

# Operations and Productivity

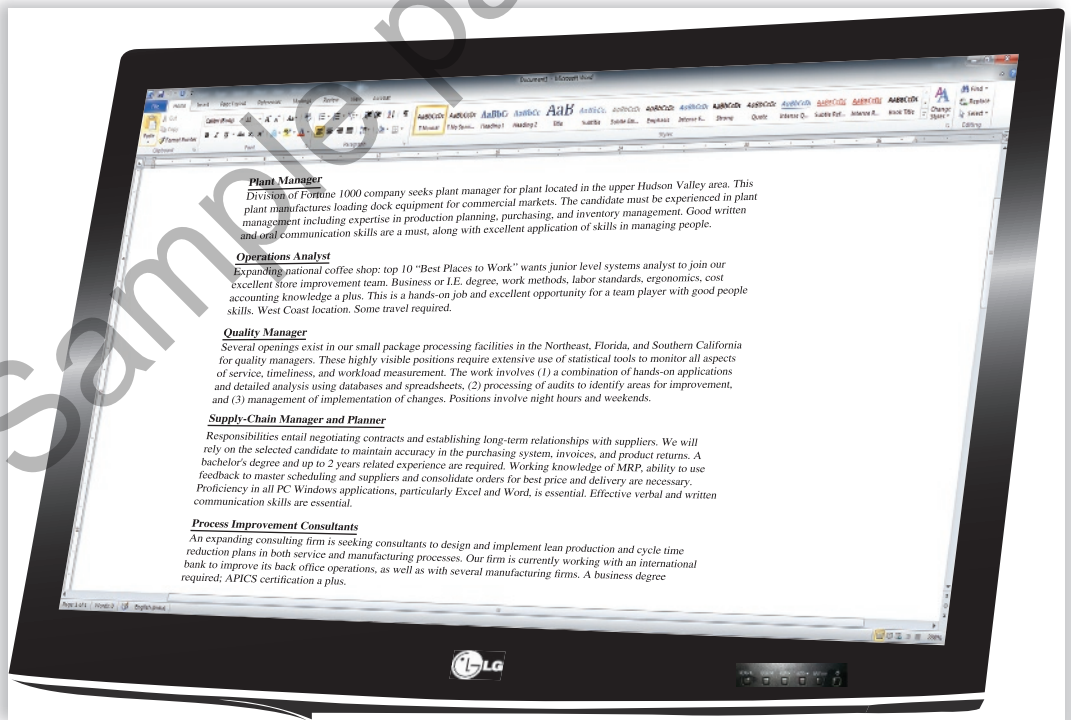
# 1

## CHAPTER OUTLINE

About 40% of *all* jobs are in operations management.

### GLOBAL COMPANY PROFILE: *Hard Rock Café*

- ◆ What Is Operations Management? 38
- ◆ Organizing to Produce Goods and Services 38
- ◆ The Supply Chain 40
- ◆ Why Study OM? 40
- ◆ What Operations Managers Do 41
- ◆ The Heritage of Operations Management 42
- ◆ Operations for Goods and Services 44
- ◆ The Productivity Challenge 46
- ◆ Current Challenges in Operations Management 52
- ◆ Ethics, Social Responsibility, and Sustainability 53



**10  
OM**  
STRATEGY  
DECISIONS

- Design of Goods and Services
- Managing Quality
- Process Strategies
- Location Strategies
- Layout Strategies
- Human Resources
- Supply Chain Management
- Inventory Management
- Scheduling
- Maintenance

## GLOBAL COMPANY PROFILE

*Hard Rock Cafe*

# Operations Management at Hard Rock Cafe

Operations managers throughout the world are producing products every day to provide for the well-being of society. These products take on a multitude of forms. They may be washing machines at Whirlpool, motion pictures at DreamWorks, rides at Disney World, or food at Hard Rock Cafe. These firms produce thousands of complex products every day—to be delivered as the customer ordered them, when the customer wants them, and where the customer wants them. Hard Rock does this for over 35 million guests worldwide every year. This is a challenging task, and the operations manager's job, whether at Whirlpool, DreamWorks, Disney, or Hard Rock, is demanding.



Hard Rock Cafe in Orlando, Florida, prepares over 3,500 meals each day. Seating more than 1,500 people, it is one of the largest restaurants in the world. But Hard Rock's operations managers serve the hot food hot and the cold food cold.

Andre Jenny/Alamy Stock Photo

Operations managers are interested in the attractiveness of the layout, but they must be sure that the facility contributes to the efficient movement of people and material with the necessary controls to ensure that proper portions are served.



Hulton Archive/Handout/Getty Images





Lots of work goes into designing, testing, and costing meals. Then suppliers deliver quality products on time, every time, for well-trained cooks to prepare quality meals. But none of that matters unless an enthusiastic waitstaff, such as the one shown here, holding guitars previously owned by members of U2, is doing its job.

Orlando-based Hard Rock Cafe opened its first restaurant in London in 1971, making it over 50 years old and the granddaddy of theme restaurants. Although other theme restaurants have come and gone, Hard Rock is still going strong, with 25 hotels, 185 restaurants, and 12 casinos in more than 74 countries—and new restaurants opening each year. Hard Rock made its name with rock music memorabilia, having started when Eric Clapton, a regular customer, marked his favorite bar stool by hanging his guitar on the wall in the London cafe. Now Hard Rock has 70,000 items and millions of dollars invested in memorabilia. To keep customers coming back time and again, Hard Rock creates value in the form of good food and entertainment.

The operations managers at Hard Rock Cafe at Universal Studios in Orlando provide more than 3,500 custom products—in this case meals—every day. These products are designed, tested, and then analyzed for cost of ingredients,

Efficient kitchen layouts, motivated personnel, tight schedules, and the right ingredients at the right place at the right time are required to delight the customer.



labor requirements, and customer satisfaction. On approval, menu items are put into production—and then only if the ingredients are available from qualified suppliers. The production process, from receiving, to cold storage, to grilling or baking or frying, and a dozen other steps, is designed and maintained to yield a quality meal. Operations managers, using the best people they can recruit and train, also prepare effective employee schedules and design efficient layouts.

Managers who successfully design and deliver goods and services throughout the world understand operations. In this text, we look not only at how Hard Rock's managers create value but also how operations managers in other services, as well as in manufacturing, do so. Operations management is demanding, challenging, and exciting. It affects our lives every day. Ultimately, operations managers determine how well we live. **K**

# LEARNING OBJECTIVES

- LO 1.1** *Define* operations management 38
- LO 1.2** *Identify* the 10 strategic decisions of operations management 42
- LO 1.3** *Identify* career opportunities in operations management 42
- LO 1.4** *Explain* the distinction between goods and services 45
- LO 1.5** *Explain* the difference between production and productivity 47
- LO 1.6** *Compute* single-factor productivity 47
- LO 1.7** *Compute* multifactor productivity 48
- LO 1.8** *Identify* the critical variables in enhancing productivity 49

## STUDENT TIP

Let's begin by defining what this course is about.

## What Is Operations Management?

### LO 1.1 *Define* operations management

#### VIDEO 1.1

Operations Management at Hard Rock

#### VIDEO 1.2

Operations Management at Frito-Lay

#### VIDEO 1.3

Celebrity Cruises: Operations Management at Sea

### Production

The creation of goods and services.

### Operations management (OM)

Activities that relate to the creation of goods and services through the transformation of inputs to outputs.

Operations management (OM) is a discipline that applies to restaurants like Hard Rock Cafe as well as to factories like Ford and Whirlpool. The techniques of OM apply throughout the world to virtually all productive enterprises. It doesn't matter if the application is in an office, a hospital, a restaurant, a department store, or a factory—the production of goods and services requires operations management. And the *efficient* production of goods and services requires effective applications of the concepts, tools, and techniques of OM that we introduce in this book.

As we progress through this text, we will discover how to manage operations in an economy in which both customers and suppliers are located throughout the world. An array of informative examples, charts, text discussions, and pictures illustrates concepts and provides information. We will see how operations managers create the goods and services that enrich our lives.

