. Human factors include the area's labor supply, local regulations, and living conditions.

#### Assessment Check Answers

# 3.1 What is the purpose of an environmental impact study, and how does it influence the location decision?

The purpose is to analyze how a proposed plant would affect the quality of life in the surrounding area. The effects on transportation facilities, energy requirements, water and sewage treatment needs, natural plant life and wildlife, and water, air, and noise pollution are studied.

## **3.2** What human factors are relevant to the location decision?

Human factors include an area's labor supply, labor costs, local regulations, and living conditions.

## Explain the major tasks of production and operations managers.

Production and operations managers use people and machinery to convert inputs (materials and resources) into finished goods and services. Four major tasks are involved. First, the managers must plan the overall production process. Next, they must pick the best layout for their facilities. Then they implement their production plans. Finally, they control the production process and evaluate results to maintain the highest possible quality.

#### Assessment Check Answers

## 4.1 What is the key responsibility of production managers?

Production managers must oversee the work of people and machinery to convert inputs (materials and resources) into finished goods and services.

## 4.2 List the four major tasks of production and operations managers.

The four tasks are planning overall production, laying out the firm's facilities, implementing the production plan, and controlling manufacturing to achieve high quality.

## **5** Compare alternative layouts for production facilities.

Process layouts effectively produce nonstandard products in relatively small batches. Product layouts are appropriate for the production of a large quantity of relatively similar products. Fixed-position layouts are common when production involves very large, heavy, or fragile products. Customer-oriented layouts are typical for service facilities where success depends on interaction between customers and service providers.

#### Assessment Check Answers

**5.1 Differentiate between the three most common layout designs: process, product, and fixed-position.** A process layout groups machinery and equipment according to their functions. The work in process moves around the plant to reach different workstations. A product layout sets up production equipment along a product-flow line, and the work in process moves along this line past workstations. A fixed-position layout places the product in one spot, and workers, materials, and equipment come to it.

#### 5.2 Describe a customer-oriented layout that is typically used by service providers.

A customer-oriented layout enhances the interactions between a company and its customers. For example, a hospital can make sure that the nurses' station is close to all of the patients' beds in a hospital wing.

#### List the steps in the purchasing process.

In the make, buy, or lease decision, production and operations managers determine whether to manufacture needed inputs in house, purchase them, or lease them from an outside supplier. Managers determine the correct materials to purchase, select appropriate suppliers, and develop an efficient ordering system. The objective is to buy the right materials in the right amounts at the right time and in the right place.

#### Assessment Check Answers

#### 6.1 What factors affect the make, buy, or lease decision?

The costs of leasing or purchasing parts from vendors, versus producing them in house, the availability of dependable, outside suppliers, and the need for confidentiality affect this decision.

#### 6.2 What factors should firms consider when selecting vendors?

Firms should compare quality, prices, speed, warranties, and the dependability of delivery and services offered by vendors.

#### Outline the advantages and disadvantages of maintaining large inventories.

The task of inventory control is to balance the need to maintain adequate supplies against the need to minimize funds invested in inventory. Excessive inventory results in unnecessary expenditures for warehousing, taxes, insurance, and maintenance. Inadequate inventory may mean production delays, lost sales, and inefficient operations.

#### Assessment Check Answers

#### 7.1 What balance must managers seek when controlling inventory?

Managers must balance the need to keep stocks on hand to meet demand against the costs of carrying inventory.

7.2 Explain perpetual inventory and vendormanaged inventory.

Perpetual inventory systems continuously monitor the amount and location of inventory and automatically generate orders at the appropriate times. Vendormanaged inventory is a system in which companies have their suppliers control and manage their inventory.

#### 7.3 What is a just-in-time inventory system, and what are some of its advantages?

With a just-in-time inventory system, component parts arrive from suppliers just as they are needed at each stage of production. By having parts arrive "just in time," the manufacturer keeps little inventory on hand and thus avoids the costs associated with holding inventory.

