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# Introduction to Operations and Supply Chain Management

In this chapter, you will learn about . . .

- The Operations Function
- The Evolution of Operations and Supply Chain Management
- Globalization
- Productivity and Competitiveness
- Strategy and Operations
- Organization of This Text
- Learning Objectives of This Course



## Operations and Supply Chain Management FOR CHOCOLATE



**T**HROUGHOUT THIS TEXT, we'll use chocolate to introduce the topics to be covered in each chapter. The cacao bean, from which chocolate is made, is the third most traded raw material in the world. We'll trace the path of cacao beans through the supply chain from South America and the Ivory Coast of Africa through the roasters, brokers, and importers, to global factories and regional distribution centers, to local stores and other outlets that sell the myriad types of chocolate products. We'll look at large and small companies, specialty products, mass-produced products, and services. We'll cover design and quality, processes and technology, planning and control, supply chains, and more. At each stage we'll illustrate how the principles of operations and supply chain management can be applied. Join us on this journey through the world of chocolate.

- **Operations management:** the design, operation, and improvement of productive systems.

- **Operations:** a function or system that transforms inputs into outputs of greater value.
- **Value chain:** a series of activities from supplier to customer that add value to a product or service.

**O**perations management designs, operates, and improves productive systems—systems for getting work done. The food you eat, the movies you watch, the stores in which you shop, and the books you read 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.

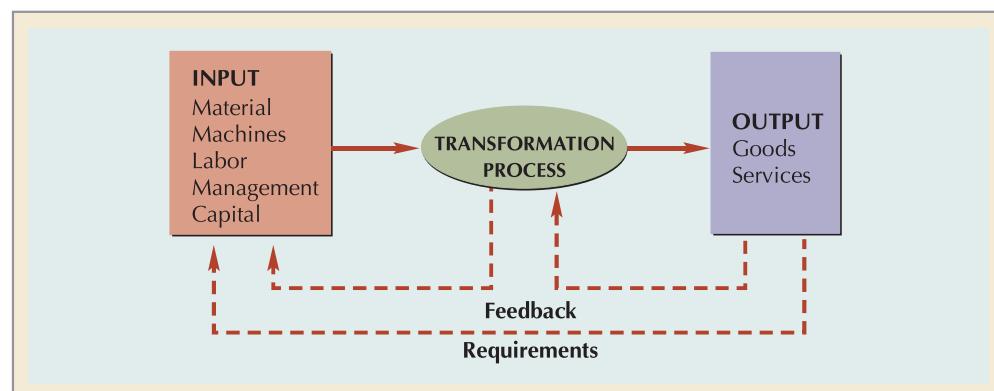
The input–transformation–output process is characteristic of a wide variety of operating systems. In an automobile factory, sheet steel is formed into different shapes, painted and finished, and then assembled with thousands of component parts to produce a working automobile. In an aluminum factory, 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

<i>physical,</i>	as in manufacturing operations;
<i>locational,</i>	as in transportation or warehouse operations;
<i>exchange,</i>	as in retail operations;
<i>physiological,</i>	as in health care;
<i>psychological,</i>	as in entertainment; or
<i>informational,</i>	as in communication.

## 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.

**Figure 1.1**  
Operations as a Transformation Process



## ALONG THE SUPPLY CHAIN

### What Do Operations and Supply Chain Managers Do?

Operations managers are the *improvement people*, the realistic, hard-nosed, make-it-work, get-it-done people; the planners, coordinators, and negotiators. They perform a variety of tasks in many different types of businesses and organizations.



Tom McCarthy/Index Stock



iStockphoto

Let's meet Claire Thielen, director of informatics at ARAMARK Healthcare; Ada Liu, division manager for Li & Fung Trading Company; and Erin Hiller, food technologist at a major chocolate manufacturer.

Claire Thielen is a health-care professional who specializes in decision support, process improvement, and organizational performance. She facilitates interdisciplinary teams as they pursue continuous quality improvement projects and analyzes methods and systems for managing information. Her projects include determining staffing patterns and workflow for computerized scheduling systems; consolidating policies, procedures, and practices for hospital mergers;



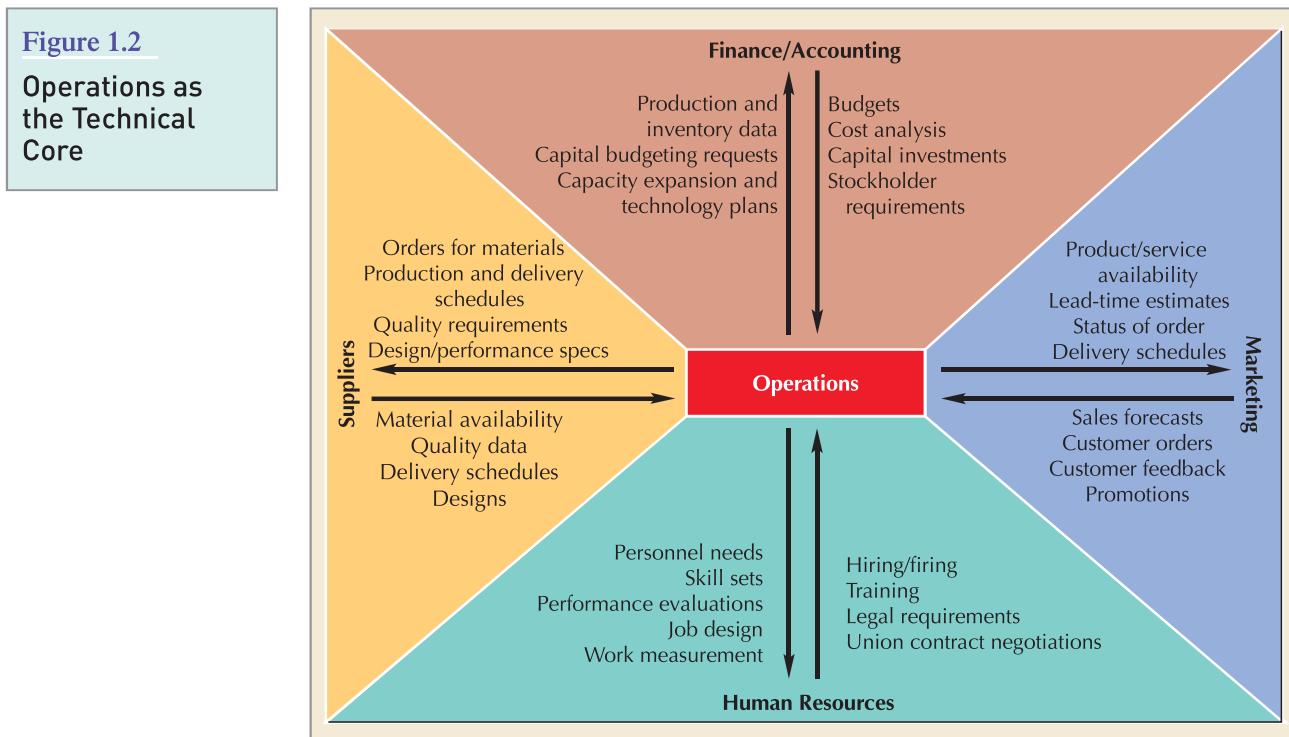
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developing and implementing balanced scorecards and benchmarking reports; designing clinical studies of new medication effectiveness; and conducting training sessions on process mapping and analysis. Claire Thielen improves quality, productivity, and information in the health-care industry.

Ada Liu is a division manager for Li & Fung, a global sourcing company. She coordinates global production and distribution for major players in the garment industry. For one particular trouser order, she had the fabric woven in China (for their unique dyeing process), chose fasteners from Hong Kong and Korea (for their durability), and sent the raw materials to Guatemala for sewing (for their basic skills, low cost, and proximity to the United States). If problems should arise, Liu can reroute the order to one of its 7,500 suppliers in 37 countries. Ada Liu is a supply chain expert for Li & Fung.

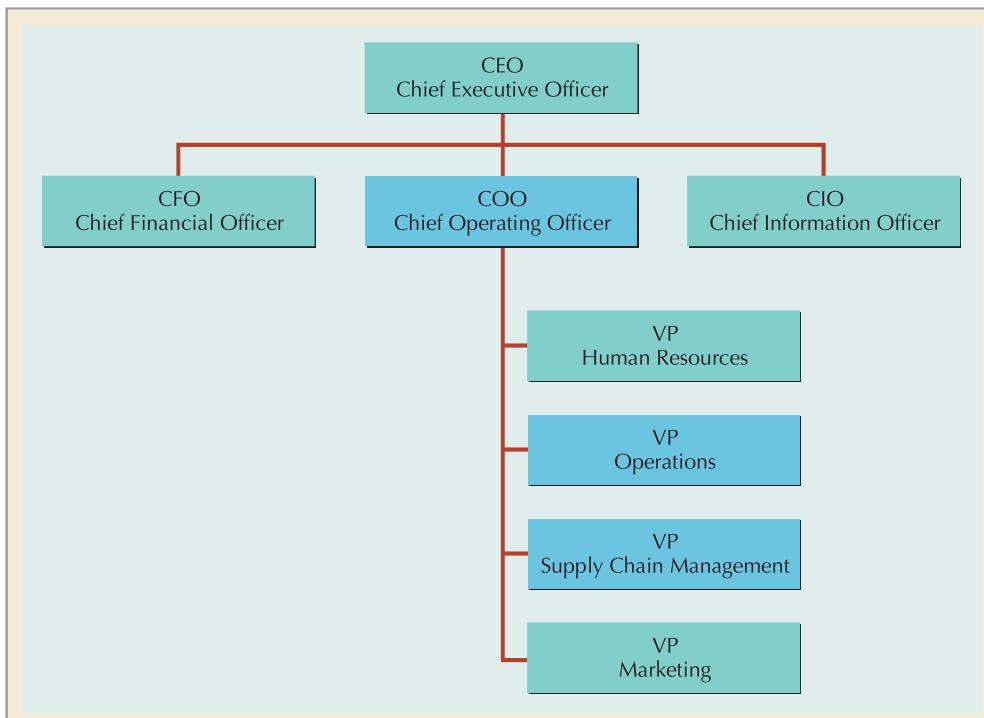
Erin Hiller is a food technologist at a major chocolate manufacturer. She supports product, process, and cost improvement activities across various product lines in the manufacturing facilities. She undertakes, initiates, and coordinates projects for determining process capabilities, reducing waste and rework, and improving both quality and productivity. She evaluates new and emerging technologies and determines whether they would be beneficial to the product lines and manufacturing operations. Erin Hiller keeps operations up-to-date and running smoothly for making chocolate.

