# Chapter 1

## Just What Do Operations Managers Do?

**Operations management** designs and operates productive systems--systems for getting work done. The food you eat, the movies you watch, the stores in which you shop, and this book you are reading are provided to you by the people in operations. Operations managers are found in banks, hospitals, factories, and government. They design systems, ensure quality, produce products, and deliver services. They work with customers and suppliers, the latest technology, and global partners. They solve problems, reengineer processes, innovate, and integrate. Operations is more than planning and controlling; it's doing. Whether it's superior quality, speed-to-market, customization, or low cost, excellence in operations is critical to a firm's success.

**Operations** is often defined as a transformation process. As shown in Figure 1.1, inputs (such as material, machines, labor, management, and capital) are transformed into outputs (goods and services). Requirements and feedback from customers are used to adjust factors in the transformation process, which may in turn alter inputs. In operations management, we try to ensure that the transformation process is performed efficiently and that the output is of greater *value* than the sum of the inputs. Thus, the role of operations is to create value. The transformation process itself can be viewed as a series of activities along a *value chain* extending from supplier to customer. Any activities that do not add value are superfluous and should be eliminated.

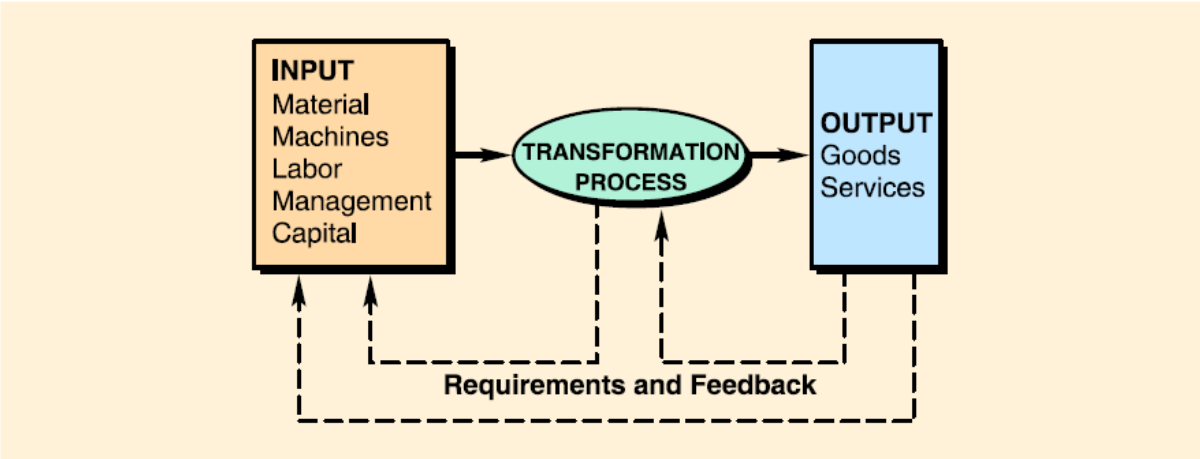


**FIGURE 1.1** Operations as a Transformation Process

The input-transformation-output process is characteristic of a wide variety of operating systems. In an automobile factory, sheet steel is formed into different shapes, painted and finished, and then assembled with thousands of component parts to produce a working automobile. In an aluminum factory, various grades of bauxite are mixed, heated, and cast into ingots of different sizes. In a hospital, patients are helped to become healthier individuals through special care, meals, medication, lab work, and surgical procedures. Obviously, "operations" can take many different forms. The transformation process can be

*physical,* as in manufacturing operations;

| | |
|---|---|
| *locational,* | as in transportation or warehouse operations; |
| *exchange,* | as in retail operations; |
| *physiological,* | as in health care; |
| *psychological,* | as in entertainment; or |
| *informational,* | as in communications. |

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## The Operations Function

Activities in operations management (OM) include organizing work, selecting processes, arranging layouts, locating facilities, designing jobs, measuring performance, controlling quality, scheduling work, managing inventory, and planning production. Operations managers deal with people, technology, and deadlines. These managers need good technical, conceptual, and behavioral skills. Their activities are closely intertwined with other functional areas of a firm.

As shown in Figure 1.2, the three primary functions of a firm are marketing, finance, and operations. *Marketing* establishes the demand for goods or services, *finance* provides the capital, and *operations* actually makes the goods or provides the service. Of the three functions, operations typically employs the greatest number of people and requires the largest investment in assets. For these reasons, management of the operations function has often been viewed as an opportunity to improve a firm's efficiency and reduce costs. But operations can also be an avenue to increase sales, gain market share, and eliminate the competition!

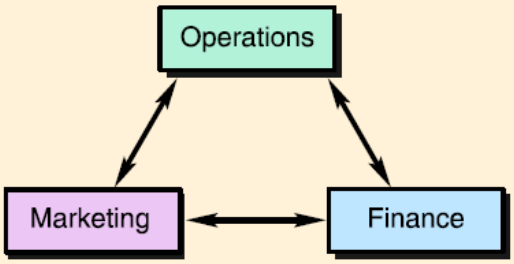



**FIGURE 1.2** Operations as One of the Three Basic Functions of a Firm

Operations can also be viewed as the *technical core* of an organization as depicted in Figure 1.3. In this scenario, the organization exists to produce goods and services for its customers. Therefore, operations is the central function or "hub" of the organization in contact with every other functional area. For example, operations interacts with *marketing* to receive estimates of customer demand and customer feedback on problems; with *finance* for capital investments, budgets, and stockholder requirements; with *personnel* to train, hire, and fire workers; and with *purchasing* to order needed materials for production.

