PART ONE

Introduction

Chapter 1 introduces you to the field of operations management. It describes the nature and scope of operations management, and how operations management relates to other parts of the organization. Among the other important topics it covers are a comparison of manufacturing and service operations, a brief history of operations management, and a list of trends in business that relate to operations. After you have read this chapter, you will have a good understanding of what the operations function of a business organization encompasses.

Chapter 2 discusses operations management in a broader context, and presents the issues of competition, strategy, and productivity. After you have read Chapter 2, you will understand the importance of the operations function relative to the goals of a business organization, and how performance of production function can be measured.

Introduction includes two chapters:

CHAPTER 1

Introduction to Operations Management

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

1. Define the term *operations management*.
2. Identify the three major functional areas of organizations and describe how they interrelate.
3. Describe the operations function and the nature of the operations manager's job.
4. Differentiate between design and operation of production systems.
5. Compare and contrast service and manufacturing operations.
6. Briefly describe the historical evolution of operations management.
7. Describe the key aspects of operations management decision making.
8. Identify some of the current trends in business that impact operations management.

CHAPTER OUTLINE

Up until the late 1990s, Sobeys was a regional chain of supermarkets in Atlantic Canada. Then, Loblaw started opening up stores in Sobeys' backyard. Sobeys' top management decided that the only way they could compete was to expand nationally. The company is now the second largest grocery chain in Canada, competing well with Loblaw.

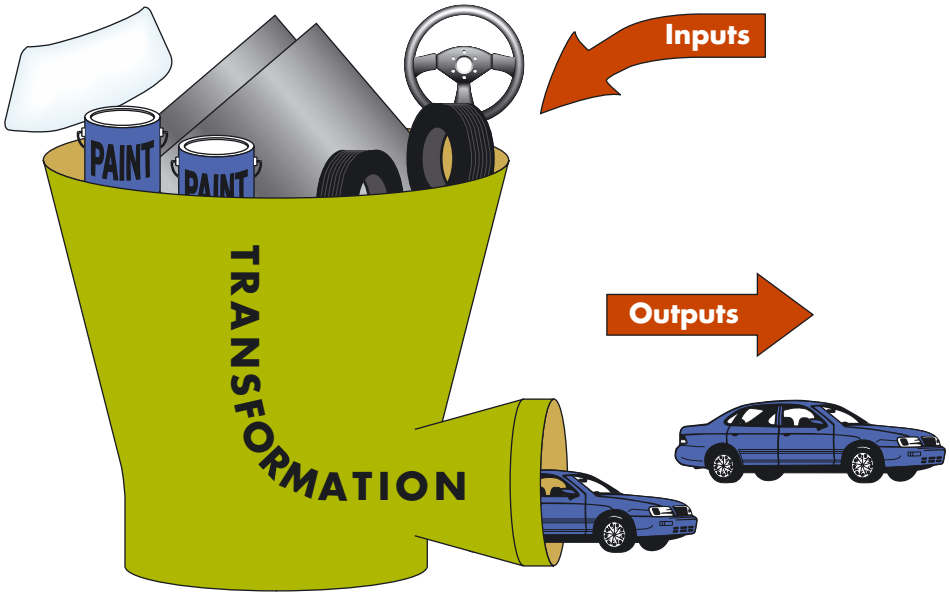
When Wal-Mart expanded into Canada in the mid-1990s, it caught Zellers by surprise. Zellers had been operating with almost no competition, carrying old merchandize, and offering little customer service. Profits shrank and losses piled up. The parent company, Hudson's Bay Company, had to change the strategic and operations direction of Zellers with the result that Zellers is now more competitive.

This book is about operations management. The subject matter is fascinating and timely: productivity, quality, e-business, global competition, and customer service are very much in the news. All are part of operations management. This first chapter presents an introduction and overview of operations management. Among the issues it addresses are: What is operations management? Why is it important? What do operations managers do? The chapter also provides a brief description of the historical evolution of operations management and a discussion of the trends that impact operations management.

INTRODUCTION

Operations management is the management of processes or systems that create goods and/or provide services. It encompasses forecasting, capacity planning, scheduling, managing inventories, assuring quality, motivating employees, deciding where to locate facilities, buying material and equipment and maintaining them, and more.

operations management The management of processes or systems that *create goods and/or provide services.*



We can use an airline company to illustrate an operations system. The system includes staff and airplanes, airport facilities, and maintenance facilities, sometimes spread out over a wide territory. Most of the activities performed by management and employees fall into the realm of operations management:

Forecasting such things as seat demand for flights, the growth in air travel, and weather and landing conditions.

Capacity planning, deciding the number of planes and where to use them.