*Sources:* Claire Theilen, LinkedIn, accessed January 10, 2010; Joanne Lee-Young, "Furiously Fast Fashions." *The Industry Standard Magazine*, (June 22, 2001); Job posting, <http://jobview.monster.com/Food-Technologist-Confectionery-Chocolate-Experience-Job>, accessed January 10, 2010 (fictional name).



The four primary functional areas of a firm are marketing, finance, operations, and human resources. As shown in Figure 1.2, for most firms, operations is the technical core or “hub” of the organization, interacting with the other functional areas and suppliers to produce goods and provide services for customers. For example, to obtain monetary resources for production, operations provides finance and accounting with production and inventory data, capital budgeting requests, and capacity expansion and technology plans. Finance pays workers and suppliers, performs cost analyses, approves capital investments, and communicates requirements of shareholders and financial markets. Marketing provides operations with sales forecasts, customer orders, customer feedback, and information on promotions and product development. Operations, in turn, provides marketing with information on product or service availability, lead-time estimates, order status, and delivery schedules. For personnel needs, operations relies on human resources to recruit, train, evaluate, and compensate workers and to assist with legal issues, job design, and union activities. Outside the organization operations interacts with suppliers to order materials or services, communicate production and delivery requirements, certify quality, negotiate contracts, and finalize design specifications.

As a field of study, operations brings together many disciplines and provides an integrated view of business organizations. Operations managers are in demand in business, industry, and government. Chief operating officers (COOs) run major corporations as shown in Figure 1.3, Vice-presidents of Operations and Supply Chain Management oversee scores of departments, facilities, and employees. Typical jobs for new college graduates include business process analyst, inventory analyst, project coordinator, unit supervisor, supply chain analyst, materials manager, quality assurance specialist, production scheduler, and logistics planner. Even if you do not pursue a career in operations, you'll be able to use the ideas you learn in this course to organize work, ensure quality, and manage processes. Regardless of your major, you can apply some aspect of operations management to your future career—as did Mark, Nicole, John, Vignesh, Margie, and Anastasia who tell their stories in Figure 1.4 and the OM Dialogues dispersed throughout the text. Let's hear first from Mark Jackson, marketing manager for Pizza Hut.



**Figure 1.3**  
**Sample  
Organizational  
Structure**

**Figure 1.4**  
**How Is Operations  
Relevant  
to My Major?**





### MARK JACKSON, Marketing Manager for Pizza Hut

As regional marketing manager for Pizza Hut, I'm responsible for 21 stores. It's my job to make sure each store is operating properly and, when new products come out, to see that they are given the attention they deserve. I also coach managers and employees about their job and their relationship with the customer.

You would think that a marketing manager's job would be concerned solely with advertising, special promotions, store signage, customer service, and the like. But we also deal with quality, forecasting, logistics, and other operational issues. Marketing and operations are almost inseparable in services. We can come out with a new product and spend mega bucks advertising it, but if the product is not made or delivered properly, all is lost.

The most important aspect of quality is consistency—so that the customer gets the same pizza at any Pizza Hut from whichever cook happens to be on shift. We have exact standards and specifications for our products, and it's important that operating procedures be followed.

Scheduling is somewhat of a headache because of staff turnover and individual limitations on working hours. Some of that is alleviated in our new system where we allow employees to request days off up to six months in advance. They can put requests into the

system when they clock in each day, and they can view upcoming schedules.

Our forecasting system keeps historical data on sales by hour and day of the week five years back. Forecasts are weighted averages of past demand—usually 60% of the past two weeks' sales and 40% of the past six weeks' sales. A manager can freeze the forecast and make manual adjustments, such as increasing demand during a home football game weekend or when a local festival is under way. Managers can also enter notes into the system when unusual occurrences affect demand, like a snow-storm. When the forecast is set, it generates a labor plan for the week, along with prep plans for salad, dough, breadsticks, and so forth. The labor plan just specifies the number of workers needed; it is up to the manager to do the detailed scheduling of individuals.

After quality, it's all about speed of delivery—whether to the customer's table or to the customer's home. We have initiatives such as *Ready for Revenue* where we pre-sauce and pre-cheese in anticipation of customer orders, and *Aces in Their Places* where we make sure the best people are scheduled and ready to go for peak demand periods. As for delivery, we keep track of percent of deliveries under 39 minutes and percent of deliveries to promise. We found we could significantly reduce the number of drivers needed (and keep the same customer satisfaction numbers) by promising delivery within 39 minutes rather than 30. We also are more efficient now that dispatching divides our delivery areas into delivery pods and uses computerized estimates of transit time.

Now that you are aware of how operations might relate to your interests, let's take a brief look at how the field of OM has evolved to its present state.

## THE EVOLUTION OF OPERATIONS AND SUPPLY CHAIN 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 workers on limited, repetitive tasks allowed them 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

### ● Craft production:

the process of handcrafting products or services for individual customers.

### ● Division of labor:

dividing a job into a series of small tasks each performed by a different worker.

### ● Interchangeable parts:

the standardization of parts initially as replacement parts enabled mass production.

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, Henry Gantt, and 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  $1\frac{1}{2}$  hours. A Model T chassis moved slowly down a conveyor belt with six workers walking alongside it, picking up parts from carefully spaced piles on the floor and fitting them to the chassis.<sup>1</sup> 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 50 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 Frederick Herzberg, Abraham Maslow, Douglas 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.

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. But in the 1970s and 1980s, industry by industry, U.S. manufacturing superiority was challenged by lower costs and higher quality from foreign manufacturers, led by Japan. 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. 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 workforce of 1000 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% to 6%, and reduced warranty costs from \$16 million a year to \$2 million a year. You can bet Motorola took notice, as did the rest of U.S. industry.

The **quality revolution** brought with it a realization that production should be tied to consumer demand. Product proliferation, shortened product lifecycles, shortened product development times, changes in technology, more customized products, and segmented markets did not fit mass production assumptions. Using a concept known as just-in-time, Toyota changed the rules of production from mass production to **lean production**, a system that prizes flexibility (rather than efficiency) and quality (rather than quantity).

The renewed emphasis on quality and the *strategic importance* of operations made some U.S. companies competitive again. Others continued to stagnate, buoyed temporarily by the expanding economies of the Internet era and globalization. Productivity soared as return on investment in information technology finally came to fruition. New types of businesses and business models emerged, such as Amazon, Google, and eBay, and companies used the Internet to connect with customers and suppliers around the world. The inflated expectations of the dot-com era came to an end and, coupled with the terrorist attacks of 9-11 and their aftermath, brought many companies back to reality, searching for ways to cut costs and survive in a global economy. They found relief in the emerging economies of China and India, and began accelerating the outsourcing of not only goods production, but services, such as information technology, call centers, and other business processes. The outsourcing of business processes brought with it a new awareness of business-to-business (B2B) services and the need for viewing services as a science.

● **Scientific management:**

the systematic analysis of work methods.

● **Mass production:**

the high-volume production of a standardized product for a mass market.

● **Quality revolution:**

an emphasis on quality and the strategic role of operations.

● **Lean production:**

an adaptation of mass production that prizes quality and flexibility.

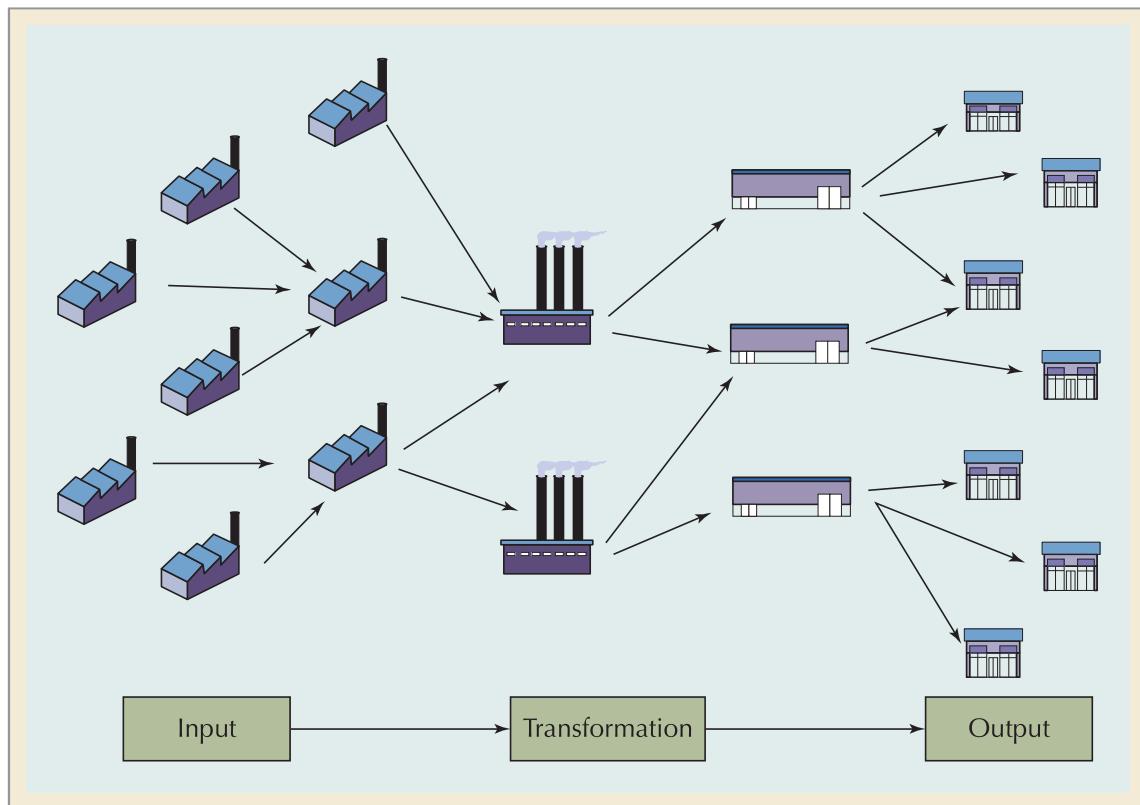
<sup>1</sup>David Halberstam, *The Reckoning* (New York: William Morrow, 1986), pp. 79–81.