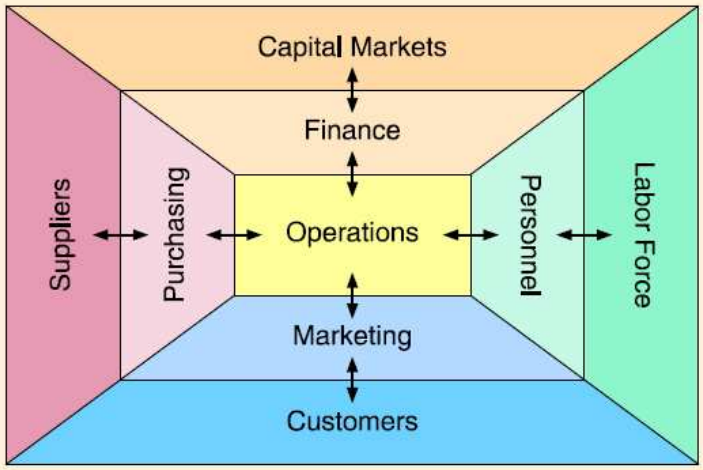
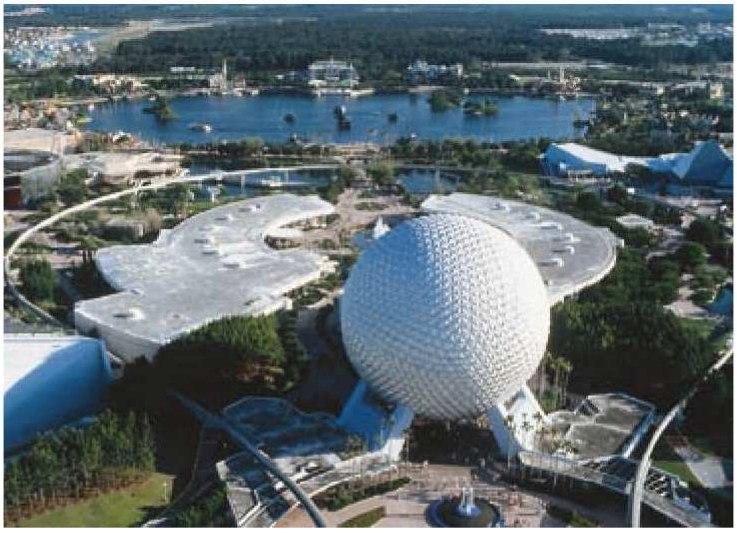



**FIGURE 1.3** Operations as the Technical Core



Operating a large amusement park, such as Disney's Epcot Center, is every bit as complicated as manufacturing an aircraft carrier. Thousands of activities must be coordinated on a daily basis. Equipment must be well-maintained, workers well-trained, and shelves well-stocked, while keeping costs down. On top of this, services typically deal with more customers (each with their own service expectations) more frequently than manufacturers, and handle more unexpected occurrences. Maybe that's why GM, Xerox, IBM, and other manufacturers routinely benchmark Disney operations.

As a field of study, operations brings together many disciplines and provides an integrated view of business organizations. To understand better the role of operations and the operations manager, let's examine some historical events in OM.

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### Pause and Reflect

**1-1.** What constitutes "operations" at (a) a bank, (b) a retail store, (c) a hospital, (d) a cable TV company?

***1-2.** Find an interesting web site related to the operations function in a firm with which you are familiar. Use e-mail to submit the URL and a paragraph describing what you found at the site to your instructor.

**These exercises require a direct link to a specific Web site. Click **Internet Exercises** for the list of internet links for these exercises.*

## A Brief History of Operations Management

Although history is full of amazing production feats--the pyramids of Egypt, the Great Wall of China, the roads and aqueducts of Rome--the widespread production of consumer goods--and thus, operations management--did not begin until the Industrial Revolution in the 1700s. Prior to that time, skilled craftspersons and their apprentices fashioned goods for individual customers from studios in their own homes. Every piece was unique, hand-fitted, and made entirely by one person, a process known as craft production. Although **craft production** still exists today, the availability of coal, iron ore and steam power set into motion a series of industrial inventions that revolutionized the way work was performed. Great mechanically powered machines replaced the laborer as the primary factor of production and brought workers to a central location to perform tasks under the direction of an "overseer" in a place called a "factory." The revolution first took hold in textile mills, grain mills, metalworking, and machine-making facilities.

Around the same time, Adam Smith's *Wealth of Nations* (1776) proposed the *division of labor,* in which the production process was broken down into a series of small tasks, each performed by a different worker. The specialization of the worker on limited, repetitive tasks allowed him or her to become very proficient at those tasks and further encouraged the development of specialized machinery.