In this chapter, we first define *operations management*, explaining its heritage and exploring the exciting role operations managers play in a huge variety of organizations. Then we discuss production and productivity in both goods- and service-producing firms. This is followed by a discussion of operations in the service sector and the challenge of managing an effective and efficient production system.

**Production** is the creation of goods and services. **Operations management (OM)** is the set of activities that creates value in the form of goods and services by transforming inputs into outputs. Activities creating goods and services take place in all organizations. In manufacturing firms, the production activities that create goods are usually quite obvious. In them, we can see the creation of a tangible product such as a Sony TV or a Harley-Davidson motorcycle.

In an organization that does not create a tangible good or product, the production function may be less obvious. We often call these activities *services*. The services may be “hidden” from the public and even from the customer. The product may take such forms as the transfer of funds from a savings account to a checking account, the transplant of a liver, the filling of an empty seat on an airplane, or the education of a student. Regardless of whether the end product is a good or service, the production activities that go on in the organization are often referred to as operations, or *operations management*.

## STUDENT TIP

Operations is one of the three functions that every organization performs.

## Organizing to Produce Goods and Services

To create goods and services, all organizations perform three functions (see Figure 1.1). These functions are the necessary ingredients not only for production but also for an organization's survival. They are:

1. *Marketing*, which generates the demand, or at least takes the order for a product or service (nothing happens until there is a sale).
2. *Production/operations*, which creates, produces, and delivers the product.
3. *Finance/accounting*, which tracks how well the organization is doing, pays the bills, and collects the money.

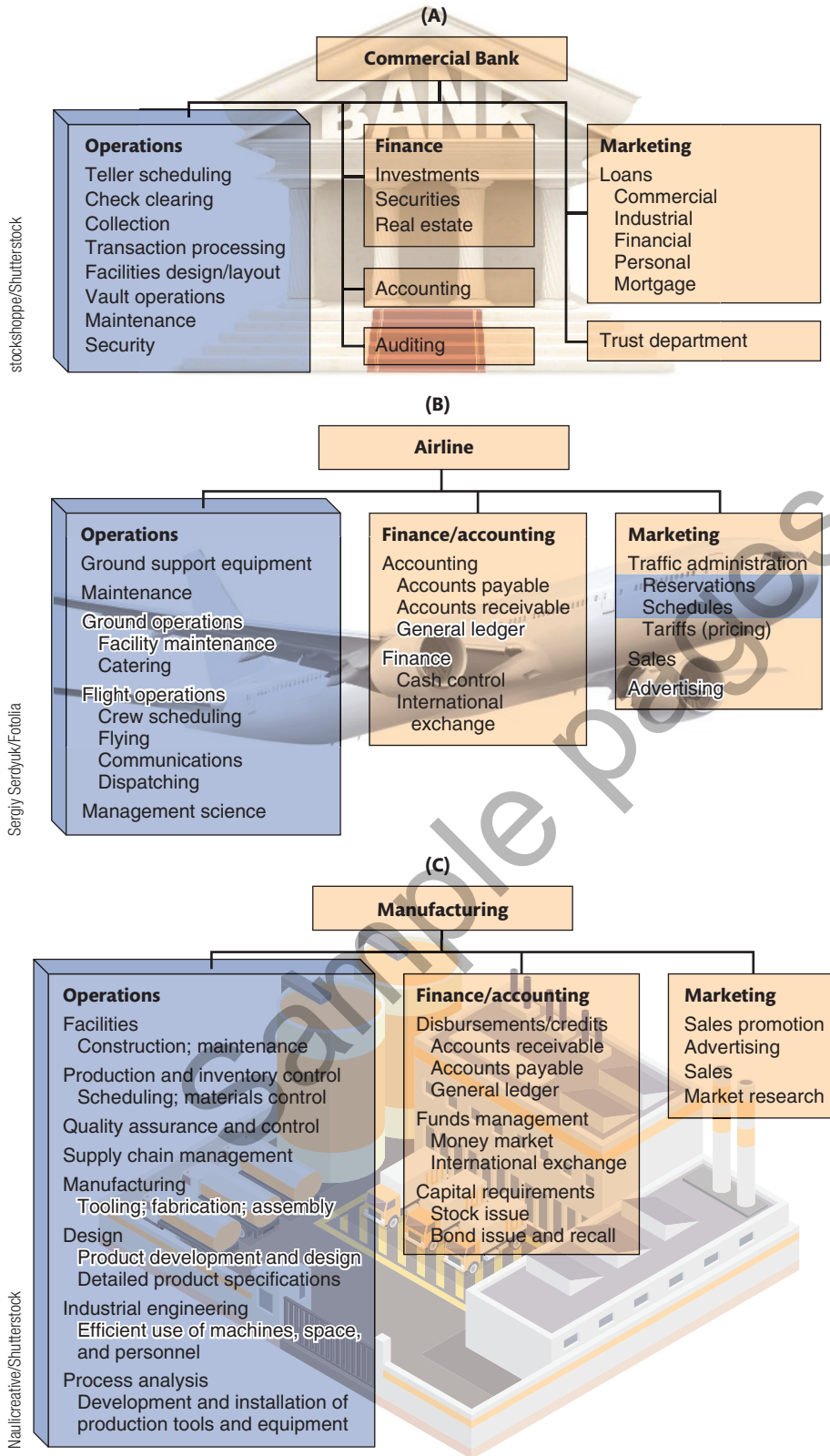


Figure 1.1

**Organization Charts for Two Service Organizations and One Manufacturing Organization**

(A) a bank, (B) an airline, and (C) a manufacturing organization. The blue areas are OM activities.

**STUDENT TIP**

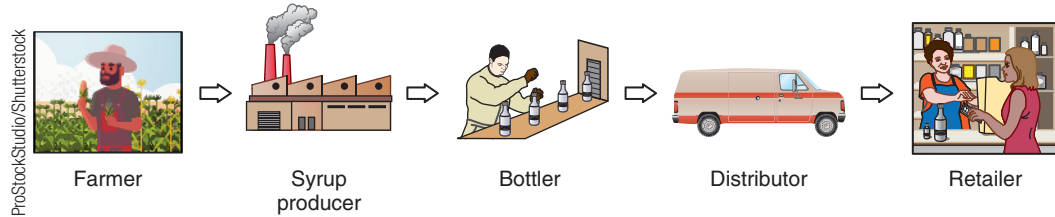
The areas in blue indicate the significant role that OM plays in both manufacturing and service firms.



Figure 1.2

**Soft Drink Supply Chain**

A supply chain for a bottle of Coke requires a beet or sugar cane farmer, a syrup producer, a bottler, a distributor, and a retailer, each adding value to satisfy a customer. Only with collaborations between all members of the supply chain can efficiency and customer satisfaction be maximized. The supply chain, in general, starts with the provider of basic raw materials and continues all the way to the final customer at the retail store.



Universities, places of worship, and businesses all perform these functions. Even a volunteer group such as Meals on Wheels is organized to perform these three basic functions. Figure 1.1 shows how a bank, an airline, and a manufacturing firm organize themselves to perform these functions. The blue-shaded areas show the operations functions in these firms.

## The Supply Chain

Through the three functions—marketing, operations, and finance—value for the customer is created. However, firms seldom create this value by themselves. Instead, they rely on a variety of suppliers who provide everything from raw materials to accounting services. These suppliers, when taken together, can be thought of as a *supply chain*. A **supply chain** (see Figure 1.2) is a global network of organizations and activities that supply a firm with goods and services.

As our society becomes more technologically oriented, we see increasing specialization. Specialized expert knowledge, instant communication, and cheaper transportation also foster specialization and worldwide supply chains. It just does not pay for a firm to try to do everything itself. The expertise that comes with specialization exists up and down the supply chain, adding value at each step. When members of the supply chain collaborate to achieve high levels of customer satisfaction, we have a tremendous force for efficiency and competitive advantage. Competition in the 21st century is not between companies; it is between *supply chains*.