**Table 1.1**  
**Historical Events  
in Operations  
Management**

Era	Events/Concepts	Dates	Originator
Industrial Revolution	Steam engine Division of labor Interchangeable parts	1769 1776 1790	James Watt Adam Smith Eli Whitney
Scientific Management	Principles of scientific management Time and motion studies Activity scheduling chart Moving assembly line	1911 1911 1912 1913	Frederick W. Taylor Frank and Lillian Gilbreth Henry Gantt Henry Ford
Human Relations	Hawthorne studies Motivation theories	1930 1940s 1950s 1960s	Elton Mayo Abraham Maslow Frederick Herzberg Douglas McGregor
Operations Research	Linear programming Digital computer Stimulation, waiting line theory, decision theory PERT/CPM MRP, EDI, EFT, CIM	1947 1951 1950s 1960s 1970s	George Dantzig Remington Rand Operations research groups  Joseph Orlicky, IBM, and others
Quality Revolution	JIT (just-in-time) TQM (total quality management) Strategy and operations Reengineering Six Sigma	1970s 1980s  1990s 1990s	Taiichi Ohno (Toyota) W. Edwards Deming, Joseph Juran  Wickham Skinner, Robert Hayes Michael Hammer, James Champy GE, Motorola
Internet Revolution	Internet, WWW ERP supply chain management E-commerce	1990s  2000s	ARPANET, Tim Berners-Lee SAP, i2 Technologies, ORACLE, DELL  Amazon, Yahoo, eBay, Google and others
Globalization	World Trade Organization European Union Global supply chains Outsourcing Service Science	1990s 2000s	China, India Emerging economics
Green Revolution	Global warming An Inconvenient Truth KYOTO	Today	Numerous scientists, statesmen, governments

- **Supply chain management:** managing the flow of information, products, and services across a network of customers, enterprises, and suppliers.

With more and more activities taking place outside the enterprise in factories, distribution centers, offices and stores overseas, managers needed to develop skills in coordinating operations across a global supply chain. The field of **supply chain management** was born to manage the flow of information, products, and services across a network of customers, enterprises, and supply chain partners. In Figure 1.1, we depicted operations as a transformation process. Extending that analogy in Figure 1.5, supply chain management concentrates on the input and output sides of transformation processes. Increasingly, however, as the transformation process is performed by suppliers who may be located



**Figure 1.5**  
**Supply Chain Management**

around the world, the supply chain manager is also concerned with the timeliness, quality, and legalities of the supplier's operations.

The era of globalization was in full swing in 2008 when a financial crisis brought on by risky loans, inflated expectations, and unsavory financial practices brought the global economy to a standstill. Operations management practices based on assumptions of growth had to be reevaluated for declining markets and resources. At the same time, concerns about global warming (worldwide) and health-care operations (domestically) ramped up investment and innovation in those fields.

It is likely that the next era in the evolution of OM will be the *Green Revolution*, which some companies and industries are embracing wholeheartedly, while others are hesitant to accept. We discuss green initiatives at length later in the text. The next section presents a brief discussion of globalization.

**The Green Revolution is the next era in OM.**

## GLOBALIZATION

Two thirds of today's businesses operate globally through global markets, global operations, global financing, and global supply chains. Globalization can take the form of selling in foreign markets, producing in foreign lands, purchasing from foreign suppliers, or partnering with foreign firms. Companies "go global" to take advantage of favorable costs, to gain access to international markets, to be more responsive to changes in demand, to build reliable sources of supply, and to keep abreast of the latest trends and technologies.

Falling trade barriers and the Internet paved the way for globalization. The World Trade Organization (WTO) has opened up the heavily protected industries of agriculture, textiles, and telecommunications, and extended the scope of international trade rules to cover services, as well as goods. The European Union (EU) required that strict quality and environmental standards be met before companies can do business with member countries. Strategic alliances, joint ventures,

- **Internet Exercises**





licensing arrangements, research consortia, supplier partnerships, and direct marketing agreements among global partners have proliferated.

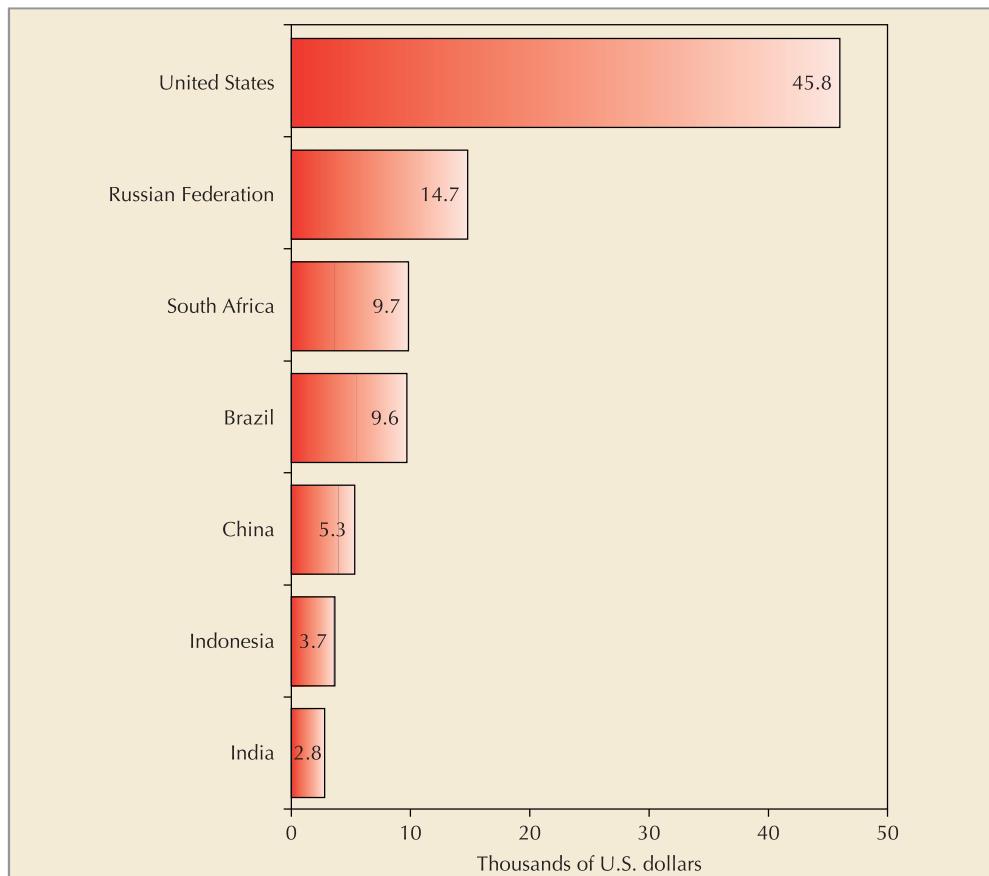
Figure 1.6 shows the hourly wage rates in U.S. dollars for production workers in nine countries. Wage rates in Norway are the highest at \$48.56 an hour, with comparable rates in Denmark. The United States and Japan pay workers \$24.59 and \$19.75 an hour, respectively, while China and Sri Lanka exhibit the lowest wage rates of \$0.81 and \$0.61 an hour. To put the wage differentials in perspective, a U.S. worker receives roughly the equivalent sum of money for working one hour as a Sri Lankan worker earns in a 40-hour week (\$24.40). China's wage rate is \$32.40 a week. Not surprisingly, much of the world has moved its manufacturing to Asia, in particular to the large and populous country of China.

## THE CHINA FACTOR

China accounts for 20% of the world's population and is the world's largest manufacturer, employing more production workers than the United States, United Kingdom, Germany, Japan, Italy, Canada, and France combined. Its 1.3 billion people represent not only an immense labor market, but a huge consumer market as well. As China's industrial base multiplies, so does its need for machinery and basic materials, and as more companies move to China, so do their suppliers and their supplier's suppliers. Although initially the preferred location for the production of low-tech goods such as toys, textiles, and furniture, China has become a strategic manufacturing base for nearly every industry worldwide.

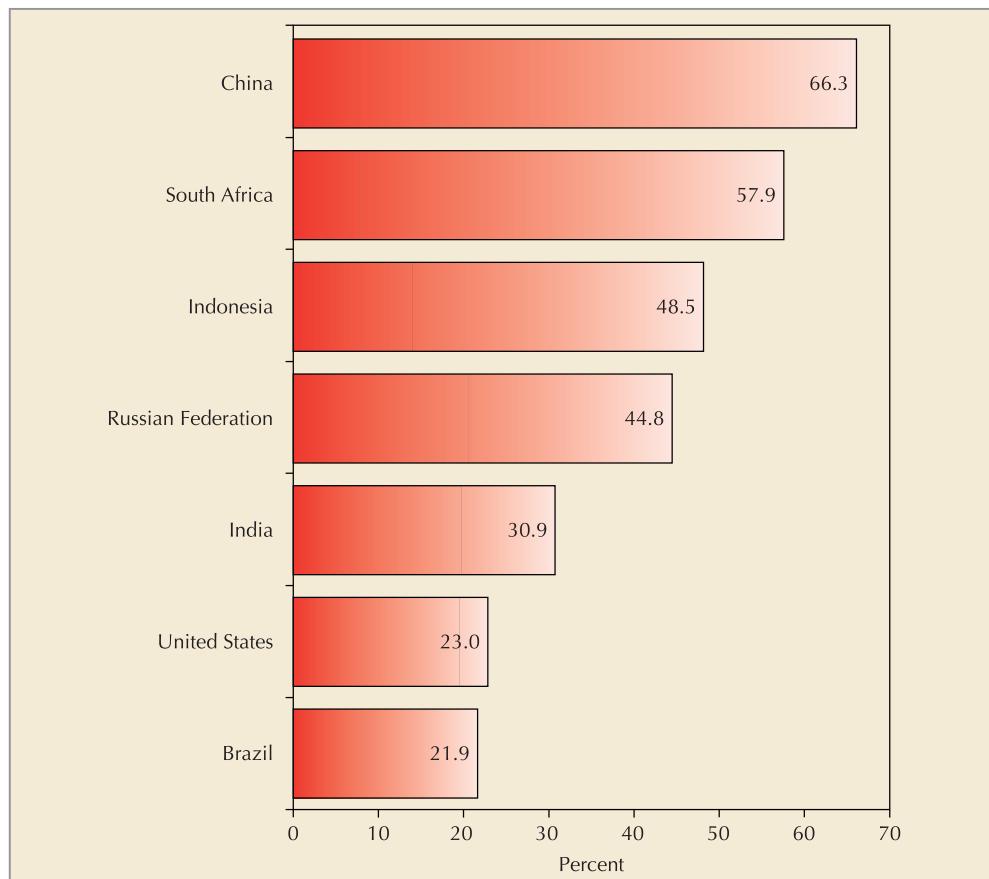
The scale of manufacturing in China is mind-boggling. For example, Foxconn (the trade name of Taiwan's Hon Hai Precision Industry Company) has two enormous industrial complexes in mainland China. The Guangdong Province site employs and houses approximately 270,000 workers, with its own dormitories, restaurants, hospital, police force, chicken farm, and soccer stadium. There are 40 separate production facilities "on campus," each dedicated to one of its major customers such as Apple, Dell, Motorola, Sony, Nintendo, and HP. Foxconn is the world's largest electronics manufacturer and China's largest exporter. It also represents a shorter supply chain because it *makes* components as well as *assembles* final products. Currently, Foxconn is making a bid to enter the retail market in China and is expanding production into Mexico to better serve the U.S. market.