The introduction of *interchangeable parts* by Eli Whitney (1790s) allowed the manufacture of firearms, clocks, watches, sewing machines, and other goods to shift from customized one-at-a-time production to volume production of standardized parts. This meant the factory needed a system of measurements and inspection, a standard method of production, and supervisors to check the quality of the worker's production.

Advances in technology continued through the 1800s. Cost accounting and other control systems were developed, but management theory and practice were virtually nonexistent.

In the early 1900s an enterprising laborer (and later chief engineer) at Midvale Steel Works named Frederick W. Taylor approached the management of work as a science. Based on observation, measurement, and analysis, he identified the best method for performing each job. Once determined, the methods were standardized for all workers, and economic incentives were established to encourage workers to follow the standards. Taylor's philosophy became known as *scientific management.* His ideas were embraced and extended by efficiency experts Frank and Lillian Gilbreth and Henry Gantt, among others. One of Taylor's biggest advocates was Henry Ford.

Henry Ford applied scientific management to the production of the Model T in 1913 and reduced the time required to assemble a car from a high of 728 hours to 1-1/2 hours. A Model T chassis moved slowly down a conveyor belt with six workers walking along beside it, picking up parts from carefully spaced piles on the floor and fitting them to the chassis.[1] The

short assembly time per car allowed the Model T to be produced in high volumes, or "en masse," yielding the name **mass production.**

American manufacturers became adept at mass production over the next fifty years and easily dominated manufacturing worldwide. The human relations movement of the 1930s, led by Elton Mayo and the Hawthorne studies, introduced the idea that worker motivation, as well as the technical aspects of work, affected productivity. Theories of motivation were developed by Herzberg, Maslow, McGregor, and others. Quantitative models and techniques spawned by the operations research groups of World War II continued to develop and were applied successfully to manufacturing and services. Computers and automation led still another upsurge in technological advancements applied to operations. These events are summarized in Table 1.1.

**TABLE 1.1 Some Historical Events in Operations Management**

| *Era* | *Events/Concepts* | *Dates* | *Originator* |
|---|---|---|---|
| Industrial Revolution | Steam engine | 1769 | James Watt |
| | Division of labor | 1776 | Adam Smith |
| | Interchangeable parts | 1790 | Eli Whitney |
| Scientific Management | Principles of scientific management | 1911 | Frederick W. Taylor |
| | Time and motion studies | 1911 | Frank and Lillian Gilbreth |
| | Activity scheduling chart | 1912 | Henry Gantt |
| | Moving assembly line | 1913 | Henry Ford |
| Human Relations | Hawthorne studies | 1930 | Elton Mayo |
| | Motivation theories | 1940's | Abraham Maslow |
| | | 1950's | Frederick Herzberg |
| | | 1960's | Douglas McGregor |
| Management Science | Linear programming | 1947 | George Dantzig |
| | Digital computer | 1951 | Remington Rand |
| | Simulation, waiting line theory, decision theory, PERT/CPM | 1950's | Operations research groups |
| | MRP | 1960's | Joseph Orlicky, IBM |
| Quality Revolution | JIT (just-in-time) | 1970's | Taiichi Ohno (Toyota) |
| | TQM (total quality management) | 1980's | W. Edwards Deming, Joseph Juran |
| | Strategy and operations | 1990's | Wickham Skinner, Robert Hayes |
| | Business process reengineering | | Michael Hammer, James Champy |
| Information Age | EDI, EFT | 1970's | Numerous individuals and companies |
| | CIM (computer-integrated manufacturing), personal computers | 1980's | |
| | Internet, World Wide Web | 1990 | Tim Berners-Lee |
| Globalization | Worldwide markets and operations | 1990's | Numerous companies and nations |
| | Supply Chain Management | | |
| | Electronic commerce | | |
| | Mass customization | | |

From the Industrial Revolution through the 1960s, the United States was the world's greatest producer of goods and services, as well as the major source of managerial and technical expertise. Looking back, 1960 was probably the peak for American manufacturing. From then on, industry by industry, U.S. manufacturing superiority was challenged by lower costs and higher quality from foreign manufacturers, led by Japan.

In the 1970s, U.S. productivity rose an average of only 1.3 percent per year, and in the 1980s, barely 0.2 percent (with many years negative), while foreign competitors boasted annual increases of 4 percent and 5 percent. Several studies published during those years confirmed what the consumer already knew--U.S.-made products of that era were inferior and could not compete on the world market. Table 1.2 compares the product performance of U.S. versus

Japanese automobiles, semiconductors, air conditioners, and color televisions of the 1970s and 1980s.