**Supply chain**

A global network of organizations and activities that supplies a firm with goods and services.

**STUDENT TIP**

Good OM managers are scarce, and as a result, career opportunities and pay are excellent.

## Why Study OM?

We study OM for four reasons:

1. OM is one of the three major functions of any organization, and it is integrally related to all the other business functions. All organizations market (sell), finance (account), and produce (operate), and it is important to know how the OM activity functions. Therefore, we study *how people organize themselves for productive enterprise*.
2. We study OM because we want to know *how goods and services are produced*. The production function is the segment of our society that creates the products and services we use.
3. We study OM to *understand what operations managers do*. Regardless of your job in an organization, you can perform better if you understand what operations managers do. In addition, understanding OM will help you explore the numerous and lucrative career opportunities in the field.
4. We study OM *because it is such a costly part of an organization*. A large percentage of the revenue of most firms is spent in the OM function. Indeed, OM provides a major opportunity for an organization to improve its profitability and enhance its service to society. Example 1 considers how a firm might increase its profitability via the production function.

### Example 1

#### EXAMINING THE OPTIONS FOR INCREASING CONTRIBUTION

Fisher Technologies is a small firm that must double its dollar contribution to fixed cost and profit in order to be profitable enough to purchase the next generation of production equipment. Management has determined that if the firm fails to increase contribution, its bank will not make the loan and the equipment cannot be purchased. If the firm cannot purchase the equipment, the limitations of the old equipment will force Fisher to go out of business and, in doing so, put its employees out of work and discontinue producing goods and services for its customers.

**APPROACH** ▶ Table 1.1 shows a simple profit-and-loss statement and three strategic options (marketing, finance/accounting, and operations) for the firm. The first option is a *marketing option*, where excellent marketing management may increase sales by 50%. By increasing sales by 50%, contribution will in turn increase 71%. But increasing sales 50% may be difficult; it may even be impossible.

**TABLE 1.1** Options for Increasing Contribution

	Options for Increasing Contribution			
	CURRENT	MARKETING OPTION <sup>a</sup> INCREASE SALES REVENUE 50%	FINANCE/ACCOUNTING OPTION <sup>b</sup> REDUCE FINANCE COSTS 50%	OM OPTION <sup>c</sup> REDUCE PRODUCTION COSTS 20%
Sales	\$100,000	\$150,000	\$100,000	\$100,000
Costs of goods	<u>-80,000</u>	<u>-120,000</u>	<u>-80,000</u>	<u>-64,000</u>
Gross margin	20,000	30,000	20,000	36,000
Finance costs	<u>-6,000</u>	<u>-6,000</u>	<u>-3,000</u>	<u>-6,000</u>
Subtotal	14,000	24,000	17,000	30,000
Taxes at 25%	<u>-3,500</u>	<u>-6,000</u>	<u>-4,250</u>	<u>-7,500</u>
Contribution <sup>d</sup>	\$ 10,500	\$ 18,000	\$ 12,750	\$ 22,500

<sup>a</sup>Increasing sales 50% increases contribution by \$7,500, or 71% (7,500/10,500).

<sup>b</sup>Reducing finance costs 50% increases contribution by \$2,250, or 21% (2,250/10,500).

<sup>c</sup>Reducing production costs 20% increases contribution by \$12,000, or 114% (12,000/10,500).

<sup>d</sup>Contribution to fixed cost (excluding finance costs) and profit.

The second option is a *finance/accounting option*, where finance costs are cut in half through good financial management. But even a reduction of 50% is still inadequate for generating the necessary increase in contribution. Contribution is increased by only 21%.

The third option is an *OM option*, where management reduces production costs by 20% and increases contribution by 114%.

**SOLUTION** ▶ Given the conditions of our brief example, Fisher Technologies has increased contribution from \$10,500 to \$22,500. It may now have a bank willing to lend it additional funds.

**INSIGHT** ▶ The OM option not only yields the greatest improvement in contribution but also may be the only feasible option. Increasing sales by 50% and decreasing finance cost by 50% may both be virtually impossible. Reducing operations cost by 20% may be difficult but feasible.

**LEARNING EXERCISE** ▶ What is the impact of only a 15% decrease in costs in the OM option? [Answer: A \$19,500 contribution; an 86% increase.]

Example 1 underscores the importance of the effective operations activity of a firm. Development of increasingly effective operations is the approach taken by many companies as they face growing global competition.

## What Operations Managers Do

All good managers perform the basic functions of the management process. The management process consists of *planning, organizing, staffing, leading, and controlling*. Operations managers apply this management process to the decisions they make in the OM function. The **Ten strategic OM decisions** are introduced in Table 1.2. Successfully addressing each of these decisions requires planning, organizing, staffing, leading, and controlling.

**Where Are the OM Jobs?** How does one get started on a career in operations? The ten strategic OM decisions identified in Table 1.2 are made by individuals who work in the disciplines shown in the blue areas of Figure 1.1. Business students who know their accounting,

### Ten Strategic OM Decisions

- Design of goods and services
- Managing quality
- Process strategies
- Location strategies
- Layout strategies
- Human resources
- Supply-chain management
- Inventory management
- Scheduling
- Maintenance

**STUDENT TIP** ◆

An operations manager must successfully address the 10 decisions around which this text is organized.

**LO 1.2** Identify the 10 strategic decisions of operations management

**TABLE 1.2** Ten Strategic Operations Management Decisions

DECISION	CHAPTER(S)
1. <i>Design of goods and services</i> : Defines much of what is required of operations in each of the other OM decisions. For instance, product design usually determines the lower limits of cost and the upper limits of quality, as well as major implications for sustainability and the human resources required.	5, Supplement 5
2. <i>Managing quality and statistical process control</i> : Determines the customer's quality expectations and establishes policies and procedures to identify and achieve that quality.	6, Supplement 6
3. <i>Process and capacity strategies</i> : Determines how a good or service is produced (i.e., the process for production) and commits management to specific technology, quality, human resources, and capital investments that determine much of the firm's basic cost structure.	7, Supplement 7
4. <i>Location strategies</i> : Requires judgments regarding nearness to customers, suppliers, and talent, while considering costs, infrastructure, logistics, and government.	8
5. <i>Layout strategies</i> : Requires integrating capacity needs, personnel levels, technology, and inventory requirements to determine the efficient flow of materials, people, and information.	9
6. <i>Human resources, job design and work measurement</i> : Determines how to recruit, motivate, and retain personnel with the required talent and skills. People are an integral and expensive part of the total system design.	10
7. <i>Supply chain management</i> : Decides how to integrate the supply chain into the firm's strategy, including decisions that determine what is to be purchased, from whom, and under what conditions.	11, Supplement 11
8. <i>Inventory management</i> : Considers inventory ordering and holding decisions and how to optimize them as customer satisfaction, supplier capability, and production schedules are considered.	12, 14, 16
9. <i>Scheduling</i> : Determines and implements intermediate- and short-term schedules that effectively and efficiently use both personnel and facilities while meeting customer demands.	13, 15
10. <i>Maintenance</i> : Requires decisions that consider facility capacity, production demands, and personnel necessary to maintain a reliable and stable process.	17

statistics, finance, and OM have an opportunity to assume entry-level positions in all of these areas. As you read this text, identify disciplines that can assist you in making these decisions. Then take courses in those areas. The more background an OM student has in accounting, statistics, information systems, and mathematics, the more job opportunities will be available. About 40% of *all* jobs are in OM.

The following professional organizations provide various certifications that may enhance your education and be of help in your career:

- ◆ Association for Supply Chain Management (ASCM/APICS) ([www.ascm.org](http://www.ascm.org))
- ◆ American Society for Quality (ASQ) ([www.asq.org](http://www.asq.org))
- ◆ Institute for Supply Management (ISM) ([www.ismworld.org](http://www.ismworld.org))
- ◆ Project Management Institute (PMI) ([www.pmi.org](http://www.pmi.org))
- ◆ Council of Supply Chain Management Professionals ([www.cscmp.org](http://www.cscmp.org))

**LO 1.3** Identify career opportunities in operations management

## The Heritage of Operations Management

The field of OM is relatively young, but its history is rich and interesting. Our lives and the OM discipline have been enhanced by the innovations and contributions of numerous individuals. We now introduce a few of these people, and we provide a summary of significant events in operations management in Figure 1.3.