Scheduling of planes for flights and for routine maintenance; scheduling of pilots and flight attendants; and scheduling of ground crews, counter staff, and baggage handlers.

Managing inventories of such items as food and beverages and spare parts.

Assuring quality, essential in flying and maintenance operations, where the emphasis is on safety. Also important in dealing with customers at ticket counters, check-in, telephone and electronic reservations, and in-flight service, where the emphasis is on efficiency and courtesy.

Employee motivation and training in all phases of operations.

Location of facilities according to top managers' decisions on which cities to provide service for, where to locate maintenance facilities, and where to locate major and minor hubs.

Buying materials such as fuel, food, bags, and spare parts. Buying aircraft and maintaining it.

Now consider a bicycle factory. This might be primarily an *assembly* operation: buying components such as frames, tires, wheels, gears, and other items from suppliers, and then assembling bicycles. The factory might also do some of the *fabrication* work itself (forming frames, making the gears and chains) and buy mainly raw materials and a few parts and materials such as paint, nuts and bolts, and tires. Among the key operations management tasks in either case are scheduling production, deciding which components to make and which to buy, ordering parts and materials, deciding on the style of bicycle to produce and how many, purchasing new equipment to replace old or worn-out equipment, maintaining equipment, motivating workers, and ensuring that quality standards are met.

Obviously, an airline company and a bicycle factory are completely different types of operations. One is primarily a service operation, the other a producer of goods. Nonetheless, these two operations have much in common. Both involve scheduling of activities, motivating employees, ordering and managing supplies, selecting and maintaining equipment, and satisfying quality standards. And in both businesses, the success of the business depends on planning.

Many companies use operations management strategies, tactics, and actions in order to improve their efficiency and effectiveness. *Efficiency* refers to operating at minimum cost and fast, whereas *effectiveness* refers to achieving the intended goals (quality). This text contains many practical and real-life examples of operations management in the form of tours, readings, cases, photos and captions, news clips, and video clips (on the DVD). For example, there is a description of how Stone Consolidated, the paper manufacturer (now part of Abitibi Consolidated), chose a location for a landfill (Chapter 8), how Standard Aero (a small aircraft engine repairer) started its total quality management process (Chapter 9), how various food companies such as Good Humor Breyers use supply chain tools to improve their operation (Chapter 16), how various companies such as Eli Lilly Canada use warehouse management systems to operate efficiently (Chapter 11), how companies such as Celestica use just-in-time systems to work efficiently (Chapter 14), and how companies such as General Dynamics Land Systems use project management techniques and software to operate effectively (Chapter 17).

WHY STUDY OPERATIONS MANAGEMENT?

You may be wondering why you need to study operations management. Actually, there are a number of very good reasons. One is that operations management activities are at the core of *all* business organizations, regardless of what business they are in. Because a large percentage of a company's expenses occur in the operations area, such as purchasing materials and workforce salaries, more efficient operations—even a small reduction in operations costs—can result in large increases in profit. Second, a large number of all jobs are in operations management—such areas as purchasing, quality assurance, production planning and control, scheduling, logistics, inventory management, and many more (see for example, Operations Management Job Ads on the next page.) Third, activities in all of the other areas of business organizations, such as finance, accounting, human resources, management information systems (MIS), and marketing are all

NEWSCLIP

Operations Management Job Ads

Purchasing Coordinator

Responsibilities

We require an experienced purchaser to manage the daily procurement of materials, tooling and shop supplies for a very busy custom machine shop. The role requires an understanding of the time constraints in the purchasing cycle including "on-demand" purchasing. Specific duties include negotiating pricing on regular purchases, following up on outstanding orders, building strong relationships with vendors, maintaining the integrity of data in the ERP system and developing strong processes and procedures for the role. The candidate must be able to deal with multiple deadlines and on-going requests for purchases from various internal sources.

Qualifications

Business Administration Diploma with 4 years experience in a manufacturing environment along with enrolment in a related certification program (PMAC or APICS). Custom machine shop experience is a definite asset. Strong computer skills with MS Office are required. Prior experience with Made2Manage ERP system is an asset.

Source: Alberta Institute of Purchasing Management Association of Canada (AIPMAC), extracted from www.aipmac.ab.ca/Employmentreferral.htm, January 25, 2005.