**TABLE 1.2 A Comparison of American and Japanese Products in the 1970s and 1980s**

| *Quality of Automobiles* | *TGWs (things gone wrong) in First Eight Months per 100 cars* | |
|---|---|---|
| Chrysler | 285 | |
| GM | 256 | |
| Ford | 214 | |
| Japanese (avg.) | 132 | |
| Toyota | 55 | |
| *Quality of Semiconductors* | *U.S. Companies* | *Japanese Companies* |
| Defective on delivery | 16% | 0% |
| Failure after 1,000 hours | 14% | 1% |
| *Quality of Room Air Conditioners* | *U.S. Companies* | *Japanese Companies* |
| Fabrication defects | 4.4% | <0.1% |
| Assembly line defects | 63.5% | 0.9% |
| Service calls | 10.5% | 0.6% |
| Warranty cost (as % of sales) | 2.2% | 0.6% |
| *Quality of Color TVs* | *U.S. Companies* | *Japanese Companies* |
| Assembly line defects per set | 1.4 | 0.01 |
| Service calls per set | 1.0 | 0.09 |

SOURCES: National Academy of Engineering, *The Competitive Status of the U.S. Auto Industry* (Washington, D.C.: National Academy Press, 1982): 90-108; A. L. Robinson, "Perilous Times for U.S. Microcircuit Makers," *Science* (May 9, 1980): 582–86; D. Garvin, "Quality on the Line," *Harvard Business Review* (September–October 1983): 64–75; I. Magaziner and R. Reich, *Minding America's Business* (New York: Harcourt Brace Jovanovich, 1982): 176; M. Porter, *Cases in Competitive Strategy* (New York: Free Press, 1983): 511.

Early rationalizations that the Japanese success in manufacturing was a cultural phenomenon were disproved by the successes of Japanese-owned plants in the United States, such as the Matsushita purchase of a failing Quasar television plant in Chicago from Motorola. Part of the purchase contract specified that Matsushita had to retain the entire hourly work force of 1,000 persons. After only two years, with the identical workers, half the management staff, and little or no capital investment, Matsushita doubled production, cut assembly repairs from 130 percent to 6 percent, and reduced warranty costs from $16 million a year to $2 million a year. You can bet Motorola took notice. (Today Motorola is one of the success stories of American manufacturing.)

How did this come about? How did a country that dominated manufacturing for most of the twentieth century suddenly become no good at it? Quite simply, U.S. companies weren't paying attention. They thought mass production had solved the "problem" of production, so they delegated the function of manufacturing to technical specialists (usually engineers) who ignored changes in the consumer environment and the strategic importance of operations. Decisions were made based on short-term financial goals rather than long-term strategic initiatives.

In the 1980s, as a competitive response to comparable but cheaper products from foreign manufacturers, Motorola began assembling products offshore in Singapore, Puerto Rico, and the South Pacific. Production costs were lower, but the speed of production was insufficient to meet customer demands. Motorola decided to change manufacturing strategies and create a state-of-the-art production facility onshore for its paging products. Within eighteen months of the decision, the so-called Bandit project (because it borrowed the best technology) successfully completed the design of a new production system that was fast and cost competitive. The photo above shows part of the carefully designed assembly line. Pagers that used to take three weeks to manufacture took two hours on the new line. Further improvements reduced the lead time for customized pagers to less than ninety minutes from order placement to order shipment. It is no surprise that Motorola currently dominates the pager market.

Mass production can produce large volumes of goods quickly, but it cannot adapt very well to changes in demand. Today's consumer market is characterized by product proliferation, shortened product life cycles, shortened product development times, changes in technology, more customized products, and segmented markets. Mass production does not "fit" that type of environment. Using a concept known as just-in-time, Japanese manufacturers changed the rules of production from mass production to *lean production.* Lean production prizes flexibility (rather than efficiency) and quality (rather than quantity). The *total quality* fervor has since spread across the globe and is the focus of operations in many successful global enterprises.

The emphasis on quality and the *strategic importance* of operations is especially important today as continuing advances in information technology have further increased competition and customer expectations. Technology, together with changing political and economic conditions, have prompted an era of industrial *globalization* in which companies compete worldwide for both market access and production resources. Although both products and services are becoming more customized in wider global markets, services, in many cases, are the key to competitiveness.

Let's examine globalization, services, and competitiveness from an operations perspective.

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### ◆ Pause and Reflect ◆

**1-3.** Briefly describe how operations have been affected as we have moved from the Industrial Revolution to the current era of globalization.

**1-4.** Why did the United States experience competitive problems in the 1970s and 1980s?

## Services

In the United States and other highly industrialized nations, the economy has shifted away from manufacturing toward service industries. Nearly 80 percent of workers worldwide are employed in services. Services account for 75 percent of the gross domestic product (GDP) for the United States, and service jobs are expected to provide virtually the entire net gain in U.S. employment over the next decade. The expansion in service jobs is primarily in high-tech firms, too, in contrast to the predominantly low-pay, low-skilled service jobs of the past. U.S. service exports more than doubled from 1988 to 1998, providing a healthy trade surplus and helping to reduce the overall trade deficit. The foreign market for services, exceeding $1.2 trillion in 1996, has tremendous potential barely tapped by U.S. firms.

Six of the top ten firms on Fortune's Global 500 list are services and eight of the top ten largest employers are service firms. As services have grown in the worldwide economy, the distinction between service operations and manufacturing operations has become increasingly blurred. The preparation of hamburgers at McDonald's and the processing of packages at Federal Express look remarkably like assembly work in a factory. For machine tool and heavy equipment manufacturers, the installation and servicing of the equipment yields far greater returns than its physical manufacture. IBM markets itself as a provider of computer solutions, rather than a manufacturer of computers.