Figure 1.7 shows the gross domestic product (GDP) per capita for the United States and the largest emerging economies. China's GDP per capita is about 12% of the U.S. level. However, as shown in Figure 1.8, China's trade as a percent of GDP is almost triple that of the United States. Having a producer economy and healthy trade balance is an advantage in a global slump. China has problems with pollution, quality, and corruption but is steering its way out of the recession and entering into what it calls "the decade of China."



**Figure 1.7**  
**GDP per Capita**

Source: U.S. Department of Labor,  
*A Chartbook of International Labor  
Comparisons*, Washington, DC:  
March 2009, p. 39.



**Figure 1.8**  
**Trade in Goods as  
a Percent of GDP**

Source: U.S. Department of Labor,  
*A Chartbook of International Labor  
Comparisons*, Washington, DC:  
March 2009, p. 43.

Yann Layma/Getty Images, Inc.



*With over 18 million people, 5,000 skyscrapers, and the world's largest deep sea container port, Shanghai is China's largest city, and the financial heart of the burgeoning economy.*

While China's manufacturing prowess may seem unbeatable, many companies have sought to reduce the risk of sourcing from only one country by expanding trade relationships with other low-cost countries, particularly India, Bangladesh, Pakistan, Vietnam, and to a lesser extent, Indonesia and Eastern Europe. Because of its proximity to the United States, Mexico and several Central American countries are popular sources for shorter lifecycle products.

Whether or not a company decides to do business with China, every company must consider the implications of the "China factor" on their profitability and competitive position. Managing global operations and quality in a far-reaching supply chain is an added challenge for operations and supply chain managers. Keeping domestic production competitive is an even bigger challenge. The New Balance "Along the Supply Chain" box shows how one company has met that challenge.

### • Virtual Tour



## ALONG THE SUPPLY CHAIN



### The Balancing Act at New Balance

Boston-based New Balance Corporation is a nonconformist in many ways. It refuses to hire superstars to endorse its product, it shuns style in favor of performance, it holds fast to its emphasis on running shoes, and it is committed to manufacturing at least some of its product in the United States. New Balance currently has five factories in the United States, the last of its kind of makers of athletic shoes. It also has wholly-owned subsidiaries in 13 countries and a number of licensees, joint ventures, and distributors all over the globe.

Of its domestic production, owner Jim Davis says "it's part of the company's culture to design and manufacture here." Producing close to their customers also allows quick turnarounds on new designs and order fulfillment. At New

Balance's factory in Norridgewock, Maine, well-trained employees make \$14 an hour working in small teams performing half-a-dozen different jobs and switching tasks every few minutes. They operate computerized sewing equipment and automated stitchers that allow one person to do the work of 20.

New Balance is able to remain competitive at home by creatively adapting new technologies to shoemaking and constantly training their employees in teamwork and technical skills. Employees start with 22 hours of classroom training on teamwork and get constant training on the factory floor. They work in teams of five or six, sharing tasks and helping one another to make sure everything gets done. Many of the ideas for process improvement come from shop floor workers.

(Continued)



Tammie Arroyo/©AP/Wide World Photos

Says Davis, "In Asia, their labor is so inexpensive that they waste it. Ours is so dear that we come up with techniques to be very efficient." Borrowing technology from apparel manufacturers, New Balance purchased 70 see-and-sew machines for \$100,000 each and set up on-site machine shops to grind the 30 templates needed for a typical shoe. Making each set of templates takes about a week, but they allow workers to produce a pair of shoes in 24 minutes, versus 3 hours in China. Labor cost per shoe is \$4 an hour in Maine

compared to \$1.30 in China. The \$2.70 labor cost differential is a manageable 4% of the \$70 selling price.

Staying involved with the manufacturing process helps New Balance develop better designs, improve quality, and innovate their processes, capabilities the company would lose if it outsourced all of its production. But staying in one country is not advantageous either, especially when a 10% market share of athletic shoes in China would be the equivalent of 100 million customers. New Balance relaunched a China strategy to prepare for the 2008 Beijing Olympic Games. To sell in China, it is necessary to produce there.

The company's earlier foray into outsourcing on the mainland was not a good experience. In one of the most notorious cases of counterfeiting, New Balance's own supplier flooded the market with unauthorized New Balance footwear and continued to do so even after the contact was canceled. New Balance spent millions of dollars in legal fees and lost millions more in sales without a satisfactory resolution to the problem. Today, the company has reduced the number of Asian suppliers and monitors them more closely. New Balance continues the balancing act between domestic and foreign production, and strives to produce closer to its markets, wherever in the world they might be.

Think about the differences between New Balance and Nike. How has each company chosen to compete? What types of shoes might New Balance want to make in its own factories? What types of shoes might it outsource?

*Sources:* Gabriel Kahn, "A Sneaker Maker Says China Partner Became Its Rival," *The Wall Street Journal* (December 19, 2002), pp. A1, A8; "New Balance Shoots for Second in Local Market," *China Daily* (November 13, 2003); "A Balancing Act," *Business and Industry* (February 11, 2004), p. 22; Anne Thompson, "Companies Buck the Outsourcing Trend," NBC News (May 12, 2006); New Balance Web site, <http://www.newbalance.com/usa/>

## INDIA, THE WORLD'S SERVICE PROVIDER

Although we may think of globalization more in the context of products than services, there has been a dramatic rise in the global outsourcing of services as well. It began with back-office work such as accounting, claims processing, and computer programming. Now it extends to call centers, brokerage firms, financial analysis, research and development, engineering, medical diagnosis, architectural design, and more advanced work in information technology. As much as China is known as the world's manufacturer, India is renowned for its export of services.

India has an enormous resource of highly skilled engineers, scientists, and technically trained workers available at less than half the cost of those located in developed countries.

In 2009, India exported \$47 billion in IT services, a number that is expected to reach \$200 billion by 2020. Indian companies, such as WIPRO, Infosys, and Tata Consultancy Services, are world leaders in software development and business processes, with plenty of room to expand. Some of that expansion is taking place in client countries, such as the United States. At the same time, multinational companies are setting up shop and expanding in India. IBM, the largest multinational company in India, employs 70,000 IT workers and is hiring an additional 5,000 workers in 2010.

China and India are not the only popular outsourcing venues. Increased outsourcing competition comes from other low-cost countries such as the Philippines, Vietnam, Malaysia, Mexico, Brazil, and Eastern Europe. In addition, many companies are bringing their supply chain closer to home, a concept known as *near-sourcing*.

### • Internet Exercises

All this means that the dynamic nature of global competition is accelerating, and companies need to fight harder to remain competitive. Operations and supply chain managers are an important part of that fight, whether it's maintaining overseas operations, coordinating supply chains, negotiating contracts, or monitoring quality. In the next section, we explore the concepts of competitiveness, and its surrogate, productivity.

## PRODUCTIVITY AND COMPETITIVENESS

A global marketplace for products and services means more customers and more intense competition. In the broadest terms, we speak of competitiveness in reference to other *countries* rather than to other companies. That's because how effectively a nation competes in the global marketplace, affects the economic success of the nation and the quality of life for its citizens. The OECD (Organization for Economic Cooperation and Development) defines **competitiveness** as “the degree to which a nation can produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its citizens.” The most common measure of competitiveness is productivity. Increases in productivity allow wages to grow without producing inflation, thus raising the standard of living. Productivity growth also represents how quickly an economy can expand its capacity to supply goods and services.

### ● Competitiveness:

the degree to which a nation can produce goods and services that meet the test of international markets.

### ● Productivity:

the ratio of output to input.

**Productivity** is calculated by dividing units of output by units of input.

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

Output can be expressed in units or dollars in a variety of scenarios, such as sales made, products produced, customers served, meals delivered, or calls answered. *Single-factor productivity* compares output to individual inputs, such as labor hours, investment in equipment, material usage, or square footage. *Multifactor productivity* relates output to a combination of inputs, such as (labor + capital) or (labor + capital + energy + materials). Capital can include the value of equipment, facilities, inventory, and land. *Total factor productivity* compares the total quantity of goods and services produced with all the inputs used to produce them. These productivity formulas are summarized in Table 1.2.

**Table 1.2**  
**Measures of Productivity**

<b>Single-Factor Productivity</b>		
$\frac{\text{Output}}{\text{Labor}}$	$\frac{\text{Output}}{\text{Materials}}$	$\frac{\text{Output}}{\text{Capital}}$
<b>Multifactor Productivity</b>		
$\frac{\text{Output}}{\text{Labor} + \text{Materials} + \text{Overhead}}$		$\frac{\text{Output}}{\text{Labor} + \text{Energy} + \text{Capital}}$
<b>Total Factor Productivity</b>		
$\frac{\text{Goods and services produced}}{\text{All inputs used to produce them}}$		

Osborne Industries is compiling the monthly productivity report for its Board of Directors. From the following data, calculate (a) labor productivity, (b) machine productivity, and (c) the multifactor productivity of dollars spent on labor, machine, materials, and energy. The average labor rate is \$15 an hour, and the average machine usage rate is \$10 an hour.