Materials Analyst/Coordinator

Responsibilities

- Analyze MRP and MPS to requisition purchase orders for Purchasing and creation of work orders
- Responsible for MPS of machines and parts sales
- Accountable for inventory turns, inventory levels and all inventory transactions
- Controls item master information related to min/max levels, source codes and lead times
- Responsible for cycle count program and all cycle count reconciliation and recording
- Creating various reports for inventory accuracy and open work orders
- Responsible for new parts log and maintaining accuracy
- Coordinate changes through engineering specification and engineering order changes
- Supervise Inventory Clerk

Qualifications

- Education/Experience: College diploma in Business Administration where Inventory Management and Purchasing were instructed
- Minimum College Degree in Business Administration and 8 years related experience. Good mathematical aptitude and attention to details for accuracy
- Preference given to C.P.I.M. designations
- Excellent interpersonal skills
- Proficient in the use of computer applications such as word processing and spreadsheets, as well as MRP material related system
- Ability to be a self-starter and professionally react to different situations
- Ability to manage multiple priorities in a fast paced environment

Source: http://www.apics-durham.org/cgi-bin/jobs/jobs_view.pl/index=27, extracted August 26, 2005.

interrelated with operations management activities. So it is essential for people who work in these areas to have a basic understanding of operations management.

Beyond all of this is the reality that operations management is about *management*, and *all managers* need to possess the knowledge and skills in the content areas you will learn about here. Among them are productivity, strategy, forecasting, quality, inventory control, and scheduling. Also, you will learn how to use a range of quantitative tools that enhance managerial decision making.

Careers in Operations Management

If you are thinking of a career in operations management, you can benefit by joining one or more of the following associations.

Purchasing Management Association of Canada (PMAC) www.pmac.ca

Supply Chain & Logistics Canada (SCL) www.sclcanada.org

American Production and Inventory Control Society (APICS) (now called the Association for Operations Management) www.apics.org

www.asq.org
www.cors.ca
www.poms.org
www.pmi.org
www.decisionsciences.org
www.iienet.org

American Society for Quality (ASQ)
Canadian Operational Research Society (CORS)
Production & Operations Management Society (POMS)
Project Management Institute (PMI)

APICS, PMAC, and ASQ all offer certification examination that can enhance your qualifications. Information about job opportunities can be obtained from all of these societies as well as from other sources, such as Decision Sciences Institute and the Institute of Industrial Engineers.

FUNCTIONS WITHIN ORGANIZATIONS

Organizations are formed to pursue goals that are achieved more efficiently and effectively by the concerted efforts of a group of people than by individuals working alone. Organizations are devoted to producing goods and/or providing services. They may be for-profit (i.e., business) or nonprofit organizations. Their goals, products, and services may be similar or quite different. Nonetheless, their functions and the way they operate are similar.

A typical organization has three basic functions: operations, finance, and marketing (see Figure 1–1). These three functions, and other supporting functions, perform different but *related* activities necessary for the operation of the organization. The functions must interact to achieve the goals and objectives of the organization, and each makes an important contribution. For instance, unless operations and marketing work together, marketing may promote goods or services that operations cannot profitably deliver, or operations may turn out goods or services for which there is no demand. Similarly, unless finance and operations work closely, funds for materials, expansion, and new equipment may not be available when needed.

Let's take a closer look at these functions.

Operations

The operations function performs all the activities *directly* related to producing goods or providing services. Hence, it exists both in fabrication and assembly operations, which are *goods-oriented*, and in areas such as health care, transportation, restaurant, and retailing, which are primarily *service-oriented* (see Table 1–1).

FIGURE 1–1
The three basic functions of business organizations and flows between them

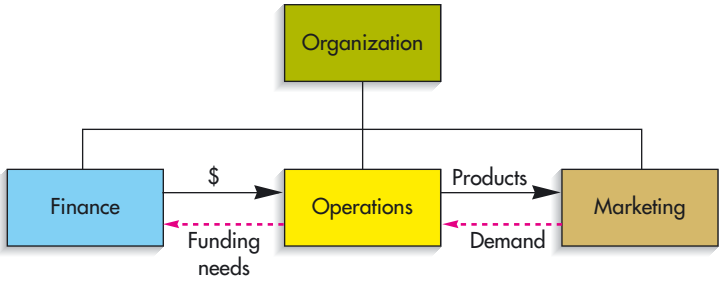


TABLE 1–1
Examples of types of operations

Type of Operations	Examples
Goods producing	Farming, mining, construction, manufacturing, power generation
Services	Warehousing, trucking, airlines
	Retailing, wholesaling, banking
	Films, radio and television
	Telephone

The operations function is the core of most organizations; it is responsible for the creation of an organization's goods or services. Inputs are used to obtain finished goods or services using one or more *transformation processes* (e.g., storing, transporting, cutting). To ensure that the desired outputs are obtained, measurements are taken at various points in the transformation process (*feedback*) and then compared with previously established standards to determine whether corrective action is needed (*control*). Figure 1–2 shows the conversion process. Table 1–2 provides two examples of inputs, transformation processes, and outputs.