#### 7.4 What is MRP used for?

Production managers use MRP programs to create schedules that identify the specific parts and materials required to produce an item. These schedules specify the exact quantities required and when to order those quantities from suppliers so that needed inventory is delivered at the best time within the production cycle.

#### Identify the steps in the production control process.

The production control process consists of five steps: planning, routing, scheduling, dispatching, and followup. Quality control is an important consideration throughout this process. Coordination of each of these phases should result in high production efficiency and low production costs.

#### Assessment Check Answers

#### 8.1 What five steps are involved in controlling the production process?

The five steps are planning, routing, scheduling, dispatching, and follow-up.

#### 8.2 What is the difference between a PERT chart and a Gantt chart?

PERT charts, which seek to minimize delays by coordinating all aspects of the production process, are used for more complex projects; Gantt charts, which track projected and actual work progress over time, are used for scheduling relatively simple projects.

#### 8.3 What is the critical path?

In a PERT chart, a red line indicates the critical path, which is the sequence of steps or operations that will take the longest time to complete.

#### Explain the benefits of quality control.

Quality control involves evaluating goods and services against established quality standards. Such checks are necessary to spot defective products and to see that they are not shipped to customers. Devices for monitoring quality levels of the firm's output include visual inspection, electronic sensors, robots, and Xrays. Companies are increasing the quality of their goods and services by using Six Sigma techniques and by becoming ISO 9000 and 14000 certified.

#### Assessment Check Answers

9.1 What are some ways in which a company can monitor the quality level of its output?

Benchmarking, quality control, Six Sigma, and ISO standards are ways of monitoring quality.

#### 9.2 What does Six Sigma mean?

Six Sigma means a company tries to make error-free products 99.9997 percent of time—just 3.4 errors per million opportunities.

## **9.3** List some of the benefits of acquiring ISO 9000 certification.

These standards define how a company should ensure that its products meet customers' requirements. Studies show that customers prefer to buy from companies that are ISO 9000 certified.

#### Business Terms You Need to Know

production 346 production and operations management 346 assembly line 348 robot 350 computer-aided design (CAD) 351 computer-aided manufacturing (CAM) 351 just-in-time (JIT) system 360 materials requirement planning (MRP) 360 scheduling 361 benchmarking 364 quality control 364 International Organization for Standardization (ISO) 365

#### Other Important Business Terms

mass production 348 flexible manufacturing system (FMS) 352 computer-integrated manufacturing (CIM) 353 environmental impact study 354 make, buy, or lease decision 357 inventory control 358 perpetual inventory 359 production control 360 production planning 360 routing 361 PERT (Program Evaluation and Review Technique) 362 critical path 362 dispatching 363 follow-up 363

#### **Review Questions**

- 1. What is utility? Define and briefly describe the four different types of utility.
- 2. Distinguish between production and manufacturing. In what ways does each of the following perform a production function?
  - a. delicatessen
  - b. dentist
  - c. local transit system
  - d. Tower Records music store

- 3. Why is production such an important business activity? In what ways does it create value for the company and its customers?
- 4. How does mass production work? Describe a good or service that would lend itself well to mass production and one that would not lend itself well to mass production.
- 5. How does flexible production compare with mass production?

- 6. Briefly describe the four different production systems. Give an example of a good or service that is produced by each.
- 7. Describe the four major tasks of production and operations managers: planning the production process, selecting the most appropriate layout, implementing the production plan, and controlling the production process.
- 8. What would be the best facility layout for each of the following?
  - a. card shop
  - b. chain of economy motels

- c. car wash
- d. accountant's office
- e. large auto dealer's service facility
- 9. Describe a flexible manufacturing system.
- 10. What are the benefits of producing a quality product? Briefly describe the International Organization for Standardization (ISO).