Units produced	100,000
Labor hours	10,000
Machine hours	5,000
Cost of materials	\$35,000
Cost of energy	\$15,000

### Solution

$$(a) \text{ Labor productivity} = \frac{\text{Output}}{\text{Labor hours}} = \frac{100,000}{10,000} = 10 \text{ units/hour}$$

$$(b) \text{ Machine productivity} = \frac{\text{Output}}{\text{Machine hours}} = \frac{100,000}{5,000} = 20 \text{ units/hour}$$

$$\begin{aligned} (c) \text{ Multifactor productivity} &= \frac{\text{Output}}{\text{Labor costs} + \text{Machine costs} \\ &\quad + \text{Material costs} + \text{Energy costs}} \\ &= \frac{100,000}{(10,000 \times \$15) + (5,000 \times \$10) \\ &\quad + \$35,000 + \$15,000} \\ &= \frac{100,000}{\$250,000} = 0.4 \text{ units per dollar spent} \end{aligned}$$

The Excel solution to this problem is shown in Exhibit 1.1.

### Example 1.1 Calculating Productivity



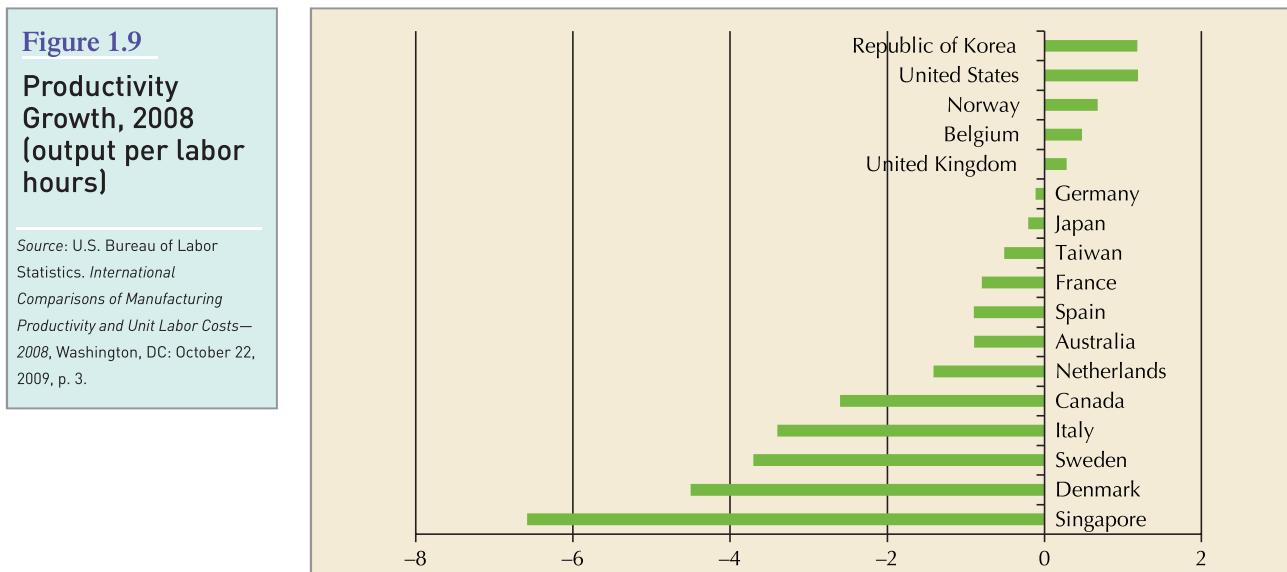
- Animated Demo Problem

Example 1.1 - Osborne Industries		
INPUT		
Units produced	100,000	
Labor hours	10,000	
Machine hours	5,000	
Labor rate	\$15	
Machine usage rate	\$10	
Cost of materials	\$35,000	B5*B7
Cost of energy	\$15,000	B5*B8
Cost of labor	\$150,000	B6*B8
Cost of machines	\$50,000	
Total cost	\$250,000	
OUTPUT		
Labor productivity	10	units / hour
Machine productivity	20	units / hour
Multifactor productivity	0.40	units / \$

### Exhibit 1.1 Osborne Industries



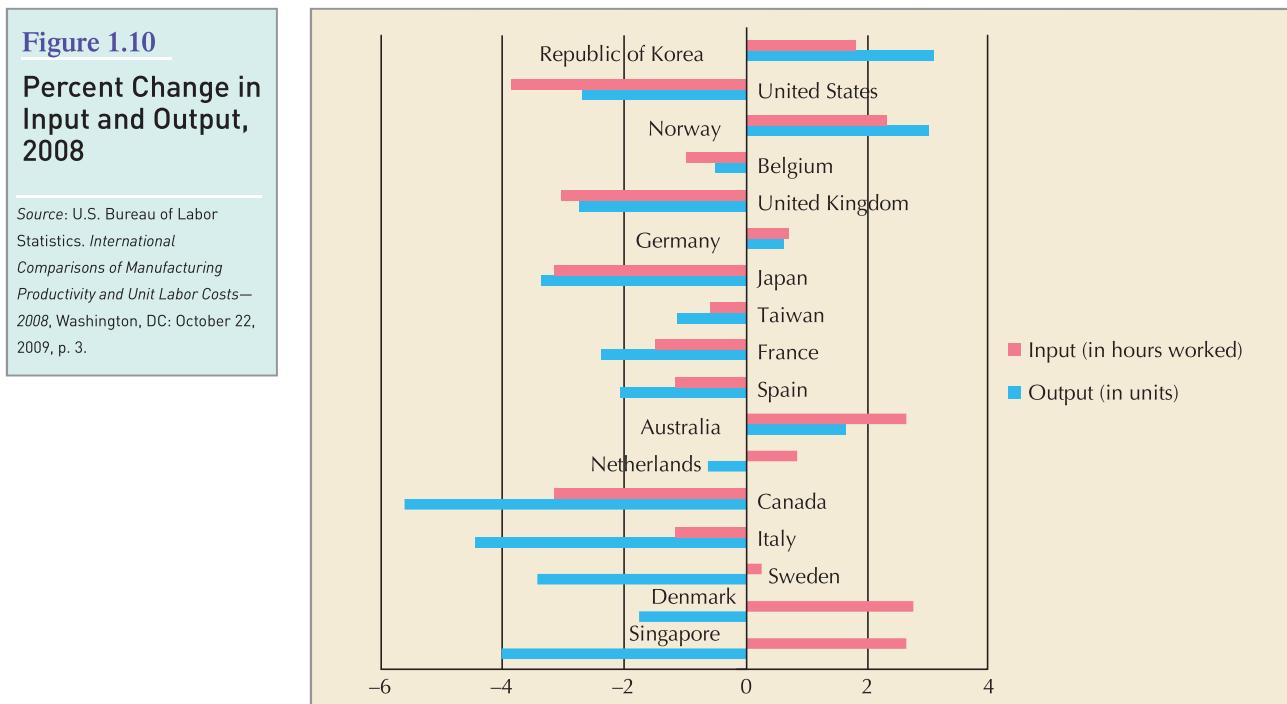
- Excel File



The most common input in productivity calculations is labor hours. Labor is an easily identified input to virtually every production process. Productivity is a relative measure. Thus, productivity statistics provided in government reports typically measure percent changes in productivity from month to month, quarter to quarter, year to year, or over a number of years.

Productivity statistics can be misleading. Examining the formula for productivity,  $\text{output}/\text{input}$ , it becomes apparent that productivity can be increased in different ways. For example, a country or firm may increase productivity by decreasing input faster than output. Thus, although the company may be retrenching, its productivity is increasing. Seldom is this avenue for increasing productivity sustainable.

Figure 1.9 shows the growth rate in productivity for select countries for 2008, a year of global recession. Only five countries exhibited positive growth rates, led by Korea and the United States with increases of 1.2%. Examining the outputs and inputs more closely in Figure 1.10, we find that Korea and the United States achieved those increases in very different ways. Korea saw small



increases in both its output and the input required to produce that output. The recession in the United States caused a *decrease* in both output and input; however, the cut in input (i.e., labor hours) was more severe, thereby producing a slight *increase* in productivity.

Productivity statistics also assume that if more input were available, output would increase at the same rate. This may not be true, as there may be limits to output other than those on which the productivity calculations are based. Furthermore, productivity emphasizes *output produced*, not *output sold*. If products produced are not sold, inventories pile up and increases in output can actually accelerate a company's decline.

As the business world becomes more competitive, firms must find their own path to sustainable competitive advantage. Effectively managed operations are important to a firm's competitiveness. How a firm chooses to compete in the marketplace is the subject of the next section: Strategy and Operations.

## STRATEGY AND OPERATIONS

**Strategy** is how the mission of a company is accomplished. It unites an organization, provides consistency in decisions, and keeps the organization moving in the right direction. Operations and supply chain management play an important role in corporate strategy.

As shown in Figure 1.11, the strategic planning process involves a hierarchy of decisions. Senior management, with input and participation from different levels of the organization, develops a corporate strategic plan in concurrence with the firm's mission and vision, customer requirements (voice of the customer), and business conditions (voice of the business). The strategic plan focuses on the gap between the firm's vision and its current position. It identifies and prioritizes what needs to be done to close the gap, and it provides direction for formulating strategies in the functional areas of the firm, such as marketing, operations, and finance. It is important that strategy in each of the functional areas be internally consistent as well as consistent with the firm's overall strategy.

Strategy formulation consists of five basic steps:

1. Defining a primary task
2. Assessing core competencies
3. Determining order winners and order qualifiers
4. Positioning the firm
5. Deploying the strategy

- **Strategy:**  
provides direction for achieving a mission.

## PRIMARY TASK

The **primary task** represents the purpose of a firm—what the firm is in the business of doing. It also determines the competitive arena. As such, the primary task should not be defined too narrowly. For example, Norfolk Southern Railways is in the business of transportation, not railroads. Paramount is

- **Primary task:**  
what the firm is in the business of doing.