It is important to note that goods and services often occur jointly. For example, having the oil changed in your car is a service, but the new oil is a good. Similarly, house painting is a service, but the paint is a good. The goods–service package is a continuum. It can range from primarily goods, with little service, to primarily service, with few goods (see Figure 1–3).

The essence of the operations function is to *add value* during the transformation process: **Value-added** is the term used to describe the difference between the cost of inputs and the value or price of outputs. In nonprofit organizations, the value of outputs (e.g., highway construction, police, and fire protection) is their value to society; the greater the value added, the greater the efficiency of these operations. In for-profit organizations, the value of outputs is measured by the prices that customers are willing to pay for those

value-added The difference between the cost of inputs and the value or price of outputs.

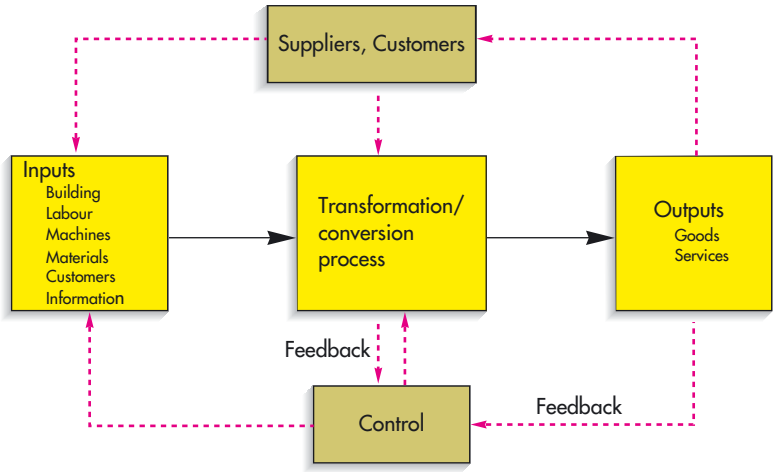


FIGURE 1–2

The operations function involves the conversion of inputs into outputs

Food Processor	Inputs	Process	Output
	Raw vegetables	Cleaning	Canned vegetables
	Metal sheets	Making cans	
	Water	Cutting	
	Energy	Cooking	
	Labour	Packing	
	Building	Labelling	
	Equipment		
Hospital	**Inputs**	**Process**	**Output**
	Doctors, nurses	Examination	Healthy patients
	Building	Surgery	
	Medical supplies	Monitoring	
	Equipment	Medication	
	Laboratories	Therapy	

TABLE 1–2

Illustrations of the transformation process

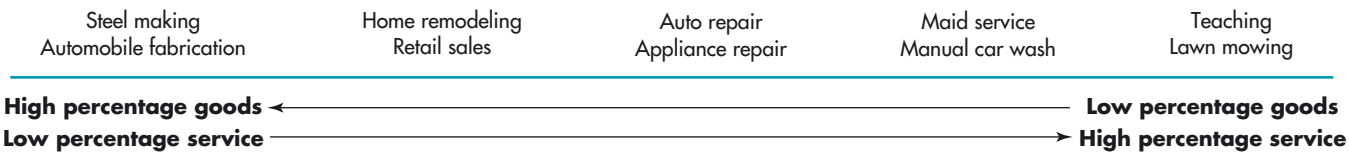


FIGURE 1–3

The goods–service continuum

goods or services. Firms use the money generated by value-added for research and development, investment in new facilities and equipment, paying workers, and *profits*. Consequently, the greater the value-added, the greater the amount of funds available for these purposes.

One way that businesses attempt to become more productive (i.e., making more output with same or less inputs) is to examine critically whether the operations performed by their workers add value. Businesses consider those that do not add value wasteful. Eliminating or improving such operations decreases the cost of inputs or processing, thereby increasing the value-added. For instance, a firm may discover it is producing an item much earlier than the scheduled delivery date to a customer, thus requiring the storage of the item in a warehouse until delivery. In effect, additional costs are incurred by storing the item without adding to the value of the item. Reducing storage time would reduce the transformation cost and, hence, increase the value-added.

Finance

The finance function performs activities related to securing resources at favourable prices and allocating those resources throughout the organization. Finance and operations management personnel cooperate by exchanging information and expertise in such activities as:

1. *Provision of funds*. The necessary funding of operations and the amount and timing of funding can be important and even critical when funds are tight. Careful planning can help avoid cash-flow problems. Most for-profit firms obtain the majority of their funds through the revenues generated by sales of goods and services.
2. *Economic analysis of investment proposals*. Evaluation of alternative investments in plant and equipment requires inputs from both operations and finance people.