#### Projects and Teamwork Applications

- 1. Imagine that you have been hired as a management consultant for one of the following types of service organizations to decide on an appropriate layout for its facility. Select one and sketch or describe the layout that you think would be best.
  - a. chain of dry-cleaning outlets
  - b. doctor's office
  - c. small, elegant lakeside restaurant
  - d. coffee house
- 2. Imagine that you have been hired as production manager for a snowboard manufacturer (or choose another type of manufacturer that interests you). What type of inventory control would you recommend for your company? Write a brief memo explaining why.
- 3. Nissan and Hyundai have built auto assembly plants in Mississippi and Alabama, respectively. What factors do you think Nissan and Hyundai considered when choosing their plant location?
- 4. Suggest two or three ways in which each of the following firms could practice effective quality control:
  - a. pharmaceutical firm
  - b. miniature golf course
  - c. Internet florist
  - d. agricultural packing house

#### Case 11.1

#### Apple Faces Shortages of iPods, iPod Shuffles, and Nanos

When consumers are clamoring for a popular product, what happens when the manufacturer can't deliver it? That's the situation recently faced by Apple, and it's not just a case of one product. Consumers who wanted the firm's iPods, iPod Shuffles, and Nanos were left empty handed. Just as one holiday season reached its peak—along with the demand for the players—supply dwindled to almost nothing. Target, Best Buy, and other retailers reported complete sellouts. Even Amazon's supply was gone. Nearly a year later, more shortages occurred. What went wrong?

No one predicted how popular the iPod line would be. Within a year, the iPod represented nearly 25 percent of Apple's total sales. "It's right up there with the most highly demanded products I've seen, and I've been in this business since '87," observed David Weisman, senior director of home merchandising at electronics retailer Crutchfield. Apple executives say that many of the shortages were due to a scarcity of component parts. Some experts criticized Apple's lack of preparedness for demand. "Apple has this history of introducing a new product and then immediately failing to meet demand for it," said one retailer. Others pointed to the reality of the situation. "Given how strong demand has been ..., you would have thought [Apple] would have gotten every last [player] they could into the stores," said Stephen Baker of marketing research firm NPD Group. "I suspect they have. It may just be they can't build them fast enough." Some of the shortages could be traced to the outsourcing of manufacturing to factories in China that, while offering lower costs, also had longer production times, longer supply chains, and more downtime due to energy shortages.

Nearly the same shortages have occurred with each new version of the iPod, including the Nano, which eventually replaced the Mini. Within days of its initial release, Microwarehouse—one of Apple's distributors located in the Philippines—began receiving thousands of orders for the new iPod. The orders far exceeded the distributor's original targets. "These are the less than 1,000-song market," said sales manager Cecilio Tuanquin Jr. "These kinds of buyers usually just want a limited number of songs in their devices especially when they couldn't listen to all the other songs in an iPod with bigger capacity." Tuanquin also said that Microwarehouse had a backlog of at least a month's worth of orders.

Apple did its best to appease customers, but in the end most just had to wait. "To try to meet the

Case 11.2

71959.

high demand, we're making and shipping iPods as fast as we can," the firm said in a written statement. "So, if one store has run out, you may find iPods in another authorized iPod reseller." Meanwhile, the firm continued to roll out new products, including its video iPod. The screen remained tiny—only  $2^{1}/_{2}$  inches wide—indicating that music is still the priority of that device. But consumers who wanted to catch a quick clip of music video or a friend's podcast while sitting in traffic, waiting for a flight, or walking to class could do so.

#### **Questions for Critical Thinking**

- What are some of the pitfalls of Apple's decision to outsource production of its iPods to factories in other countries?
- 2. Describe two or three steps that Apple might take to avoid shortages of popular products in the future.

**Sources:** Rob Pegoraro, "With Video iPod, the Music Still Comes First," *Washington Post*, accessed July 5, 2006, http://www.washingtonpost.com; "Apple Expected to Unveil Video iPod," Associated Press, accessed July 5, 2006, http://news.yahoo.com; Peter Burrows, "What's the Next Verse in Apple's Song?" *BusinessWeek*, accessed July 5, 2006, http://www.businessweek.com; Yossi Sheffi, "Business Life Summer School: Day Sixteen," *Financial Times*, accessed July 5, 2006, http://www.ft.com; Nick Wingfield, "Out of Tune: iPod Shortage Rocks Apple," *Wall Street Journal*, accessed July 5, 2006, http://online.wsj.com; Alexander Villafania, "iPod Nano Waiting List: Two Months," INQ7, accessed September 22, 2005, http://www.inq7.net.