Eli Whitney (1800) is credited for the early popularization of interchangeable parts, which was achieved through standardization and quality control. Through a contract he signed with





Everett Collection/Newscom

Cost Focus		Quality Focus	Customization Focus	Globalization Focus
<b>Early Concepts</b> 1776–1880 Labor Specialization (Smith, Babbage) Standardized Parts (Whitney)	<b>Mass Production Era</b> 1910–1980 Moving Assembly Line (Ford/Sorensen) Statistical Sampling (Shewhart) Economic Order Quantity (Harris) Linear Programming (Dantzig) Material Requirements Planning (MRP)	<b>Lean Production Era</b> 1980–1995 Just-in-Time (JIT) Computer-Aided Design (CAD) Electronic Data Interchange (EDI) Total Quality Management (TQM) Baldrige Award Empowerment Kanbans	<b>Mass Customization Era</b> 1995–2005 Internet/E-Commerce Enterprise Resource Planning International Quality Standards (ISO) Finite Scheduling Supply Chain Management Mass Customization Build-to-Order Radio Frequency Identification (RFID)	<b>Globalization Era</b> 2005–2025 Global Supply Chains and Logistics Containerization of Shipping Growth of Transnational Organizations Sustainability Ethics in the Global Workplace Internet of Things (IoT) Digital Operations Industry 4.0

Figure 1.3

**Significant Events in Operations Management**

the U.S. government for 10,000 muskets, he was able to command a premium price because of their interchangeable parts.

Frederick W. Taylor (1881), known as the father of scientific management, contributed to personnel selection, planning and scheduling, motion study, and the now popular field of ergonomics. One of his major contributions was his belief that management should be much more resourceful and aggressive in the improvement of work methods. Taylor and his colleagues, Henry L. Gantt and Frank and Lillian Gilbreth, were among the first to systematically seek the best way to produce.

Another of Taylor’s contributions was the belief that management should assume more responsibility for:

1. Matching employees to the right job.
2. Providing the proper training.
3. Providing proper work methods and tools.
4. Establishing legitimate incentives for work to be accomplished.

By 1913, Henry Ford and Charles Sorensen combined what they knew about standardized parts with the quasi-assembly lines of the meatpacking and mail-order industries and added the revolutionary concept of the assembly line, where workers stood still and material moved.

Quality control is another historically significant contribution to the field of OM. Walter Shewhart (1924) combined his knowledge of statistics with the need for quality control and provided the foundations for statistical sampling in quality control. W. Edwards Deming

(1950) believed, as did Frederick Taylor, that management must do more to improve the work environment and processes so that quality can be improved.

Operations management will continue to progress as contributions from other disciplines, including *industrial engineering, statistics, management, analytics, and economics*, improve decision making.

Innovations from the *physical sciences* (biology, anatomy, chemistry, physics) have also contributed to advances in OM. These innovations include new adhesives, faster integrated circuits, gamma rays to sanitize food products, and specialized glass for iPhones and plasma TVs. Innovation in products and processes often depends on advances in the physical sciences.

Especially important contributions to OM have come from *information technology*, which we define as the systematic processing of data to yield information. Information technology—with digitalization, wireless links, Internet, and e-commerce—is reducing costs and accelerating communication.

Decisions in operations management require individuals who are well versed in analytical tools, in information technology, and often in the biological or physical sciences. In this textbook, we look at the diverse ways a student can prepare for a career in operations management.

**STUDENT TIP** ◆

Services are especially important because almost 80% of all jobs are in service firms.

## Operations for Goods and Services

**Services**

Economic activities that typically produce an intangible product (such as education, entertainment, lodging, government, financial, and health services).

Manufacturers produce a tangible product, while service products are often intangible. But many products are a combination of a good and a service, which complicates the definition of a service. Even the U.S. government has trouble generating a consistent definition. Because definitions vary, much of the data and statistics generated about the service sector are inconsistent. However, we define **services** as including repair and maintenance, government, food and lodging, transportation, insurance, trade, financial, real estate, education, legal, medical, entertainment, and other professional occupations.

The operation activities for both goods and services are often very similar. For instance, both have quality standards, are designed and produced on a schedule that meets customer demand, and are made in a facility where people are employed. However, some major differences *do* exist between goods and services. These are presented in Table 1.3.

**TABLE 1.3** Differences Between Goods and Services

CHARACTERISTICS OF SERVICES	CHARACTERISTICS OF GOODS
Intangible: Ride in an airline seat	Tangible: The seat itself
Produced and consumed simultaneously: Beauty salon produces a haircut that is consumed as it is produced	Product can usually be kept in inventory (beauty care products)
Unique: Your investments and medical care are unique	Similar products produced (iPads, earbuds)
High customer interaction: Often what the customer is paying for (consulting, education)	Limited customer involvement in production
Inconsistent product definition: Auto insurance changes with age and type of car	Product standardized (iPhone)
Often knowledge based: Legal, education, and medical services are hard to automate	Standard tangible product tends to make automation feasible
Services dispersed: Service may occur at retail store, local office, house call, or via Internet	Product typically produced at a fixed facility
Quality may be hard to evaluate: Consulting, education, and medical services	Many aspects of quality for tangible products are easy to evaluate (strength of a bolt)
Reselling is unusual: Musical concert or medical care	Product often has some residual value

We should point out that in many cases, the distinction between goods and services is not clear-cut. In reality, almost all services and almost all goods are a mixture of a service and a tangible product. Even services such as consulting may require a tangible report. Similarly, the sale of most goods includes a service. For instance, many products have the service components of financing and delivery (e.g., automobile sales). Many also require after-sale training and maintenance (e.g., office copiers and machinery). “Service” activities may also be an integral part of production. Human resource activities, logistics, accounting, training, field service, and repair are all service activities, but they take place within a manufacturing organization. Very few services are “pure,” meaning they have no tangible component. Counseling may be one of the exceptions.

**LO 1.4** Explain the distinction between goods and services

## Growth of Services

Services constitute the largest economic sector in postindustrial societies. Until about 1900, most Americans were employed in agriculture. Increased agricultural productivity allowed people to leave the farm and seek employment in the city. Similarly, manufacturing employment has decreased for the past 60 years. The changes in agriculture, manufacturing, and service employment as a percentage of the workforce are shown in Figure 1.4. Although the number of people employed in manufacturing has decreased since 1950, each person is now producing almost 20 times more than in 1950. Moreover, manufacturing’s influence on employment and the economic system extends well beyond direct manufacturing to include the related advances in technology, as well as the warehousing and logistics necessary to move products through the supply chain to the ultimate consumer. The total manufacturing impact accounts for about 30% of gross domestic product (GDP).

Services became the dominant employer in the early 1920s, with manufacturing employment peaking at about 32% in 1950. The huge productivity increases in agriculture and manufacturing have allowed more of our economic resources to be devoted to services. Consequently, much of the world can now enjoy the pleasures of education, health services, entertainment, and myriad other things that we call services. Examples of firms and percentage of employment in the U.S. service sector are shown in Table 1.4. Table 1.4 also provides employment percentages for the nonservice sectors of manufacturing, construction, agriculture, and mining on the bottom four lines.

### Service sector

The segment of the economy that includes trade, financial, lodging, education, legal, medical, and other professional occupations.

## Service Pay

Although there is a common perception that service industries are low paying, in fact, many service jobs pay very well. Operations managers in the maintenance facility of an airline are very well paid, as are the operations managers who supervise computer services to the financial community. About 42% of all service workers receive wages above the national average. However, the service-sector average is driven down because 14 of the U.S. Department of Commerce categories of the 33 service industries do indeed pay below the all-private industry average. Of these, retail trade, which pays only 61% of the national private industry average, is large. But even considering the retail sector, the average wage of all service workers is about 96% of the average of all private industries.