Marketing

Marketing's focus is on selling and/or promoting the goods or services of an organization. Marketing is also responsible for assessing customer wants and needs, and for communicating those needs and feedback to operations people and to product design people (usually engineers in manufacturing companies). That is, operations needs information about demand so that it can plan accordingly (e.g., purchase materials or schedule work), while product design people need information that relates to improving current products and services, and designing new ones. Marketing, design, and production must work closely together to successfully implement design changes and to develop and produce new products. Marketing can provide valuable insight on what competitors are doing. One important piece of information marketing needs from operations is the manufacturing or service **lead time** in order to give customers realistic estimates of how long it will take to fill their orders.

lead time The time between ordering a good or service and receiving it.

Thus, marketing, operations, and finance must interface on product and process design, forecasting, setting realistic schedules, and quality and quantity decisions.

Other Functions

There are a host of other supporting functions that interface with operations (see Figure 1–4).

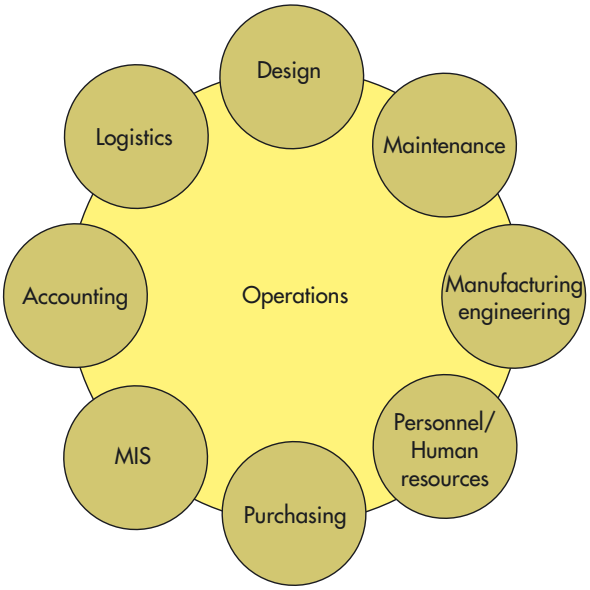


FIGURE 1–4
Operations interfaces with a number of supporting functions

Accounting supplies information to management on costs of labour, materials, and overhead, and may provide reports on items such as scrap, downtime, and inventories. Accounting includes accounts payables and accounts receivables. Accountants gather the information needed for financial statements as well.

Management information systems (*MIS*) is concerned with providing management with the information it needs to effectively manage. This occurs mainly through designing systems (hardware and software) to capture relevant information and preparing reports.

Purchasing has responsibility for procurement of materials, supplies, equipment, and services. Close contact with operations is necessary to ensure correct quantities and timing of purchases. The purchasing department is often called on to evaluate vendors for quality, delivery time reliability, service, price, and flexibility. Purchasing may also be involved in arranging incoming transportation, receiving, and inspecting the purchased goods.

The *personnel* or *human resources* department is concerned with recruitment and training of personnel, labour relations, contract negotiations, wage and salary administration, and ensuring the health and safety of employees.

Product design in manufacturing companies usually is done by engineers, but in other companies it could be done by architects, scientists, chemists, and chefs. Designers create goods and services from information given to them on markets by marketing and provide product specifications to operations to make the products.

Maintenance is responsible for general upkeep and repair of equipment, buildings and grounds, heating and air-conditioning; removing toxic wastes; parking; and perhaps security.

Manufacturing engineering is responsible for design or purchase of the machines and equipment needed in the production process. Also called process engineers, they are mainly trained as mechanical engineers, but other fields like electrical and chemical may also be needed.

Logistics involves the transportation of raw material to the plant, storage, and shipping of goods to warehouses, retail outlets, or final customers.

Many of these interfaces are elaborated on in later chapters.

THE SCOPE OF OPERATIONS MANAGEMENT

We have already noted that the operations manager is responsible for the creation of goods and services. This encompasses acquisition of resources and the conversion

of raw material into outputs using one or more transformation processes. This involves designing, planning, executing, and controlling the elements that make up the process.

A primary function of an operations manager is to guide the system by decision making. Certain decisions affect the *design* of the system, and others affect the *operation* (planning, execution, control) of the system. Design decisions are usually strategic and long term (1–5 years ahead), whereas planning decisions are tactical and medium term (1–12 months ahead), and execution and control decisions are short-term (1–12 weeks ahead).