Lands' End, headquartered in Dodgeville, Wisconsin, is the largest specialty catalogue company in the United States. The company's products include casual and tailored clothing for men, women, and children, shoes and accessories, soft luggage, and items for bed and bath. Fast, efficient operations allows Lands' End to offer convenient at-home shopping of quality merchandise at competitive prices. We'll examine operations management at Lands' End throughout this text.

It is apparent that manufacturing and service operations go hand-in-hand. Manufacturing companies cannot function without the support of services such as accounting, personnel, advertising, transportation, financial and legal; and many services would not exist if the goods they support were not produced. Television repair shops would be obsolete without

televisions, and televisions would be no good without broadcasting services! In this text, we provide plentiful examples of both service and manufacturing operations, recognizing their common and unique concerns.

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**Pause and Reflect**

***1-8.** Access the Department of Commerce's site on International Trade in Services. Name the top five service exports. How does the export of services compare to the export of goods? To what country are most services exported? Comment on the balance of trade in services.

**These exercises require a direct link to a specific Web site. Click **Internet Exercises** for the list of internet links for these exercises.*

## Competitiveness

A global marketplace for both products and services means more customers and more intense competition. Competitiveness can be viewed from a national, industry, or firm perspective.

In the broadest terms, we speak of competitiveness in reference to other *countries* rather than to other companies. That's because competitiveness affects the economic success of a nation and the quality of life for its citizens. **Competitiveness** is "the degree to which a nation, can, under demanding and rapidly changing market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its citizens."[3] We measure a nation's competitiveness by its gross domestic product (GDP), import/export ratio, and increases in productivity.

### Productivity as a Measure of Competitiveness

**Productivity,** the most common measure of competitiveness, is calculated by dividing units of output by units of input.

$$\text{Productivity} = \frac{\text{output}}{\text{input}}$$

The predominant input in productivity calculations is *labor hours.* According to the Bureau of Labor Statistics, even though labor is the only factor of production explicitly considered, comparisons of productivity *over time* implicitly reflect the joint effects of many other factors, including technology, capital investment, capacity utilization, energy use, and managerial skills. Thus, productivity statistics provided in government reports typically measure *changes in productivity* from month to month, quarter to quarter, year to year, or over a number of years.

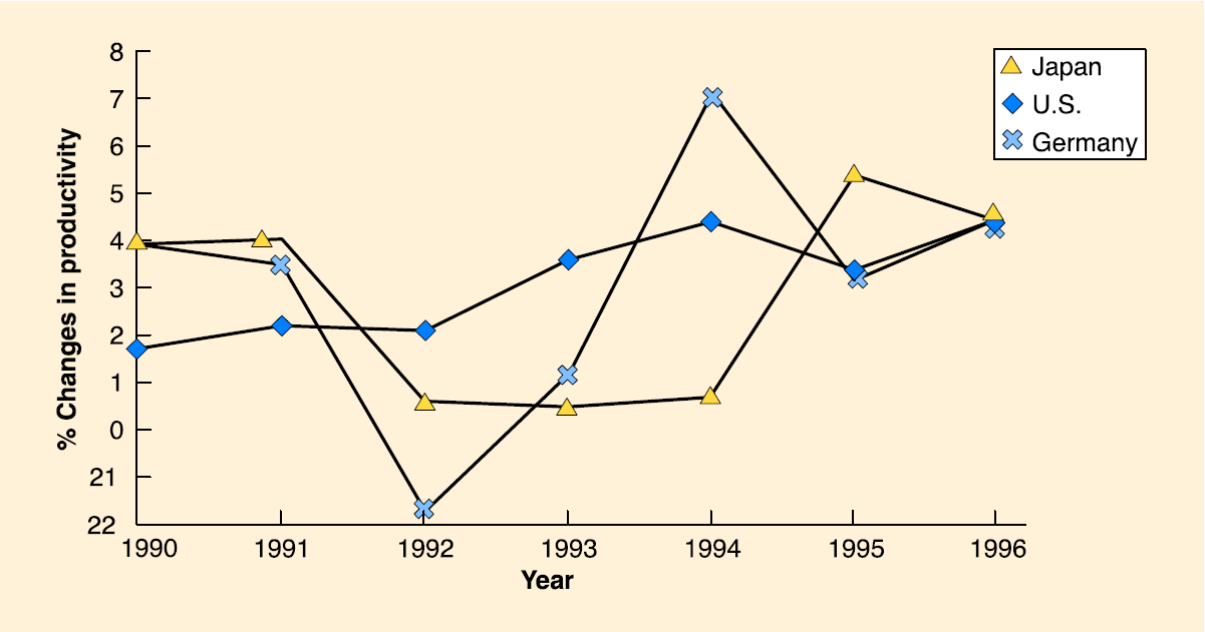


**FIGURE 1.7** Productivity in the 1990s

Figure 1.7 shows annual percent changes in productivity from 1990 to 1996 for the United States, Germany, and Japan. Although productivity varied widely in the first half of the 1990s, by 1996 the three countries had virtually identical rates of productivity growth. Upon further examination of the input and output data provided in Figure 1.8, however, we can see that the manner in which each country increased productivity differed significantly. Japan increased productivity solely by using its existing inputs more efficiently to produce greater output. The United States achieved the same effect by producing more output with a slight decrease in input. Germany did not increase output or input--rather, a slight decrease in output was offset by a dramatic decrease in input. Figure 1.8 also shows changes in input and output for France, Italy, Sweden, the United Kingdom, and Canada.