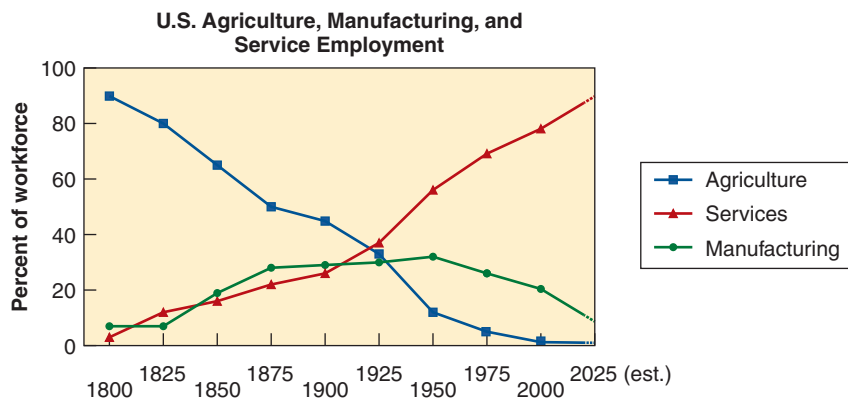


Figure 1.4

### U.S. Agriculture, Manufacturing, and Service Employment

Source: U.S. Bureau of Labor Statistics.

**TABLE 1.4** Examples of Organizations in Each Sector

SECTOR	EXAMPLE	PERCENTAGE OF ALL JOBS	
<b>Service Sector</b>			
Education, Medical, Other	San Diego State University, Arnold Palmer Hospital	14.9	} 85.7
Trade (retail, wholesale), Transportation, Utilities	Walgreen's, Walmart, Nordstrom, Alaska Airlines	17.0	
Information, Publishers, Broadcast	IBM, Bloomberg, Pearson, ESPN	1.8	
Professional, Legal, Business Services, Associations	Snelling and Snelling, Waste Management, American Medical Association, Ernst & Young	17.2	
Finance, Insurance, Real Estate	Citicorp, American Express, Prudential, Aetna	10.8	
Leisure, Lodging, Entertainment	Red Lobster, Motel 6, Celebrity Cruises	10.2	
Government (Fed, State, Local)	U.S., State of Alabama, Cook County	13.8	
<b>Manufacturing Sector</b>	General Electric, Ford, U.S. Steel, Intel		7.9
<b>Construction Sector</b>	Bechtel, McDermott		4.6
<b>Agriculture</b>	King Ranch		1.4
<b>Mining Sector</b>	Homestake Mining		0.4
<b>Grand Total</b>			100.0

Source: Bureau of Labor Statistics, 2020.

**STUDENT TIP** ◆

## The Productivity Challenge

Why is productivity important?  
Because it determines our standard of living.

**Productivity**

The ratio of outputs (goods and services) divided by one or more inputs (such as labor, capital, or management).

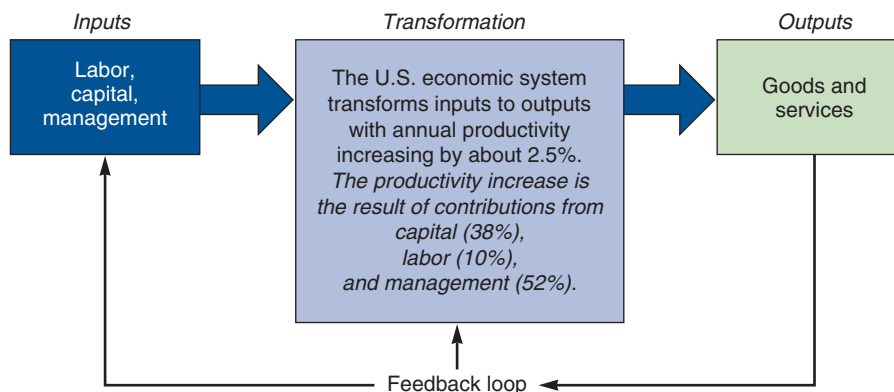
The creation of goods and services requires changing resources into goods and services. The more efficiently we make this change, the more productive we are and the more value is added to the good or service provided. **Productivity** is the ratio of outputs (goods and services) divided by the inputs (resources, such as labor and capital) (see Figure 1.5). The operations manager's job is to enhance (improve) this ratio of outputs to inputs. Improving productivity means improving efficiency.<sup>1</sup>

This improvement can be achieved in two ways: reducing inputs while keeping output constant or increasing output while keeping inputs constant. Both represent an improvement in productivity. In an economic sense, inputs are labor, capital, and management, which are integrated into a production system. Management creates this production system, which provides the conversion of inputs to outputs. Outputs are goods and services, including such diverse

**Figure 1.5**

**The Economic System Adds Value by Transforming Inputs to Outputs**

An effective feedback loop evaluates performance against a strategy or standard. It also evaluates customer satisfaction and sends signals to managers controlling the inputs and transformation process.





items as guns, butter, education, improved judicial systems, and ski resorts. *Production* is the making of goods and services. High production may imply only that more people are working and that employment levels are high (low unemployment), but it does not imply high *productivity*.

Measurement of productivity is an excellent way to evaluate a country's ability to provide an improving standard of living for its people. *Only through increases in productivity can the standard of living improve.* Moreover, only through increases in productivity can labor, capital, and management receive additional payments. If returns to labor, capital, or management are increased without increased productivity, prices rise. On the other hand, downward pressure is placed on prices when productivity increases because more is being produced with the same resources.

The benefits of increased productivity are illustrated in the *OM in Action* box, “Improving Productivity at Starbucks.”

For well over a century (from about 1869), the U.S. has been able to increase productivity at an average rate of almost 2.5% per year. Such growth has doubled U.S. wealth every 30 years. However, U.S. annual productivity growth in the early part of the 21st century is slightly below the 2.5% range for the economy as a whole and in recent years has been trending down.

In this text, we examine how to improve productivity through operations management. Productivity is a significant issue for the world and one that the operations manager is uniquely qualified to address.

**LO 1.5** Explain the difference between production and productivity

## Productivity Measurement

The measurement of productivity can be quite direct. Such is the case when productivity is measured by labor-hours per ton of a specific type of steel. Although labor-hours is a common measure of input, other measures such as capital (dollars invested), materials (tons of ore), or energy (kilowatts of electricity) can be used.<sup>3</sup> An example of this can be summarized in the following equation:

$$\text{Productivity} = \frac{\text{Units produced}}{\text{Input used}} \quad (1-1)$$

For example, if units produced = 1,000 and labor-hours used is 250, then:

$$\text{Single-factor productivity} = \frac{\text{Units produced}}{\text{Labor-hours used}} = \frac{1,000}{250} = 4 \text{ units per labor-hour}$$

**LO 1.6** Compute single-factor productivity

### OM in Action

#### Improving Productivity at Starbucks<sup>2</sup>

“This is a game of seconds . . .” says Silva Peterson, whom Starbucks has put in charge of saving seconds. Her team of 10 analysts is constantly asking themselves: “How can we shave time off this?”

Peterson's analysis suggested that there were some obvious opportunities. First, stop requiring signatures on credit-card purchases under \$25. This sliced 8 seconds off the transaction time at the cash register.

Then analysts noticed that Starbucks' largest cold beverage, the Venti size, required two bending and digging motions to scoop up enough ice. The scoop was too small. Redesign of the scoop provided the proper amount in one motion and cut 14 seconds off the average time of 1 minute.

Third were new espresso machines; with the push of a button, the machines grind coffee beans and brew. This allowed the server, called a “barista” in Starbucks's vocabulary, to do other things. The savings: about 12 seconds per espresso shot.

As a result, operations improvements at Starbucks outlets have increased the average transactions per hour to 11.7—a 46% increase—and yearly volume by \$250,000, to about \$1 million. The result: a 27% improvement in overall productivity—about 4.5% per year. In the service industry, a 4.5% per year increase is very tasty.



**Single-factor productivity**

Indicates the ratio of goods and services produced (outputs) to one resource (input).