**Figure 1.11**  
**Strategic Planning**

in the business of communication, not making movies. Amazon's business is providing the fastest, easiest, and most enjoyable shopping experience, while Disney's is making people happy! The primary task is usually expressed in a firm's *mission statement*.

### • Internet Exercises



Mission statements clarify what business a company is in—for Levi Strauss it's “branded casual apparel”; for Intel it's supplying “building blocks to the Internet economy”; for Binney & Smith (Crayola) it's “colorful visual expression”; for Currency Doubleday it's “ideas that link business with life's meaning”; for eBay it's “trading communities”; and for Merck it's “preserving and improving human life.” Mission statements are the “constitution” for an organization, the corporate directive, but they are no good unless they are supported by strategy and converted into action. Thus, the next step in strategy formulation is assessing the core competencies of a firm.

## CORE COMPETENCIES

- **Core competency:**  
what the firm does better than anyone else.

**Core competency** is what a firm does better than anyone else, its *distinctive competence*. A firm's core competence can be exceptional service, higher quality, faster delivery, or lower cost. One company may strive to be first to the market with innovative designs, whereas another may look for success arriving later but with better quality.

Based on experience, knowledge, and know-how, core competencies represent *sustainable competitive advantages*. For this reason, products and technologies are seldom core competencies. The advantage they provide is short-lived, and other companies can readily purchase, emulate, or improve on them. Core competencies are more likely to be *processes*, a company's ability to *do* certain things better than a competitor. Thus, while a particular product is not a core competence, the process of developing new products is. For example, while the iPod was a breakthrough product, it is Apple's ability to turn out hit product after hit product (e.g., iPhone, iPad, MacBook, etc.) that gives it that competitive advantage.

Core competencies are not static. They should be nurtured, enhanced, and developed over time. Close contact with the customer is essential to ensuring that a competence does not become obsolete. Core competencies that do not evolve and are not aligned with customer needs can become *core rigidities* for a firm. Walmart and Dell, seemingly unstoppable companies in their field, went astray when they failed to update their competencies to match changes in customer desires. For Dell, the low cost and mail order delivery of computers did not match the customer's desire to see and test computers before purchase, or to receive personalized after-purchase customer service. For Walmart, the obsession with lower costs led to image problems of a behemoth corporation with little regard for employees, suppliers, or local communities. Customers preferred to pay slightly more for the better designed products of more community-involved companies like Target. To avoid these problems, companies need to continually evaluate the characteristics of their products or services that prompt customer purchase; that is, the order qualifiers and order winners.

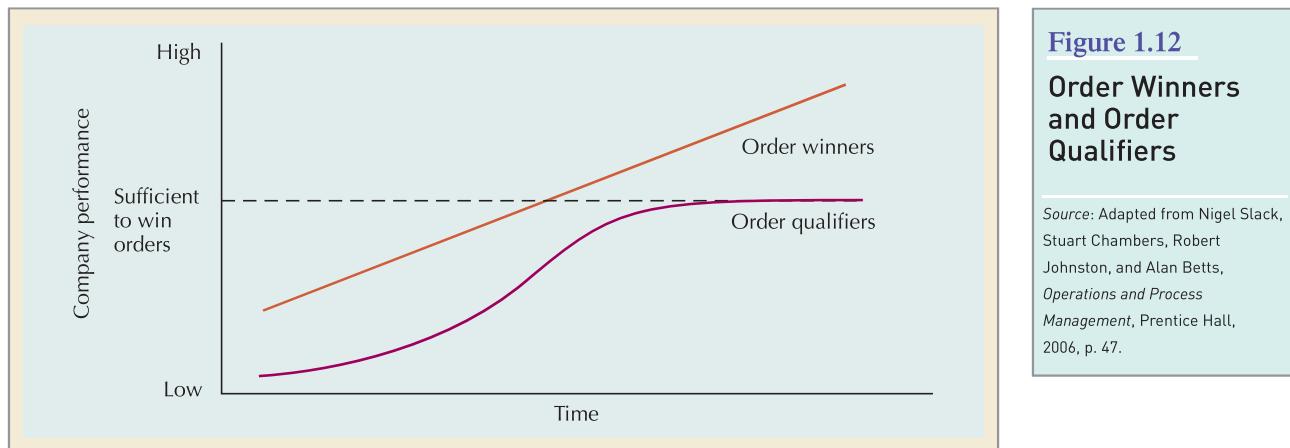
## ORDER WINNERS AND ORDER QUALIFIERS

- **Order qualifiers:**  
what qualifies an item to be considered for purchase.
- **Order winner:**  
what wins the order.

A firm is in trouble if the things it does best are not important to the customer. That's why it's essential to look toward customers to determine what influences their purchase decision.

**Order qualifiers** are the characteristics of a product or service that qualify it to be considered for purchase by a customer. An **order winner** is the characteristic of a product or service that wins orders in the marketplace—the final factor in the purchasing decision. For example, when purchasing a DVD or Blu-ray player, customers may determine a price range (order qualifier) and then choose the product with the most features (order winner) within that price range. Or they may have a set of features in mind (order qualifiers) and then select the least expensive player (order winner) that has all the required features.

Order winners and order qualifiers can evolve over time, just as competencies can be gained and lost. Japanese and Korean automakers initially competed on price but had to ensure certain levels of quality before the U.S. consumer would consider their product. Over time, the consumer was willing to pay a higher price (within reason) for the assurance of a superior-quality Japanese car. Price became a qualifier, but quality won the orders. Today, high quality, as a standard of the automotive industry, has become an order qualifier, and innovative design or superior gas mileage wins the orders.



As shown in Figure 1.12, order qualifiers will only take a firm so far. The customer expects the qualifiers, but is not “wowed” by them. For example, a low price might be a qualifier, but reducing the price further may not win orders if the features or design are not adequate. At a minimum, a firm should meet the qualifiers. To excel, the firm needs to develop competencies that are in tune with the order winners. Marketing helps to identify these qualifiers and winners. Oftentimes, these characteristics are in the purview of operations and supply chain management, such as cost, speed to the market, speed of delivery, or customization. Other characteristics such as product or service design are supported by operations and supply chain management, but are not completely under their control.

## POSITIONING THE FIRM

No firm can be all things to all people. Strategic **positioning** involves making choices—choosing one or two important things on which to concentrate and doing them extremely well. A firm’s positioning strategy defines how it will compete in the marketplace—what unique value it will deliver to the customer. An effective positioning strategy considers the strengths and weaknesses of the organization, the needs of the marketplace, and the positions of competitors.<sup>2</sup>

Let’s look at firms that have positioned themselves to compete on cost, speed, quality, and flexibility.

- **Positioning:**  
how the firm chooses to compete.

**Eliminate all waste.**

### Competing on Cost

Companies that compete on cost relentlessly pursue the elimination of all waste. In the past, companies in this category produced standardized products for large markets. They improved yield by stabilizing the production process, tightening productivity standards, and investing in automation. Today, the entire cost structure is examined for reduction potential, not just direct labor costs. High-volume production and automation may or may not provide the most cost-effective alternative. A lean production system provides low costs through disciplined operations.

- **Speed:**  
Fast moves, fast adaptations, tight linkages.

### Competing on Speed

More than ever before, **speed** has become a source of competitive advantage. The Internet has conditioned customers to expect immediate response and rapid product shipment. Service organizations such as McDonald’s, LensCrafters, and Federal Express have always competed on speed. Now manufacturers are discovering the advantages of *time-based competition*, with build-to-order production and efficient supply chains. In the fashion industry where trends are temporary, Gap’s six-month time-to-market can no longer compete with the nine-day design-to-rack lead time of Spanish retailer, Zara.

<sup>2</sup>These factors can be depicted in a SWOT matrix, which lists the current strengths (S) and weaknesses (W) internal to the company, and the opportunities (O) and threats (T) external to the company.

## ALONG THE SUPPLY CHAIN

### Trader Joe's Unique Strategy

There are two basic approaches to strategy. Do what everyone else does, only better; or do something entirely different. Trader Joe's has chosen the "differentiation" strategy. TJ is a specialty grocery store chain located primarily in urban areas that stocks unusual goods at value prices. The stores are small, cramped, and low-rent; not at all what you would expect for upscale shoppers. With only about 10% of the stock of a traditional supermarket, selection is limited; but what a selection it is—unusual recipes, high quality ingredients, imported wines and cheeses, health foods, exotic products from around the world, and private label specialties. The stock is constantly changing, with new products being brought in as others are phased out. This creates a "treasure hunt" type atmosphere that encourages frequent visits from loyal customers. The stores are fun and quirky, too. The staff gives excellent, if irreverent, service with the feel of a mom-and-pop store (only Mom and Pop wear Hawaian shirts).

Behind this strategy is an operations and supply chain network that is cost conscious and efficient. Product selection is carefully tended to. Every item sold in TJ is tested, tasted, or used by one of its buyers or employees. TJ stocks fresh items only in season and does not worry about running out of items or replenishing stock within a certain time frame. Scarcity helps to create the adventuresome atmosphere. The supply chain is simpler without national brands and general merchandise to contend with, but it does involve more legwork for TJ buyers to personally find, vet, and purchase the merchandise to be sold. This sometimes involves making single purchases of large amounts (often sell-outs) or traveling across the globe to find those special items.

The stores themselves are rustic, with hand-painted signs and chalkboards to announce daily specials. Store managers are called captains; assistant managers are known as first mates. Company policy is for full-time employees to make at least the median household income for their communities. Store captains can make six figures annually. Turnover among full-time crew is a mere 4%. Seventy percent of the crew are part-time; part-timers can earn health-care benefits, a draw for creative types who wouldn't normally seek supermarket jobs.

TJ doesn't accept coupons, issue loyalty cards, or feature weekly sales. Instead it adopts an everyday, low-price strategy, with the highest margin in the industry. Advertising is local and folksy. The TJ model attempts to make grocery shopping an enriching experience rather than a weekly chore to be avoided.



Ric Francis/CAP/Wide World Photos

TJ has a well-crafted strategy, matching the product offerings to its customer base, creating a culture of customer service and excitement, and building an operations and supply chain network that provides value (and a treasure, perhaps) for the customer.