#### Washburn Guitars: Sound Since 1883

This video case appears on page 620. A recently filmed video, designed to expand and highlight the written case, is available for class use by instructors.

## Case





## The Second City Theater Continuing Case Management: Empowering People to Achieve Business Objectives

The most important asset of The Second City is its talent. Well known as the creative launch pad for comedy greats such as John Belushi, Bill Murray, and Mike Myers, the success of The Second City continues to depend on the quality of its performers. Second City managers are adept at finding and cultivating comedians, then producing and presenting that special brand of comedy, which continues to attract and please the paying audience.

In front of the Chicago Second City entrance is a chronological list of names, those of every performer who has opened a new revue on one of Second City's stages. This nondescript list is the first step in Second City's customer-oriented layout. Inside the Second City building, a visitor can see how these names came to life on stage and screen. Large black-and-white pictures capture famous Second City comedians in the costumes and characters that made them famous and the Second City tradition uniquely identifiable. The spirit of creation and off-the-cuff humor are part of the atmosphere in this building. Ascending the spiral staircase, patrons are met with pictures of today's Second City Main Stage cast, the newest generation of comedy mavericks. Once inside the theater, audience members witness a newly created Second City revue

that speeds through both engaging sketch comedy and biting cultural and political satire. The experience is full of energy and based on an intimate relationship between ensemble and audience. Finally, a night at the Second City ends where its tradition began—with a thirty-minute set of completely improvised comedy based on audience suggestions and the momentum of their laughter. The experience has a similar impact at the four other Second City theaters.

The Second City became famous in 1959 with its first cast of characters, called The Compass Players, and has since been able to garner impressive reviews and profitable returns on a regular basis. The Second City comprises a growing comedy dynasty that includes three stages in Chicago, along with stages in Toronto, Las Vegas, Denver, and Detroit. It also has numerous touring companies performing around the world and multiple shows being produced on cruise lines or specifically created for various businesses. In total they have nearly one hundred performers representing the best in comedy. So how does The Second City control the quality of all of its productions? CEO Andrew Alexander, who has produced more than 200 Second City revues since joining the company in 1974, says that SC "looks for individuals that are

intelligent, have a point of a view, and the potential to become a good actor. And a comedic sensibility doesn't hurt." This general welcoming of talent has brought hundreds of performers of all ages to Second City's door. Creating a diverse cast of eight people who can function as a creative team six nights a week, however, calls for a certain kind of vision. This vision and this approach originated with the Compass Players themselves. "SC was founded . . with the goal to use improvisational techniques developed in the late 1930's by Viola Spolin to create satirical revues for commercial audiences," says Alexander. The Second City ensemble uses improvisational techniques such as risk taking, acceptance, and communication to create comedic material and form a cohesive foundation for the team. Similarly, Second City fosters a relationship with its audience such that new material can be tried out on a nightly basis. Hot topics and sensitive issues are broached by the fearless Second City cast, a collection of scenes, songs, characters, and improvisations that unite the ensemble's creative endeavors under the heading of a new revue. The most successful works are archived for further study and entertainment.

According to Kelly Leonard, vice president of Second City, the corpo-

ration's top management continues to advance with the culture of improvisational comedy in mind. "Second City's culture is built upon improvisation. We 'Yes, and . . .' to ideas, we are always creating. We trade ideas, build upon what makes us laugh or think." The concept of affirming an idea ("Yes"), and building on it ("and") has developed a strong cultural infrastructure for the organization. "In the Second City," says Leonard, "authority and the norm are to be disturbed—creativity and originality are to be celebrated."