**Multifactor productivity**

Indicates the ratio of goods and services produced (outputs) to many or all resources (inputs).

The use of just one resource input to measure productivity, as shown in Equation (1-1), is known as **single-factor productivity**. However, a broader view of productivity is **multifactor productivity**, which includes all inputs (e.g., capital, labor, material, energy). Multifactor productivity is also known as *total factor productivity*. Multifactor productivity is calculated by combining the input units as shown here:

$$\text{Multifactor productivity} = \frac{\text{Output}}{\text{Labor} + \text{Material} + \text{Energy} + \text{Capital} + \text{Miscellaneous}} \quad (1-2)$$

To aid in the computation of multifactor productivity, the individual inputs (the denominator) can be expressed in dollars and summed as shown in Example 2.

**Example 2****COMPUTING SINGLE-FACTOR AND MULTIFACTOR GAINS IN PRODUCTIVITY**

Collins Title Insurance Ltd. wants to evaluate its labor and multifactor productivity with a new computerized title-search system. The company has a staff of four, each working 8 hours per day (for a payroll cost of \$640/day) and overhead expenses of \$400 per day. Collins processes and closes on 8 titles each day. The new computerized title-search system will allow the processing of 14 titles per day. Although the staff, their work hours, and pay are the same, the overhead expenses are now \$800 per day.

**APPROACH** ► Collins uses Equation (1-1) to compute labor productivity and Equation (1-2) to compute multifactor productivity.

**SOLUTION** ►

$$\text{Labor productivity with the old system: } \frac{8 \text{ titles per day}}{32 \text{ labor-hours}} = .25 \text{ title per labor-hour}$$

$$\text{Labor productivity with the new system: } \frac{14 \text{ titles per day}}{32 \text{ labor-hours}} = .4375 \text{ title per labor-hour}$$

$$\text{Multifactor productivity with the old system: } \frac{8 \text{ titles per day}}{\$640 + \$400} = .0077 \text{ title per dollar}$$

$$\text{Multifactor productivity with the new system: } \frac{14 \text{ titles per day}}{\$640 + \$800} = .0097 \text{ title per dollar}$$

Labor productivity has increased from .25 to .4375. The change is  $(.4375 - .25)/.25 = 0.75$ , or a 75% increase in labor productivity. Multifactor productivity has increased from .0077 to .0097. This change is  $(.0097 - .0077)/.0077 = 0.26$ , or a 26% increase in multifactor productivity.

**INSIGHT** ► Both the labor (single-factor) and multifactor productivity measures show an increase in productivity. However, the multifactor measure provides a better picture of the increase because it includes all the costs connected with the increase in output.

**LEARNING EXERCISE** ► If the overhead goes to \$960 (rather than \$800), what is the multifactor productivity? [Answer: .00875.]

**RELATED PROBLEMS** ► 1.1, 1.2, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11, 1.13, 1.14, 1.17

**LO 1.7** Compute multifactor productivity

Use of productivity measures aids managers in determining how well they are doing. But results from the two measures can be expected to vary. If labor productivity growth is entirely the result of capital spending, measuring just labor distorts the results. Multifactor productivity is usually better, but more complicated. Labor productivity is the more popular measure. The multifactor-productivity measures provide better information about the

trade-offs among factors, but substantial measurement problems remain. Some of these measurement problems are:

1. *Quality* may change while the quantity of inputs and outputs remains constant. Compare a smart LED TV of this decade with a black-and-white TV of the 1950s. Both are TVs, but few people would deny that the quality has improved. The unit of measure—a TV—is the same, but the quality has changed.
2. *External elements* may cause an increase or a decrease in productivity for which the system under study may not be directly responsible. A more reliable electric power service may greatly improve production, thereby improving the firm's productivity because of this support system rather than because of managerial decisions made within the firm.
3. *Precise units of measure* may be lacking. Not all automobiles require the same inputs: Some cars are subcompacts, others are 911 Turbo Porsches.

Productivity measurement is particularly difficult in the service sector, where the end product can be hard to define. For example, economic statistics ignore the quality of your haircut, the outcome of a court case, or the service at a retail store. In some cases, adjustments are made for the quality of the product sold but *not* the quality of the sales presentation or the advantage of a broader product selection. Productivity measurements require specific inputs and outputs, but a free economy is producing worth—what people want—which includes convenience, speed, and safety. Traditional measures of outputs may be a very poor measure of these other measures of worth. Note the quality-measurement problems in a law office, where each case is different, altering the accuracy of the measure “cases per labor-hour” or “cases per employee.”

## Productivity Variables

As we saw in Figure 1.5, productivity increases are dependent on three **productivity variables**:

1. *Labor*, which contributes about 10% of the annual increase.
2. *Capital*, which contributes about 38% of the annual increase.
3. *Management*, which contributes about 52% of the annual increase.

These three factors are critical to improved productivity. They represent the broad areas in which managers can take action to improve productivity.

**Labor** Improvement in the contribution of labor to productivity is the result of a healthier, better-educated, and better-nourished labor force. Some increase may also be attributed to a shorter workweek. Historically, about 10% of the annual improvement in productivity is attributed to improvement in the quality of labor. Three key variables for improved labor productivity are:

1. Basic education appropriate for an effective labor force.
2. Diet of the labor force.
3. Social overhead that makes labor available, such as transportation and sanitation.

Illiteracy and poor diets are a major impediment to productivity, costing countries up to 20% of their productivity. Infrastructure that yields clean drinking water and sanitation is also an opportunity for improved productivity, as well as an opportunity for better health, in much of the world.

In developed nations, the challenge becomes *maintaining and enhancing the skills of labor* in the midst of rapidly expanding technology and knowledge. Recent data suggest that the average American 17-year-old knows significantly less mathematics than the average Japanese at the same age, and about half cannot answer the questions in Figure 1.6. Moreover, about one-third of American job applicants tested for basic skills were deficient in reading, writing, or math.

Overcoming shortcomings in the quality of labor while other countries have a better labor force is a major challenge. Perhaps improvements can be found not only through increasing competence of labor but also via *better utilized labor with a stronger commitment*. Training, motivation, team building, and the human resource strategies discussed in Chapter 10, as well as improved education, may be among the many techniques that will contribute to increased labor productivity. Improvements in labor productivity are possible; however, they can be expected to be increasingly difficult and expensive.

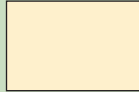
### Productivity variables

The three factors critical to productivity improvement—labor, capital, and the art and science of management.

**LO 1.8** *Identify the critical variables in enhancing productivity*

Figure 1.6

About Half of the 17-Year-Olds in the U.S. Cannot Correctly Answer Questions of This Type

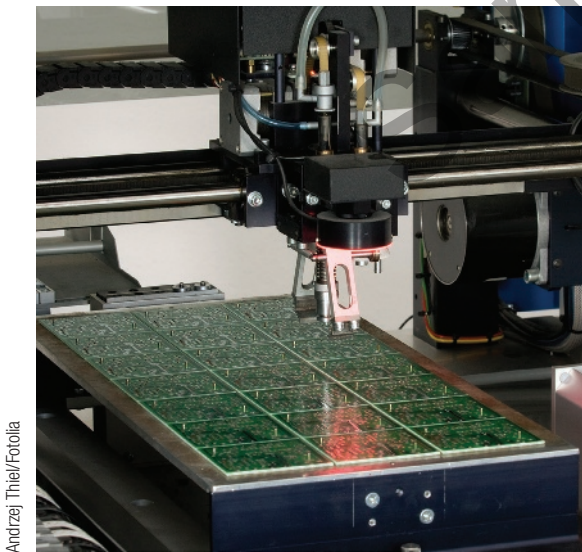
 <p>6 yds 4 yds</p> <p>What is the area of this rectangle?</p> <p>_____ 4 square yds _____ 6 square yds _____ 10 square yds _____ 20 square yds _____ 24 square yds</p>	<p>If <math>9y + 3 = 6y + 15</math> then <math>y =</math></p> <p>_____ 1                      _____ 4 _____ 2                      _____ 6</p>
	<p>Which of the following is true about 84% of 100?</p> <p>_____ It is greater than 100 _____ It is less than 100 _____ It is equal to 100</p>

**Capital** Human beings are tool-using animals. Capital investment provides those tools. Capital investment has increased in the U.S. every year except during a few very severe recession periods. Annual capital investment in the U.S. has increased at an annual rate of 1.5% after allowances for depreciation.