System design involves decisions that relate to system capacity, the geographic location of facilities, arrangement of departments and placement of equipment within physical structures, product and service planning, and acquisition of equipment. *System operation* involves management of personnel, inventory planning and control, production planning, scheduling, project management, and quality assurance. In many instances, the operations manager is more involved in day-to-day operating decisions than with decisions relating to system design. However, the operations manager has a vital stake in system design because *system design essentially determines many of the parameters of system operation*. For example, costs, space, capacities, and quality are directly affected by design decisions. Even though the operations manager is not solely responsible for making all design decisions, he or she can provide those decision makers with a wide range of information that will have a bearing on their decisions. Table 1–3 provides additional details on the nature and scope of operations decisions, and indicates where the topics are discussed in this textbook.

TABLE 1–3

Design and operation decisions

Decision Area	Basic Questions	Chapter
Forecasting	What will the demand be?	3
Design		
Product and service design	What do customers want? How can products and services be improved?	4
Capacity (long term)	How much capacity will be needed? How can the organization best meet capacity requirements?	5
Process selection	What processes should the organization use?	6
Layout	What is the best arrangement for departments, machines and equipment, in terms of work flow?	6
Design of work systems	What is the best way to motivate employees? How can productivity be improved? How to measure work? How to improve work methods?	7
Location	What is a satisfactory location for a facility (factory, store, etc.)?	8
Operation (planning, execution and control)		
Quality	How is quality defined? How are quality goods and services achieved and improved?	9
Quality control	Are processes performing adequately? What standards should be used? Are standards being met?	10
Inventory management	How much to order? When to reorder? Which items should get the most attention?	11
Aggregate planning	How much capacity will be needed over the medium term? How can capacity needs best be met?	12
Material requirements planning	What material, parts, and subassemblies will be needed, and when?	13
Just-in-time manufacturing	How to manage production so that it is fast and lean?	14
Scheduling	How can jobs best be scheduled? When to schedule staff?	15
Supply chain management	Which supplier to choose? How to transport goods?	16
Project management	Which activities are the most critical to the success of a project? What resources will be needed, and when will they be needed?	17
Waiting lines	What service capacity is appropriate?	18

DIFFERENTIATING FEATURES OF OPERATIONS SYSTEMS

A number of features differentiate operations systems. A brief discussion of some of these features will help you develop a better understanding of the nature and scope of operations management. The three described are degree of product standardization, type of process, and production of goods versus services.

Degree of Product Standardization

The output of production systems can range from highly standardized to highly customized. *Standardized output* means that there is a high degree of uniformity (i.e., little variety) in goods or services. Standardized goods include radios, televisions, computers, newspapers, canned foods, automobile tires, pens and pencils, and commodities such as steel, sugar, and paper. Standardized services include automatic car washes, televised newscasts, taped lectures, commercial airline service, fast food service, motels, utilities, and education. *Customized output* means that the product or service is designed for a specific case or individual. Customized goods include eyeglasses, custom-fitted clothing, window glass (cut to order), and customized draperies. Customized services include tailoring, taxi rides, and surgery.

Systems with standardized output can generally take advantage of standardized methods, less-skilled workers, materials, and mechanization, all of which contribute to higher volumes and lower unit costs. In custom systems, on the other hand, each job is sufficiently different so that workers must be more skilled, the work moves slower, and the work is less susceptible to mechanization.

Type of Process

The degree of product standardization and the volume (quantity) of output of a product or service influence the way a firm organizes its production process. On one end of the scale is a single, large-scale project such as the launching of a space shuttle (service) or the construction of a skyscraper (product). On the other end is a continuous process, such as oil refining. Between these extremes are customized individual units of output (job shop), such as custom-made furniture and auto repair; batches, such as paint and food products; and mass production (repetitive process), such as automobiles, personal computers, and appliances.

You will learn more about these different types of operations in later chapters.

Production of Goods versus Services

Production of goods results in a *tangible output*, such as an automobile, a clock radio, a golf ball, a refrigerator—anything that we can see or touch. It may take place in a factory, but can occur elsewhere. Service, on the other hand, generally implies an *act*. A physician's examination, TV and auto repair, lawn care, and projecting a film in a theatre are examples of services. The majority of service jobs fall into these categories:

Government services (federal, provincial, municipal).

Wholesale/retail (clothing, food, appliances, stationery, toys, etc.).

Financial services (banking, stock brokerage, insurance, etc.).

Health care (doctors, dentists, hospitals, etc.).

Professional services (lawyers, accountants, architects)

Personal services (laundry, dry cleaning, hair/beauty, gardening, etc.).

Business services (data processing, e-business, advertising, employment agencies, etc.).