1. How is TJ able to offer upscale products at bargain prices?
2. How does TJ compare with Whole Foods or Costco?
3. Is TJ strategy scalable? In other words, as the company grows, will it be able to maintain the same focused strategy?

*Sources:* Christopher Palmeri, "Trader Joe's Recipe for Success," *BusinessWeek* (February 21, 2008); Irwin Speizer, "The Grocery Chain That Shouldn't Be," *Fast Company* (December 19, 2007); Len Lewis, *The Trader Joe's Adventure: A Unique Approach to Business into a Retail and Cultural Phenomenon* (Chicago: Dearborn Trade Publication, 2005).

## Competing on Quality

Most companies approach quality in a defensive or reactive mode; **quality** is confined to minimizing defect rates or conforming to design specifications. To compete on quality, companies must view it as an opportunity to please the customer, not just a way to avoid problems or reduce rework costs.

To please the customer, one must first understand customer attitudes toward and expectations of quality. One good source is the American Customer Satisfaction Index compiled each year by the American Society for Quality and the National Quality Research Center. Examining recent winners of the Malcolm Baldrige National Quality Award and the criteria on which the award are based also provides insight into companies that compete on quality.

The Ritz-Carlton Hotel Company is a Baldrige Award winner and a recognized symbol of quality. The entire service system is designed to understand the individual expectations of more than 500,000 customers and to “move heaven and earth” to satisfy them. Every employee is empowered to take immediate action to satisfy a guest’s wish or resolve a problem. Processes are uniform and well defined. Teams of workers at all levels set objectives and devise quality action plans. Each hotel has a quality leader who serves as a resource and advocate for the development and implementation of those plans.

- **Quality:**  
a way to please the customer.

## Competing on Flexibility

Marketing always wants more variety to offer its customers. Manufacturing resists this trend because variety upsets the stability (and efficiency) of a production system and increases costs. The ability of manufacturing to respond to variation has opened up a new level of competition. **Flexibility** has become a competitive weapon. It includes the ability to produce a wide variety of products, to introduce new products and modify existing ones quickly, and to respond to customer needs.

National Bicycle Industrial Company fits bicycles to exact customer measurements. Bicycle manufacturers typically offer customers a choice among 20 or 30 different models. National offers 11,231,862 variations and delivers within two weeks at costs only 10% above standard models. Computerized design and computer-controlled machinery allow customized products to be essentially mass produced. The popular term for this phenomenon is **mass customization**.

- **Flexibility:**  
the ability to adjust to changes  
in product mix, production volume,  
or design.

## STRATEGY DEPLOYMENT

“The difficulty is not in knowing what to do. It’s doing it,” said Kodak’s former CEO, George Fisher. Implementing strategy can be more difficult than formulating strategy. Strategies unveiled with much fanfare may never be followed because they are hard to understand, too general, or unrealistic. Strategies that aim for results five years or so down the road mean very little to the worker who is evaluated on his or her daily performance. Different departments or functional areas in a firm may interpret the same strategy in different ways. If their efforts are not coordinated, the results can be disastrous.

Consider Schlitz Brewing Company, whose strategy called for reduced costs and increased efficiency. Operations achieved its goals by dramatically shortening its brewing cycle—and, in the process, lost 6 of every 10 customers when the clarity and taste of the beer suffered. The efficiency move that was to make the company the most profitable in its industry instead caused its stock value to plummet from \$69 per share to \$5 per share. Schlitz has since been sold to Pabst Brewing Company who combed through company documents and interviewed retired Schlitz brewmasters and taste-testers to derive and reintroduce the original 1960’s “with gusto” formula.

Strategy deployment converts a firm’s positioning strategy and resultant order winners and order qualifiers into specific performance requirements.

- **Mass customization:**  
the mass production of  
customized products.

Companies struggling to align day-to-day decisions with corporate strategy have found success with two types of planning systems—policy deployment and the balanced scorecard.

## Policy Deployment

Policy deployment, also known as hoshin planning, is adapted from Japan’s system of *hoshin kanri*, which is roughly translated from Japanese as “shining metal pointing direction”—a compass.

**Policy deployment** tries to focus everyone in an organization on common goals and priorities by translating corporate strategy into measurable objectives throughout the various functions and levels of the organization. As a result, everyone in the organization should understand the strategic

- **Policy deployment:**  
translates corporate strategy into  
measurable objectives.



### • Virtual Tour

Is your company pointed in one direction? AT&T uses the analogy of migrating geese to explain the concept of policy deployment. Naturalists believe the instinctive V-formation allows the geese to follow one leader and migrate in a cohesive unit toward their destination. Policy deployment does the same thing—it enables business leaders to mobilize the organization toward a common destination, aligning all employees behind a common goal and a collective wisdom.



© blickwinkel/Alamy

### • Internet Exercises

- **Hoshins:** the action plans generated from the policy deployment process.

**Figure 1.13**

### Derivation of an Action Plan Using Policy Deployment

plan, be able to derive several goals from the plan, and determine how each goal ties into their own daily activities.

Suppose the corporate strategic plan of competing on speed called for a reduction of 50% in the length of the supply chain cycle. Senior management from each functional area would assess how their activities contribute to the cycle, confer on the feasibility of reducing the cycle by 50%, and agree on each person's particular role in achieving the reduction. Marketing might decide that creating strategic alliances with its distributors would shorten the average time to release a new product. Operations might try to reduce its purchasing and production cycles by reducing its supplier base, certifying suppliers, using e-procurement, and implementing a just-in-time (JIT) system. Finance might decide to eliminate unnecessary approval loops for expenditures, begin prequalifying sales prospects, and explore the use of electronic funds transfer (EFT) in conjunction with operations' lean strategy.

The process for forming objectives would continue in a similar manner down the organization with the *means* of achieving objectives for one level of management becoming the *target*, or objectives, for the next level. The outcome of the process is a cascade of action plans (or **Hoshins**) aligned to complete each functional objective, which will, in turn, combine to achieve the strategic plan.

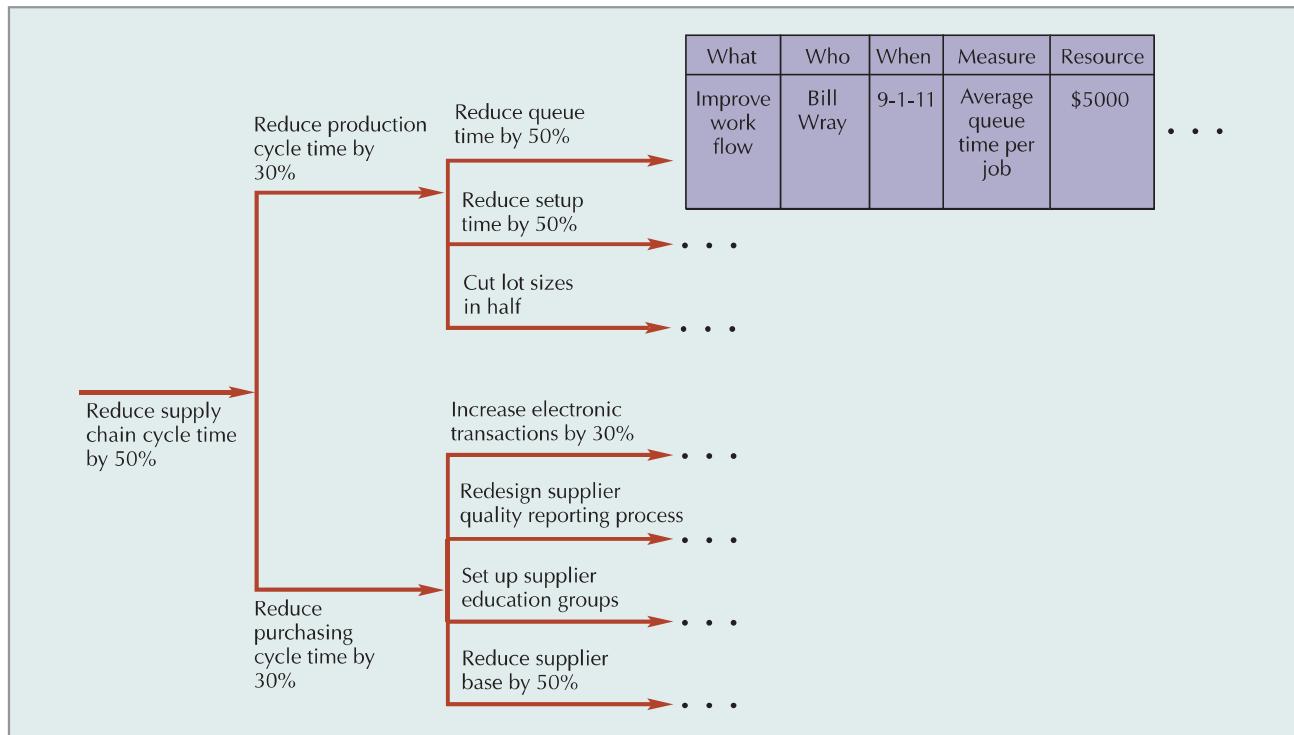


Figure 1.13 shows an abbreviated operations action plan for reducing supply chain cycle time. Policy deployment has become more popular as organizations are more geographically dispersed and culturally diverse.

## Balanced Scorecard

The **balanced scorecard**, developed by Robert Kaplan and David Norton,<sup>3</sup> examines a firm's performance in four critical areas:

1. *Finances*—How should we look to our shareholders?
2. *Customers*—How should we look to our customers?
3. *Processes*—At which business processes must we excel?
4. *Learning and Growing*—How will we sustain our ability to change and improve?

● **Balanced scorecard:**

a performance assessment that includes metrics related to customers, processes, and learning and growing, as well as financials.

It's called a *balanced* scorecard because more than financial measures are used to assess performance. Operational excellence is important in all four areas. How efficiently a firm's assets are managed, products produced, and services provided affects the financial health of the firm. Identifying and understanding targeted customers helps determine the processes and capabilities the organization must concentrate on to deliver value to the customer. The firm's ability to improve those processes and develop competencies in new areas is critical to sustaining competitive advantage.