The Second City actively devotes itself to a variety of endeavors and functions as a markedly departmentalized corporation. The company's initiatives are separated geographically, functionally, and in relation to its customers. It has stages in two countries and touring companies around the world. They function with The Second City Business Company, operating specifically for the corporate community; in regard to its customers, The Second City gains a significant revenue from its box office and its Training Center. External communication, which is usually related to the specific department undertaking, is overseen by management staff working with performers/ teachers to build an appropriate business relationship with the client.

The Second City communicates internally through a large e-mail list created for anyone who chooses to be a "Second Citizen" while on the SC website. This list informs patrons and students about news, show openings, reviews, special events, and other interesting happenings in the Second City community. This is the most formal way that management disseminates information to others involved with the theater. With a high number of aspiring actors filling in the Second City environment, an active grapevine enriches the culture with news of upcoming shows and staff openings for performers . . . or cocktail waitresses.

The Second City functions primarily as a comedy club, and most of the employees who staff its bar, box office, and theater house are current or former students of the Training Center. While resident performers are granted Equity Actor Benefits, these lower-level employees are granted flexible, part-time schedules to accommodate their thespian lifestyles and the motivating knowledge that alumni such as Tina Fey, Chris Farley, and Stephen Colbert have all trained at the same institution. A variety of class levels all focus on team-building skills, active listening, and the quick, confident reactions necessary for the Second City brand

of comedy. Exposing its students to the true method of the Second City, the Training Center offers plenty of performance opportunities. Graduates of the Second City Training Program are produced in their own SC style revue, complete with a seasoned Second City director empowering them to use every skill at their disposal.

As new generations of Second City fans come up to the second floor of the concrete building on North Avenue and Wells Street in Chicago, Second City visionaries will cling to its black-and-white photos as the core symbols of success. Meanwhile, the next wave of Second City talent and the newest faces in comedy could be the employees tearing your ticket and serving your beverage.

#### QUESTIONS

- How does Second City's management differ from that of a traditional company?
- 2. How would you summarize the culture of Second City?
- Why is it important for Second City to maintain its caliber of comedy? How does it do so?
- 4. How does ensemble play a role in the managerial techniques of Second City?



## Part 3: Launching Your Management Career

Part 3, "Management: Empowering People to Achieve Business Objectives," covers Chapters 8 through 11, which discuss management, leadership, and the internal organization; human resource management, motivation, and labor-management relations; improving performance through empowerment, teamwork, and communication; and production and operations management. In those chapters, you read about top managers and company founders such as Michael Bloomberg of Bloomberg LP, who is also mayor of New York City; middle manager Jeff McCracken, a chief engineer at Norfolk Southern who managed a team of 100 employees and dozens of engineers who rebuilt miles of railroad tracks destroyed by a hurricane; and supervisory manager Charles Lee, a production supervisor at an American Airlines maintenance center responsible for motivating airplane mechanics to repair and maintain passenger jets, all while finding ways to cut company costs. As these managers show, an incredible variety of jobs is available to those choosing management careers. And the demand for managers will continue to grow. The U.S. Department of Labor estimates that managerial jobs will grow by 11 percent over the next decade.<sup>1</sup>

So what kinds of jobs might you be able to choose from if you launch a management career? As you learned in Chapter 8, three types of management jobs exist: supervisory managers, middle managers, and top managers. Supervisory management, or first-line management, includes positions such as supervisor, office manager, department manager, section chief, and team leader. Managers at this level work directly with the employees who produce and sell a firm's goods and services.

Middle management includes positions such as general managers, plant managers, division

managers, and regional or branch managers. They are responsible for setting objectives consistent with top management's goals and planning and implementing strategies for achieving those objectives.

Top managers include such positions as chief executive officer (CEO), chief operating officer (COO), chief financial officer (CFO), chief information officer (CIO), and executive vice president. Top managers devote most of their time to developing long-range plans, setting a direction for their organization, and inspiring a company's executives and employees to achieve their vision for the company's future. Top managers travel frequently between local, national, and global offices as they meet and work with customers, suppliers, and company managers and employees.