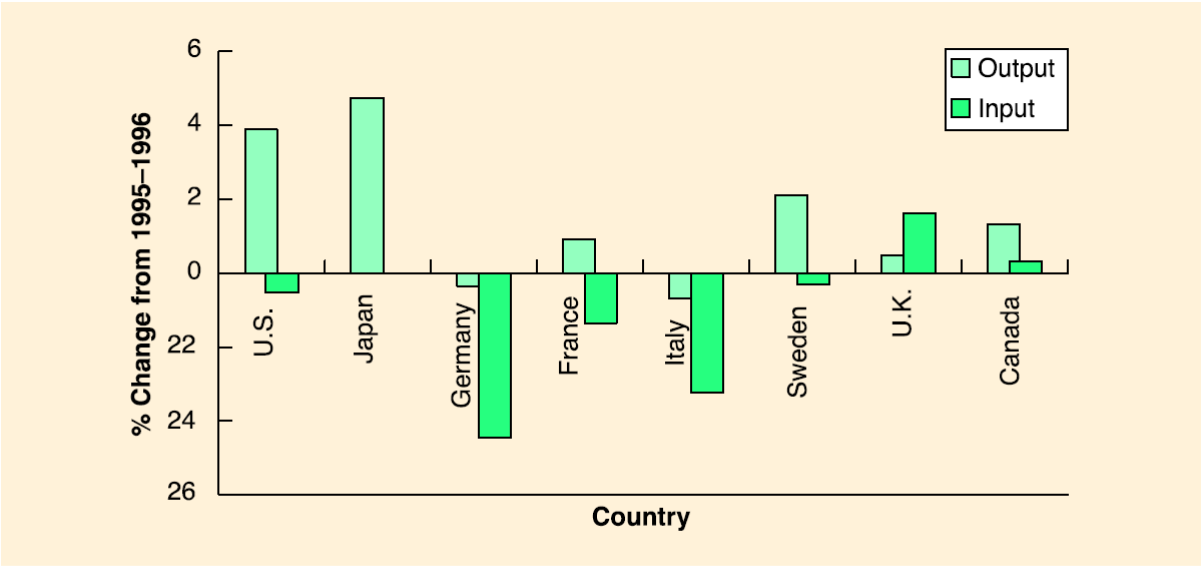


**FIGURE 1.8** Changes in Input and Output

Source: U.S. Department of Labor, Bureau of Labaor Statistics, *Foreign Labor Statistics* (2-9-98).

**Pause and Reflect**

**1-9.** Examine Figure 1.8. How did productivity change for France, Italy, Sweden, the United Kingdom, and Canada?

***1-10.** Investigate the role of government in improving industrial competitiveness. Begin with the U.S. Council on Competitiveness and United Kingdom's Study of Manufacturing and Business Processes. What is the state of industrial competitiveness in each country? What are the panel's concerns? Their recommendations? Find a similar site for at least one other country and compare their priorities and initiatives.

**These exercises require a direct link to a specific Web site. Click **Internet Exercises** for the list of internet links for these exercises.*

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[3]*Report of the President's Commission on Industrial Competitiveness,* chaired by John A. Young, President and CEO, Hewlett-Packard, 1985.

## Competitive Industries

Competition within industries is more intense when the firms are relatively equal in size and resources, products and services are standardized, and industry growth is either slow (so that one company gains at the expense of another) or exponential (so that gaining a foothold in the market is a strategic imperative). Industry competitiveness can be measured by the number of major players in the industry, average market share, and average profit margin. Probably the most competitive industry worldwide is pharmaceuticals, in which the largest manufacturer holds a mere 4.7 percent market share. Price wars, relentless advertising (such as nightly phone calls from long-distance carriers), frequency of new product or service introductions, and purchasing incentives (extended warranties, financial packages, switching bonuses, and so on) provide additional evidence of competition within industries.

In some industries, competition is limited because it is difficult for new firms to enter the industry. Many of the **barriers to entry**[4]--economies of scale, capital requirements, access to supply and distribution channels, and learning curves--are operations oriented. Let's explore them in more detail.

1. *Economies of scale.* In many industries, as the number of units produced increases, the cost of producing each individual unit decreases, which is known as **economies of scale.** New companies entering such an industry may not have the demand to support large volumes of production, and thus, their unit cost would be higher.
2. *Capital investment.* Large initial investments in facilities, equipment, and training may be required to become a "player" in some industries. For example, opening a new hospital requires an enormous investment in facilities, equipment, and professional personnel; in contrast, a day-care center may operate out of an existing home with only minimal equipment, training, and licensing requirements.
3. *Access to supply and distribution channels.* Existing firms within an industry have established supply and distribution channels that may be difficult for new firms to replicate. Examples: Toys 'R Us dominates its suppliers. Wal-Mart's information and

distribution systems provide a strong competitive advantage. VISA will not allow its member banks to do business with American Express.