Table 1.3 is a balanced scorecard worksheet. The worksheet selects areas of the strategy map to incorporate in annual objectives for the company. The objectives are then operationalized with

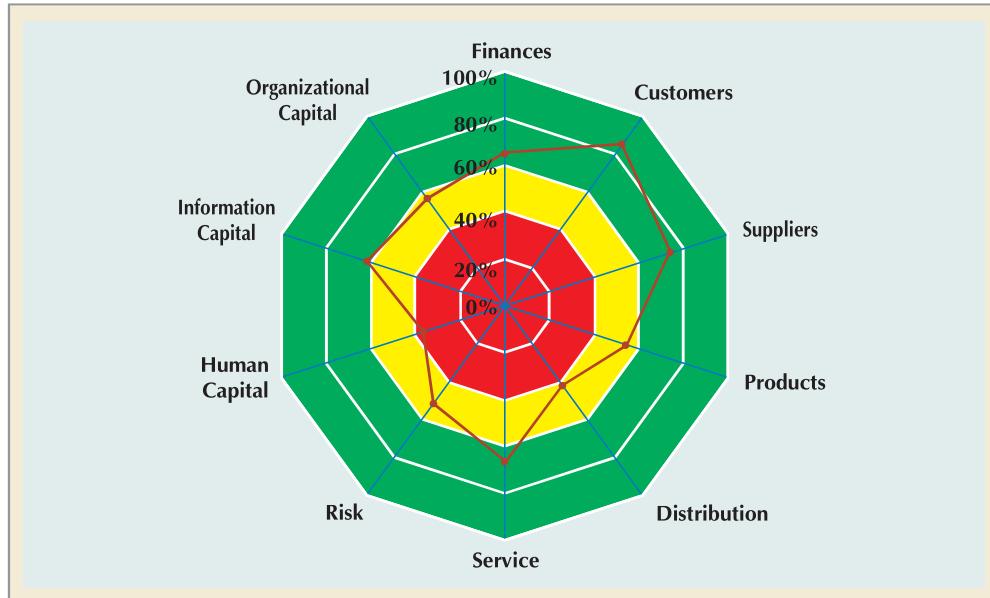
**Table 1.3**  
**The Balanced Scorecard Worksheet**

Dimension	Objectives	Key Performance Indicator	Goal for 2011	KPI Results to Date	Score	Mean Performance
Finances	Productivity	Become industry cost leader	% reduction in cost per unit	20%	10%	50%
	Growth	Increase market share	Market share	50%	40%	80%
Customers	Quality	Zero defects	% good quality first pass	100%	80%	80%
	Timeliness	On-time delivery	% of on-time deliveries	95%	90%	95%
Processes	Suppliers	Integrate into production	% orders delivered to assembly	50%	40%	80%
		Reduce inspections	% suppliers ISO 9000 certified	90%	60%	67%
	Products	Reduce time to produce	Cycle time	10 mins.	12 mins.	83%
		Improve quality	# warranty claims	200	1000	20%
	Distribution	Reduce transportation costs	% FTL shipments	75%	30%	40%
	Service	Improve response to customer inquiries	% queries satisfied on first pass	90%	60%	67%
	Risk	Reduce inventory obsolescence	Inventory turnover	12	6	50%
		Reduce customer backlog	% order backlogged	10%	20%	50%
Learning & Growing	Human capital	Develop quality improvement skills	# of six sigma Black Belts	25	2	8%
			% trained in SPC	80%	50%	63%
	Information capital	Provide technology to improve processes	% customers who can track orders	100%	60%	60%
			% suppliers who use EDI	80%	50%	63%
	Organizational capital	Create innovative culture	# of employee suggestions	100	60	60%
			% of products new this year	20%	10%	50%

<sup>3</sup>See Robert S. Kaplan and David P. Norton, "Transforming the Balanced Scorecard from Performance Measurement to Strategic Management." *Accounting Horizons* (March 2001), pp. 87–104; and Robert S. Kaplan and David P. Norton, "Having Trouble with Your Strategy? Then Map It," *Harvard Business Review* (September/October 2000), pp. 167–176.

**Figure 1.14**

**A Radar Chart of the Balanced Scorecard**



● **Key performance indicators (KPI):**

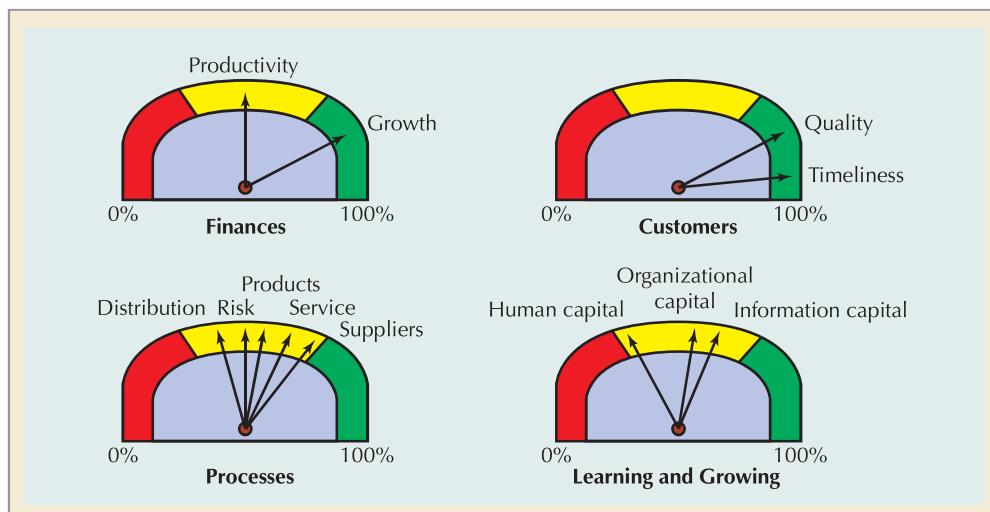
a set of measures that help managers evaluate performance in critical areas.

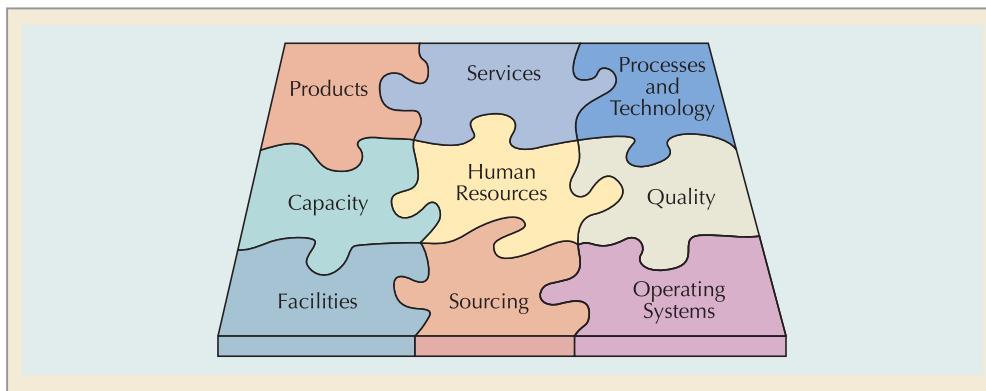
**key performance indicators (KPI).** The goals for the year are given, and the KPI results are recorded. The score converts the different performance measures into percentage completed. For example, if the goal is to achieve 12 inventory turns a year and the company manages only 6, then the goal is 50% achieved. The mean performance column averages the score for each dimension. The scorecard performance can be visualized in many ways, two of which are illustrated in Figures 1.14 and 1.15.

Figure 1.14 is a radar chart of the balanced scorecard. Goals 0% to 40% achieved appear in the red “danger” zone, 40% to 80% achieved are in the yellow “cautionary” zone, and 80% to 100% achieved are in the green “moving ahead” zone. In this example, the company is in the danger zone for human capital and distribution, but is doing well with growth, quality, timeliness, and service. Figure 1.15 shows the same information in an alternative format. The dashboard presents each scorecard perspective in a different graphic. The red zone is set at 25% or less goal achievement, yellow from 25% to 75%, and green in excess of 75%, although different limits can be set for each perspective. The company excels in growth, quality, and timeliness, and is not in danger on any measure. Note that different limits can be set for each gauge, and measures other than percentages can be used. Dashboards are popular ways for managers to quickly interpret the massive amounts of data collected each day and in some cases can be updated in real time.

**Figure 1.15**

**A Dashboard for the Balanced Scorecard**





**Figure 1.16**  
An Integrated Operations Strategy

## OPERATIONS STRATEGY

The operations function helps strategy evolve by creating new and better ways of delivering a firm's competitive priorities to the customer. Once a firm's competitive priorities have been established, its operating system must be configured and managed to provide for those priorities. This involves a whole series of interrelated decisions on products and services, processes and technology, capacity and facilities, human resources, quality, sourcing, and operating systems. As shown in Figure 1.16, all these decisions should "fit" like pieces in a puzzle. A tight strategic fit means competitors must replicate the entire system to obtain its advantages. Thus, the competitive advantage from an integrated operating system is more sustainable than short-lived products or technologies. Beginning with quality, the remaining chapters in Part I put together the pieces of the operations strategy puzzle.

## ORGANIZATION OF THIS TEXT

The organization of this textbook reflects the emergence of supply chain management as an integral part of the study of operations. The first half of the text concentrates on issues and decisions that are common to most enterprises—ensuring quality, designing products and services, analyzing processes, designing facilities, developing human resources, and managing projects. The second half emphasizes activities that are influenced by and are most likely shared with entities along the supply chain—sourcing and logistics, forecasting demand, establishing inventory levels, coordinating sales and operations, developing resource plans, lean manufacturing and supply chains, and scheduling work. A diagram of the chapters in each half of the text is shown in Table 1.4. Please note that your professor may elect to cover these topics in a different order than presented in the text. This is perfectly understandable given the interdependency of decisions in operations and supply chain management.

<b>Part I—Operations Management</b>	
Chapter 1	Introduction to Operations and Supply Chain Management
Chapter 2	Quality Management
Chapter 3	Statistical Process Control
Chapter 4	Product Design
Chapter 5	Service Design
Chapter 6	Processes and Technology
Chapter 7	Capacity and Facilities Design
Chapter 8	Human Resources
Chapter 9	Project Management

**Table 1.4**  
**Organization of the Text**

(continued)