Education (schools, colleges, universities, etc.).

Hotels and restaurants

Recreation

Transportation and warehousing

Utilities

Manufacturing and service are often similar in terms of *what* is done but different in terms of *how* it is done. For example, both involve design and operation decisions. Manufacturers must decide what size factory is needed. Service organizations (e.g., hospitals) must decide what size building is needed. Both must make decisions on location, scheduling and control of operations, and allocation of scarce resources.

Manufacturing and service organizations differ chiefly because manufacturing is goods-oriented and service is act-oriented. The differences involve the following:

1. Customer contact, use of inventories, and demand variability
2. Uniformity of input
3. Labour content of jobs
4. Uniformity of output
5. Measurement of productivity
6. Quality assurance

Let us consider each of these differences.

1. Often, by its nature, service involves a much higher degree of customer contact than manufacturing. The performance of a service often occurs at the point of consumption. For example, repairing a leaky roof must take place where the roof is, and surgery requires the presence of the patient. On the other hand, manufacturing allows a separation between production and consumption, so that manufacturing may occur away from the consumer. This permits a fair degree of latitude in selecting work methods, assigning jobs, scheduling work, and exercising control over operations. In addition, product-oriented operations can build up inventories of finished goods (e.g., cars, refrigerators), enabling them to absorb some of the shocks caused by variable demand. Service operations, however, cannot build up inventories and are much more sensitive to demand variability—banks and supermarkets alternate between lines of customers waiting for service and idle tellers or cashiers waiting for customers.

2. Service operations are subject to greater variability of inputs than typical manufacturing operations. Each patient, each lawn, and each auto repair presents a specific problem that often must be diagnosed before it can be remedied. Manufacturing operations often have the ability to carefully control the amount of variability of inputs.
3. Services often require a higher labour content whereas manufacturing can be more capital-intensive (i.e., mechanized).
4. Because high mechanization generates products with low variability, manufacturing tends to be smooth and efficient; service activities sometimes appear to be slow and awkward, and output is more variable. Automated services are an exception to this.
5. Measurement of productivity (i.e., output per unit time) is more straightforward in manufacturing due to the high degree of uniformity of most manufactured items. In service operations, variations in demand intensity and in requirements from job to job make productivity measurement considerably more difficult. For example, compare the productivity of two doctors. One may have a large number of routine cases while the other does not, so their productivity appears to differ unless a very careful analysis is made.
6. Quality assurance is more challenging in services when production and consumption occur at the same time. In manufacturing, errors can be corrected before the customer receives the output.

Although it is convenient to think in terms of systems devoted exclusively to goods or services, most real systems are a blend of both. For instance, maintenance and repair of equipment are services performed by virtually every manufacturing firm. Similarly, most service organizations typically sell goods that complement their services. Thus, a lawn-care firm usually sells goods such as weed killers, fertilizers, and grass seed. Hospitals dispense drugs along with health services. Restaurants sell food. Movie theatres sell popcorn, candy, and beverages.

The service sector and the manufacturing sector are both important to the economy. The service sector has been growing and now accounts for more than 70 percent of jobs in Canada. See Figure 1–5.

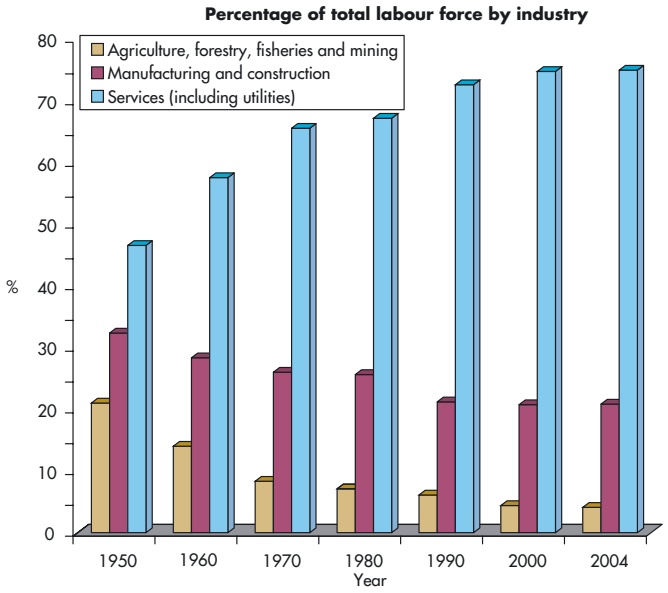


FIGURE 1–5

Percentage of total labour force by industry

Source: Adapted from Statistics Canada CANSIM database, http://cansim2.statcan.ca, Table 282–0090, various series, January 24, 2005; and census data.