4. *Learning curves.* Lack of experience can be a barrier to entry in an industry with significant learning curves. For example, U.S. firms dominate the aerospace industry because of their experience and expertise in airplane design and construction. However, this may not always be the case, as component manufacturers in Korea and Japan are gaining valuable experience as suppliers to aerospace firms. Shipbuilders claim a 10 percent learning curve (and corresponding cost advantage) for each similar vessel built. Hospitals performing heart transplants exhibit an amazing 79 percent learning curve.[5]

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### Pause and Reflect

***1-11.** Examine this year's Global 500 by industry. Which industries are the most competitive? Which industries are the least competitive? Are some industries dominated by certain countries? Which industries are the most profitable?

**1-12.** Explore the emergence of high-tech industries and the changing rules of competition. How does e-commerce affect competitiveness?

**1-13.** Discuss four common barriers that firms may experience as they try to enter a new industry.

**1-14.** Choose an industry on which you will be the class "expert" for the duration of this course. Write an initial profile of major players, customers, structure, and competitive issues.

**These exercises require a direct link to a specific Web site. Click **Internet Exercises** for the list of internet links for these exercises.*

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[4]These are adapted from Michael Porter, *Competitive Advantage* (New York: Free Press, 1985).

[5]David Smith and Jan Larson, "The Impact of Learning on Cost: The Case of Heart Transplantation," *Hospital and Health Services Administration* (Spring 1989): 85-97. Learning curves are discussed in more detail in Chapter 8.

## Issues and Trends in Operations

Operations is a field that is rapidly changing and growing in importance. Current issues and future trends in operations include:

1. *Intense competition.* The intensity of worldwide competition continues to increase. Global restructuring, the emergence of newly industrialized economies, and the Internet have opened new markets worldwide. As world markets grow, so do potential customers, as well as the number and quality of competitors.
2. *Global markets, global sourcing, and global financing.* Few companies are able to survive by competing in the domestic market alone. Companies need to learn about

foreign societies, understand foreign customers, build networks, and forge partnerships. Production takes place wherever in the world it can be done the cheapest, access to capital markets is worldwide, and the global supply chain reaches around the world.

3. *Importance of strategy.* Companies need long-term global strategies to survive in the marketplace. Vertically integrated partnerships, partnerships with other companies in the same industry, partnerships with educational institutions, and partnerships with government are needed to strengthen competitive positions. A new type of capitalism based on strategic alliances and cooperative specialization within industries may become a necessity.
4. *Product variety and mass customization.* An increasing variety of products and services will be offered, in many cases, customized for individuals. This means the expected life of products will continue to decrease, and product and service innovations will hit the market at an increasing rate.
5. *More services.* Eighty percent of jobs in the United States are provided by the service sector. Many corporations we think of as successful manufacturing firms, such as GM, GE, IBM, and Westinghouse, actually generate more than half of their income from services. For both manufacturing and service firms, *customer service* is a competitive battleground that will continue to intensify.
6. *Emphasis on quality.* The quality of products and services continues to improve as customer expectations of quality grow. Zero defects will be the norm. Quality that delights the customer and provides a competitive advantage will be the goal.
7. *Flexibility.* The most successful production systems are the most flexible, measured by the ability to adjust to changes in product design, changes in product mix, changes in the volume of demand, and changes in process technology.
8. *Advances in technology.* Information technology, electronic commerce, and telecommunications will continue to advance at a rapid rate. Advanced materials (metal-based composites, polymer-based composites, and high-tech ceramics), smart materials, advanced machining (EDM, lasers, electron beams, plasma flame cutting, flexible tooling and fixturing), intelligent sensors, smart robots, biotechnology, digital imaging, artificial intelligence, superconductors and supercomputing will dramatically change how products and services are designed and how firms compete.
9. *Worker involvement.* The empowerment of the workforce has had a significant impact on operations in the 1990s. This trend will continue in the future as the ability to create, absorb, and utilize *knowledge* holds the key to success. Countries that perform the best in the world market will have the best research and development (R&D), the best education system, the brightest people, and the savvy to use those assets to their fullest.
10. *Environment and ethical concerns.* Companies and industries increasingly consider the environmental impact of the design, manufacture, distribution, use, and disposal of their products and services. The impetus for environmental responsibility may shift from government regulations to customer requirements. As companies compete and produce across national borders, corporate ethics and social responsibility will be dictated more by customer expectations and corporate culture than by legalities in the host country.

## THE COMPETITIVE EDGE

## Malden Mills' Greatest Asset--Its People

A five-alarm fire destroys your textile factory in Massachusetts where costs are high. Do you retire and pocket the insurance money? Do you use the opportunity to relocate to the Sunbelt or overseas? Not if you're Aaron Feuerstein, the 70-year-old owner of Malden Mills. You rebuild on the same site, and you pay full wages to your 1,000 employees until production can be restarted--that's a $15 million payout for months of idle labor. Crazy, you say? Feuerstein calls it good business.