Most managers start their careers in areas such as sales, production, or finance, so you likely will start in a similar entry-level job. If you do that job and other jobs well, you may be considered for a supervisory position. Then, if you are interested and have the technical, human, and conceptual skills to succeed, you'll begin your management career at the supervisory level. But what kinds of supervisory management jobs are typically available? Let's review the exciting possibilities.

Administrative service managers manage basic services—such as clerical work, payroll, travel, printing and copying, data records, telecommunications, security, parking, and supplies—without which no organization could operate. On average, administrative service managers earn \$60,000 a year.<sup>2</sup>

*Construction managers* plan, schedule, and coordinate the building of homes, commercial buildings such as offices and stores, and indus-

trial facilities such as manufacturing plants and distribution centers. Unlike administrative service managers, who work in offices, construction managers typically work on building sites with architects, engineers, construction workers, and suppliers. On average, construction managers earn \$70,000 a year.<sup>3</sup>

Food service managers run restaurants and services that prepare and offer meals to customers. They coordinate workers and suppliers in kitchens, dining areas, and banquet operations; are responsible for those who order and purchase food inventories; maintain kitchen equipment; and recruit, hire, and train new workers. Food service managers can work for chains such as Ruby Tuesday or Olive Garden, for local restaurants, and for corporate food service departments in organizations. On average, food service managers earn \$40,000 a year.<sup>4</sup>

Human resource managers help organizations follow federal and local labor laws; effectively recruit, hire, train, and retain talented workers; administer corporate pay and benefits plans; develop and administer organizational human resource policies; and, when necessary, participate in contract negotiations or handle disputes. Human resource management jobs vary widely, depending on how specialized the requirements are. On average, human resource managers earn from \$66,000 to \$93,000 a year, depending on the area in which they specialize.<sup>5</sup>

Lodging managers work in hotels and motels but also help run camps, ranches, and recreational resorts. They may oversee guest service, front desk, kitchen, restaurant, banquet, house cleaning, and maintenance workers. Because they are expected to help satisfy customers 24/7, they often work long hours and may be on call when not at work. On average, lodging managers earn \$38,000 a year.<sup>6</sup>

Medical and health service managers work in hospitals, nursing homes, doctors' offices, and corporate and university settings. They run departments that offer clinical services; ensure that state and federal laws are followed; and handle decisions related to the management of patient care, nursing, surgery, therapy, medical records, and financial payments. On average, medical and health service managers earn \$67,000 a year.<sup>7</sup>

Purchasing managers lead and control organizational supply chains that ensure that companies have needed materials to produce the goods and services they sell, purchase materials at reasonable prices, and oversee deliveries when and where they are needed. Purchasing managers work with wholesale and retail buyers, buying goods that are then resold to others; purchasing agents, who buy supplies and raw materials for their organizations; and contract specialists, who negotiate and supervise purchasing contracts with key suppliers and vendors. On average, purchasing managers earn \$72,000 a year.<sup>8</sup>

Production managers direct and coordinate operations that manufacture goods. They work with employees who produce parts and assemble products, help determine which new machines should be purchased and when existing machines need maintenance, and are responsible for achieving production goals that specify the quality, cost, schedule, and quantity of units to be produced. On average, production managers earn \$73,000 a year.<sup>9</sup>

## Career Assessment Exercises in Management

- The American Management Association is a global, not-for-profit professional organization that provides a range of management development and educational services to individuals, companies, and government agencies. Access the AMA's Web site at http://www .amanet.org. Explore the "Free Resources" link there (you will have to register). Pick an article or research area that interests you. Provide a one-page summary of the management issues discussed in the feature.
- Go online to a business news service, such as Yahoo! News or Google News, or look at the business section of your local newspaper. Find a story relating to a first-line supervisor, middle manager, or top executive. Summarize that person's duties. What decisions does that

person make and how do those decisions affect his or her organization?

3. Pick a supervisory management position from the descriptions provided here that interests you. Research the career field. What skills do you possess that would make you a good candidate for a management position in that field? What work and other experience do you need to help you get started? Create a list of both your strengths and weaknesses and formulate a plan to add to your strengths.