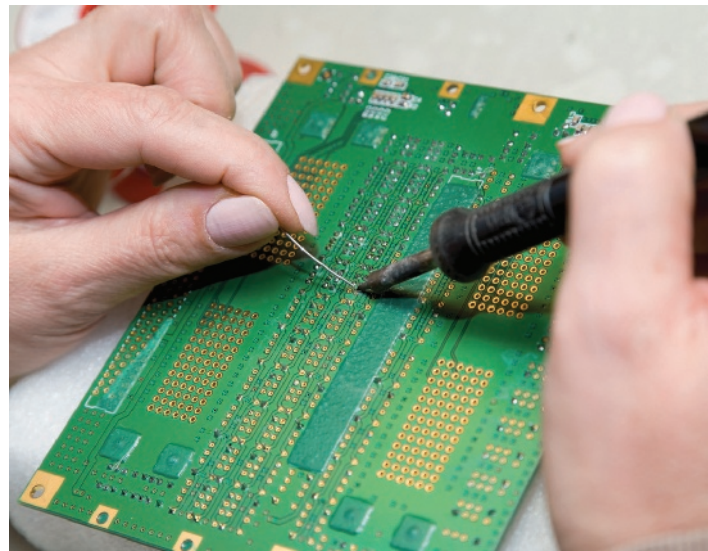
Inflation and taxes increase the cost of capital, making capital investment increasingly expensive. When the capital invested per employee drops, we can expect a drop in productivity. Using labor rather than capital may reduce unemployment in the short run, but it also makes economies less productive and therefore lowers wages in the long run. Capital investment is often a necessary, but seldom a sufficient, ingredient in the battle for increased productivity.

The trade-off between capital and labor is continually in flux. The higher the cost of capital or perceived risk, the more projects requiring capital are “squeezed out”: they are not pursued because the potential return on investment for a given risk has been reduced. Managers adjust their investment plans to changes in capital cost and risk.

**Management** Management is a factor of production and an economic resource. Management is responsible for ensuring that labor and capital are effectively used to increase productivity. Management accounts for over half of the annual increase in productivity. This



Andrzej Thiel/Fotolia



Guy Shapira/Shutterstock

The effective use of capital often means finding the proper trade-off between investment in capital assets (automation, left) and human assets (a manual process, right). While there are risks connected with any investment, the cost of capital and physical investments is fairly clear-cut, but the cost of employees has many hidden costs including fringe benefits, social insurance, and legal constraints on hiring, employment, and termination.



increase includes improvements made through the use of knowledge and the application of technology.

Using knowledge and technology is critical in postindustrial societies. Consequently, post-industrial societies are also known as **knowledge societies**. Knowledge societies are those in which much of the labor force has migrated from manual work to technical and information-processing tasks requiring ongoing education. The required education and training are important high-cost items that are the responsibility of operations managers as they build organizations and workforces. The expanding knowledge base of contemporary society requires that managers use *technology and knowledge effectively*.

*More effective use of capital* also contributes to productivity. It falls to the operations manager, as a productivity catalyst, to select the best new capital investments as well as to improve the productivity of existing investments.

The productivity challenge is difficult. A country cannot be a world-class competitor with second-class inputs. Poorly educated labor, inadequate capital, and dated technology are second-class inputs. High productivity and high-quality outputs require high-quality inputs, including good operations managers.

#### Knowledge society

A society in which much of the labor force has migrated from manual work to work based on knowledge.

## Productivity and the Service Sector

The service sector provides a special challenge to the accurate measurement of productivity and productivity improvement. The traditional analytical framework of economic theory is based primarily on goods-producing activities. Consequently, most published economic data relate to goods production. But the data do indicate that, as our contemporary service economy has increased in size, we have had slower growth in productivity.

Productivity of the service sector has proven difficult to improve because service-sector work is:

1. Typically labor intensive (e.g., counseling, teaching).
2. Frequently focused on unique individual attributes or desires (e.g., investment advice).
3. Often an intellectual task performed by professionals (e.g., medical diagnosis).
4. Often difficult to mechanize and automate (e.g., a haircut).
5. Often difficult to evaluate for quality (e.g., performance of a law firm).

The more intellectual and personal the task, the more difficult it is to achieve increases in productivity. Low-productivity improvement in the service sector is also attributable to the growth of low-productivity activities in the service sector. These include activities not previously a part of the measured economy, such as child care, food preparation, house cleaning, and laundry service. These activities have moved out of the home and into the measured economy as more and more women have joined the workforce. Inclusion of these activities

Olaf Janotke/Agencja Fotograficzna Caro/Alamy Stock Photo



Siemens, a multi-billion-dollar German conglomerate, has long been known for its apprentice programs in its home country. Because education is often the key to efficient operations in a technological society, Siemens has spread its apprentice-training programs to its U.S. plants. These programs are laying the foundation for the highly skilled workforce that is essential for global competitiveness.

## OM in Action

### Taco Bell Improves Productivity and Goes Green to Lower Costs<sup>4</sup>

Founded in 1962 by Glenn Bell, Taco Bell seeks competitive advantage via low cost. Like many other services, Taco Bell relies on its operations management to improve productivity and reduce cost.

Its menu and meals are designed to be easy to prepare. Taco Bell has shifted a substantial portion of food preparation to suppliers who could perform food processing more efficiently than a stand-alone restaurant. Ground beef is precooked prior to arrival and then reheated, as are many dishes that arrive in plastic boil bags for easy sanitary reheating. Similarly, tortillas arrive already fried and onions prepped. Efficient layout and automation has cut to 8 seconds the time needed to prepare tacos and burritos and has cut time in the drive-through lines by 1 minute. These advances have been combined with training and empowerment to increase the span of management from one supervisor for 5 restaurants to one supervisor for 30 or more.

Operations managers at Taco Bell have cut in-store labor by 15 hours per day and reduced floor space by more than 50%. The result is a store that can average 164 seconds for each customer, from drive-up to pull-out.

More recently, Taco Bell completed the rollout of its new Grill-to-Order kitchens by installing water- and energy-saving grills that conserve 300 million gallons of water and 200 million kilowatt hours of electricity each year. This “green”-inspired cooking method also saves the company’s 5,800 restaurants \$17 million per year.

Effective operations management has resulted in productivity increases that support Taco Bell’s low-cost strategy. Taco Bell is now the fast-food low-cost leader with a 58% share of the Mexican fast-food market.



Bob Pardue-Signs/Alamy Stock Photo

has probably resulted in lower measured productivity for the service sector, although, in fact, actual productivity has probably increased because these activities are now more efficiently produced than previously.

However, despite the difficulty of improving productivity in the service sector, improvements are being made. And this text presents a multitude of ways to make these improvements. Indeed, what can be done when management pays attention to how work actually gets done is astonishing!

Although the evidence indicates that all industrialized countries have the same problem with service productivity, the U.S. remains the world leader in overall productivity *and* service productivity. Retailing is twice as productive in the U.S. as in Japan, where laws protect shopkeepers from discount chains. The U.S. telephone industry is at least twice as productive as Germany’s. The U.S. banking system is also 33% more efficient than Germany’s banking oligopolies. However, because productivity is central to the operations manager’s job and because the service sector is so large, we take special note in this text of how to improve productivity in the service sector. (See, for instance, the *OM in Action* box, “Taco Bell Improves Productivity and Goes Green to Lower Costs.”)

## Current Challenges in Operations Management

Operations managers work in an exciting and dynamic environment. This environment is the result of a variety of challenging forces, from globalization of world trade to the transfer of ideas, products, and money at electronic speeds. Let’s look at some of these challenges:

### STUDENT TIP

One of the reasons OM is such an exciting discipline is that an operations manager is confronted with ever-changing issues, from technology, to global supply chains, to sustainability.