"Why would I chase cheap labor [or alienate my workers] when I might run the risk of losing the advantage I've got, which is superior quality?" says Feuerstein. The key to continued success is to create unsurpassed *value* "with superior products, service, teamwork, productivity and cooperation with the buyer." To do that, you need capable, experienced textile designers, engineers, and workers.

It's Malden's workers that give the company its competitive edge. Employee retention at Malden Mills is above 95 percent--so is customer retention. The correlation between loyal customers and loyal employees is no coincidence. In the 1980s, when the market for its major product--artificial furs--collapsed, it was employees in R&D and production who saved the company by inventing a new fabric called *Polartec.* L. L. Bean, Lands' End, Patagonia, North Face, and Eddie Bauer buy as much of the fabric as Malden can supply.

At the European trade show one year after the fire, Malden introduced a new line of fabric based on Polartec--for upholstery. Maybe those workers weren't complete couch potatoes after all.

*Source:* Thomas Teal, "Not a Fool, Not a Saint," *Fortune* (November 11, 1996): 201-4.

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### Pause and Reflect

***1-16.** Look for articles related to operations management in Fortune, Business Week, or CNN. How do they relate to the trends in operations discussed in the chapter?

***1-17.** Operations management is one of the most popular courses at Harvard Business School. From the days of Wickham Skinner, Harvard has been known for its operations expertise. Link to the Technology and Operations Management unit at Harvard. Read and summarize one of the working papers of the faculty.

**1-18.** List several issues and trends in operations for the future. What actions do you recommend to prepare for the future challenges?

**These exercises require a direct link to a specific Web site. Click **Internet Exercises** for the list of internet links for these exercises.*

# Primary Topics in Operations Management

There are many issues, concepts, and techniques associated with the field of operations management (OM). This text is designed as an introductory survey course in OM that covers many different topics. In the following sections, we provide a brief overview of the primary topics in operations management. They are presented in the order in which operational decisions are made within a firm. It is not a coincidence that the chapters in this text are organized in a similar fashion.

## Deploying Strategy

Strategy is only as good as the results it produces. Good results require that the corporation vision and strategic plan be converted into a series of consistent, achievable action plans to be deployed throughout the organization. Operations strategy must be consistent with corporate strategy and may provide the distinctive competence on which a firm competes. This topic appears in the text as *operations strategy.*

## Assuring Quality

Quality drives operational decisions. The level of quality a company seeks to achieve is a strategic decision that eventually determines how a product is made or a service is delivered. Designing products and services, designing and planning the production process, locating and developing the production facility, designing jobs and work activities, and planning and scheduling the flow of products throughout the system are all areas of operations management that are increasingly dominated by quality. For this reason, the first two topics presented after the initial discussion of strategy are *quality management* and *statistical quality control.*

## Designing Products and Services

The traditional starting point in the production process is designing the product or service. Decisions related to design include converting customer requirements to product or service characteristics, determining the desired level of quality, selecting materials, and evaluating the resulting production costs. This topic is covered in the text as *product and service design.*

## Planning the Production Process

Once the product or service has been designed, the physical process that will produce the product or deliver the service must be constructed. Plans are developed for acquiring materials, determining the types of job skills, equipment, and technology required, and managing the process. This topic is referred to as *process planning, analysis, and reengineering.*

## Laying Out the Facility

The production process that has been designed must be physically housed in a facility and laid out in an effective manner so that the product can be produced or service delivered as efficiently as possible. Decision making focuses on how to arrange different parts of the production or delivery process in the facility in order to ensure a smooth flow and minimal cycle time. The title of this area of operations management is *facility layout.*

## Designing Jobs and Work

A primary component of the production process is the work performed by people, alone, together, or with machines and equipment. *Human resources management* is the area of OM concerned with making sure that jobs meet the requirements of the production process in the most efficient and effective manner possible.

## Managing the Supply Chain

Once the production process and facility have been designed, decisions must be made regarding where to locate the facility in relation to customers and suppliers and how to manage the supply chain. A *supply chain* encompasses all the facilities, functions, and activities involved in producing and delivering a product or service, from the suppliers (and their suppliers) to the customer (and their customers).

## Forecasting Demand for Products and Services

Once the physical facility and production process are in place to produce a product or deliver a service, a host of planning decisions are required to determine how much to produce and when to produce it. These decisions are based on customer demand. *Forecasting* involves using a number of different methods and quantitative techniques to provide accurate estimates of demand, which are subsequently used to make production decisions.

## Production Planning and Scheduling

Once management has determined how much product or service is needed to meet the demand, production schedules that involve a myriad of decisions are developed. These decisions include how much material or how many parts to order, when material or parts should be ordered, how many workers to hire, and how these workers should be scheduled on jobs and machines. Decisions must also be made to ensure the amount of inventory available at each stage of the production process is sufficient to avoid unnecessary delays, and the amount of final inventory is sufficient to meet customer demand. For service operations, the number of servers required to serve customers in a timely manner must be established. Production planning represents a major area of decision making in operations management and includes the topics of *capacity and aggregate production planning, inventory management, material requirements planning, scheduling, just-in-time systems, service improvement,* and *project planning.*

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### Pause and Reflect

**1-19.** What activities are involved in the operations function? Which activities are related to your major? What would you be especially interested in learning in this course?