- ◆ **Globalization:** The rapid decline in the cost of communication and transportation has made markets global. Similarly, resources in the form of capital, materials, talent, and labor are also now global. As a result, countries throughout the world are contributing to globalization as they vie for economic growth. Operations managers are rapidly seeking creative designs, efficient production, and high-quality goods via international collaboration.
- ◆ **Supply-chain partnering:** Shorter product life cycles, demanding customers, and fast changes in technology, materials, and processes require supply-chain partners to be in tune with the needs of end users. And because suppliers may be able to contribute unique expertise, operations managers are outsourcing and building long-term partnerships with critical players in the supply chain.

- ◆ *Sustainability*: Operations managers' continuing battle to improve productivity is concerned with designing products and processes that are ecologically sustainable. This means designing green products and packaging that minimize resource use, can be recycled or reused, and are generally environmentally friendly.
- ◆ *Technological change*: **Industry 4.0** is the name given to the new digital world. Some consider Industry 4.0 the fourth industrial revolution, hence the name. Why is this considered the fourth industrial revolution? The first industrial revolution included the harnessing of water and steam power in the late 1700s, leading to rapid mechanization and division of labor. This was followed quickly by electricity and the second industrial revolution's assembly lines and mass production. The third, in the 20th century, yielded communication between man and machine with computers, automation, and robots. Finally, the fourth, *Industry 4.0*, is the widespread use of precision sensors and digital signals—in a word, *digitalization*. From raw materials to design to manufacturing to logistics, services, and ultimately the end consumer, digital signals surround us. Moreover, digitalization suggests connecting this massive amount of data *in real time*. Harnessing the vast and growing array of digital signals is a huge opportunity for operations management, but it is also a significant challenge.
- ◆ *Mass customization*: Once managers recognize the *world* as the marketplace, the cultural and individual differences become quite obvious. In a world where consumers are increasingly aware of innovation and options, substantial pressure is placed on firms to respond in a creative way. And OM must rapidly respond with product designs and flexible production processes that cater to the individual whims of consumers. The goal is to produce customized products, whenever and wherever needed.
- ◆ *Lean operations*: Lean is the management model sweeping the world and providing the standard against which operations managers must compete. Lean can be thought of as the driving force in a well-run operation, where the customer is satisfied, employees are respected, and waste does not exist. The theme of this text is to build organizations that are more efficient, where management creates enriched jobs that help employees engage in continuous improvement, and where goods and services are produced and delivered when and where the customer desires them. These ideas are also captured in the phrase *Lean*.

These challenges must be successfully addressed by today's operations managers. This text will provide you with the foundations necessary to meet those challenges.

## Ethics, Social Responsibility, and Sustainability

The systems that operations managers build to convert resources into goods and services are complex. And they function in a world where the physical and social environment is evolving, as are laws and values. These dynamics present a variety of challenges that come from the conflicting perspectives of **stakeholders**, such as customers, distributors, suppliers, owners, lenders, employees, and community. Stakeholders, as well as government agencies at various levels, require constant monitoring and thoughtful responses.

Identifying ethical and socially responsible responses while developing sustainable processes that are also effective and efficient productive systems is not easy. Managers are also challenged to:

- ◆ Develop and produce safe, high-quality green products
- ◆ Train, retain, and motivate employees in a safe workplace
- ◆ Honor stakeholder commitments

Managers must do all this while meeting the demands of a very competitive and dynamic world marketplace. If operations managers have a *moral awareness and focus on increasing productivity in this system*, then many of the ethical challenges will be successfully addressed. The organization will use fewer resources, the employees will be committed, the market will be satisfied, and the ethical climate will be enhanced. Throughout this text, we note ways in which operations managers can take ethical and socially responsible actions while successfully addressing these challenges of the market. We also conclude each chapter with an *Ethical Dilemma* exercise.

### Industry 4.0

The fourth industrial revolution with widespread real-time digitalization.

### Stakeholders

Those with a vested interest in an organization, including customers, distributors, suppliers, owners, lenders, employees, and community members.

## Summary

Operations, marketing, and finance/accounting are the three functions basic to all organizations. The operations function creates goods and services. Much of the progress of operations management has been made in the twentieth century, but since the beginning of time, humankind has been attempting to improve its material well-being. Operations managers are key players in the battle to improve productivity.

As societies become increasingly affluent, more of their resources are devoted to services. In the U.S., more than 85% of the workforce is employed in the service sector. Productivity improvements and a sustainable environment are difficult to achieve, but operations managers are the primary vehicle for making improvements.

### Key Terms

Production (p. 38)	Services (p. 44)	Productivity variables (p. 49)
Operations management (OM) (p. 38)	Service sector (p. 45)	Knowledge society (p. 51)
Supply chain (p. 40)	Productivity (p. 46)	Industry 4.0 (p. 53)
Ten strategic OM decisions (p. 41)	Single-factor productivity (p. 48)	Stakeholders (p. 53)
	Multifactor productivity (p. 48)	

### Ethical Dilemma

The American car battery industry boasts that its recycling rate now exceeds 95%, the highest rate for any commodity. However, with changes brought about by specialization and globalization, parts of the recycling system are moving offshore. This is particularly true of automobile batteries, which contain lead. The Environmental Protection Agency (EPA) is contributing to the offshore flow with newly implemented standards that make domestic battery recycling increasingly difficult and expensive. The result is a major increase in used batteries going to Mexico, where environmental standards and control are less demanding than they are in the U.S. One in five batteries is now exported to Mexico. There is seldom difficulty finding buyers because lead is expensive and in worldwide demand. While U.S.

recyclers operate in sealed, mechanized plants, with smokestacks equipped with scrubbers and plant surroundings monitored for traces of lead, this is not the case in most Mexican plants. The harm from lead is legendary, with long-run residual effects. Health issues include high blood pressure, kidney damage, detrimental effects on fetuses during pregnancy, neurological problems, and arrested development in children.

Given the two scenarios below, what action do you take?

- You own an independent auto repair shop and are trying to safely dispose of a few old batteries each week. (Your battery supplier is an auto parts supplier who refuses to take your old batteries.)
- You are manager of a large retailer responsible for disposal of thousands of used batteries each day.

### Discussion Questions

- Why should one study operations management?
- What are some career opportunities in the operations management discipline?
- Identify four people who have contributed to the theory and techniques of operations management.
- Briefly describe the contributions of the four individuals identified in the preceding question.
- Figure 1.1 outlines the operations, finance/accounting, and marketing functions of three organizations. Prepare a chart similar to Figure 1.1 outlining the same functions for one of the following:
  - a newspaper
  - a drugstore
  - a college library
  - a summer camp
  - a small costume-jewelry factory
- What are the three basic functions of a firm?
- Identify the 10 strategic operations management decisions.
- Apply the 10 OM decisions to Amazon. (*Hint:* As a starting point, read the Global Profile that begins Chapter 12.)
- In an article titled “The Productivity Paradox,” Wickham Skinner attributed failure in productivity to cost reduction programs, which he said produce narrowness of vision. He recommended abandoning old-fashioned productivity as a goal in favor of setting a new objective of competitiveness.<sup>5</sup> Discuss this historical and seminal viewpoint.
- The U.S., and indeed much of the rest of the world, has been described as a “knowledge society.” How does this affect productivity measurement and the comparison of productivity between the U.S. and other countries?
- What are the measurement problems that occur when one attempts to measure productivity?
- Mass customization and rapid product development were identified as challenges to modern manufacturing operations. What is the relationship, if any, between these challenges? Can you cite any examples?
- What are the five reasons productivity is difficult to improve in the service sector?
- Discuss the overlap among operations, marketing, and finance—the three functions basic to all organizations—for small and medium-sized enterprises.
- As a library or Internet assignment, find the U.S. productivity rate (increase) last year for the (a) national economy, (b) manufacturing sector, and (c) service sector.