THE OPERATIONS MANAGER'S JOB

The operations manager is the key figure in the system: he or she has the ultimate responsibility for the creation of goods or provision of services.

The kinds of jobs that operations managers oversee vary tremendously from organization to organization largely because of the different products or services involved. Thus, managing a banking operation obviously requires a different kind of expertise than managing a steelmaking operation. However, in a very important respect, the jobs are the same: They are both essentially *managerial*. In every case, the operations manager must coordinate the use of resources through the management processes of planning, organizing, directing, and controlling.

Examples of the responsibilities of operations managers according to these classifications are given in Table 1–4. Note that operations managers require both technical and behavioural competence.

In a survey of production/operations managers of approximately 250 Australian companies (two-thirds manufacturing), the following characteristics were discovered: approximately half joined the company after trade school and were promoted through ranks; thus, they were deficient in business management, accounting/finance, and computer skills. Approximately half had total responsibility over planning, quality, and maintenance, whereas the other half provided major inputs into these decisions. Approximately half would like more control over planning, information systems, personnel, and quality decisions. Most production/operations managers were given targets for cost reduction and

Planning	Organizing
Capacity	Degree of centralization
Location	Departments
Mix of products and services	Subcontracting
Production process	Suppliers
Layout	Staffing
Controlling	Directing
Inventory control	Scheduling
Quality control	Issuance of work orders
Production pace	Job assignments
Motivation	Purchasing
Cost control	Logistics

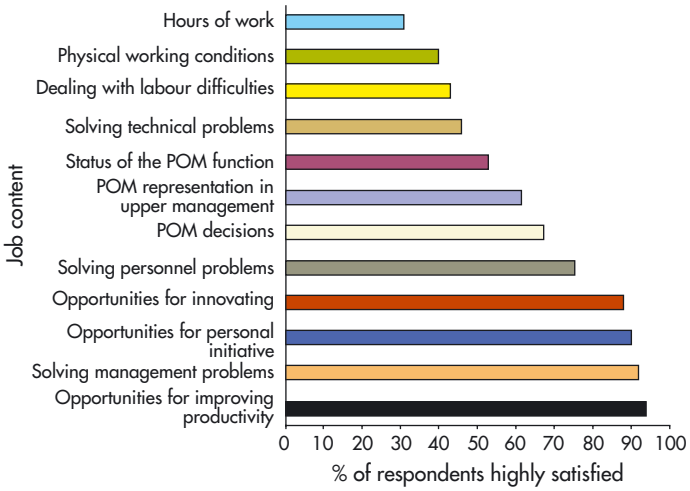
TABLE 1–4

Responsibilities of operations managers

FIGURE 1–6

Level of job satisfaction

Source: B. D'Netto, A. S. Sohal, and J. Trevillyan, "An Empirical Assessment of the Production/Operations Manager's Job," *Production and Inventory Management Journal*, 1st Quarter 1998, 39(1), pp. 57–61. Reprinted with permission of APICS, The Association for Operations Management.



productivity improvement. A list of job content and satisfaction of respondents for each is given in Figure 1–6. Most enjoy these challenges, whereas more than half are not happy with the heavy hours of work, working conditions, dealing with labour difficulty, and solving technical problems. Further questions revealed that most are happy with their compensation, work variety, work importance, and autonomy, whereas most are unhappy with their benefits and feedback from top management.

OPERATIONS MANAGERS AND DECISION MAKING

The chief role of an operations manager is that of a decision maker. In this capacity, the operations manager exerts considerable influence over the degree to which the goals and objectives of the organization are realized.

Throughout this book, you will encounter the broad range of decisions that operations managers must make, and you will be introduced to the tools necessary to handle those decisions. This section describes general approaches to decision making, including the use of models, quantitative approaches, analysis of trade-offs, the systems approach, establishing priorities, and ethics.

Models

model An abstraction of reality; a simplified representation of something.

A **model** is an abstraction of reality, a simplified representation of something. For example, a child's toy car is a physical model of a real automobile. Mathematical models represent important characteristics of the object by mathematical symbols and their relationship by mathematical equations and inequalities. Examples of mathematical models include formulas and sets of equations. Schematic models are graphs, charts, and drawings. Common statistical models include Normal distribution and regression equations.

Real life involves an overwhelming amount of detail, much of which is irrelevant for any particular problem. Models ignore the unimportant details so that attention can be concentrated on the most important aspects of a situation, thus increasing the opportunity to understand a problem and its solution.

Because schematic, mathematical, and statistical models play a significant role in operations management decision making, they are heavily integrated into the material of this text. For each model, try to learn (1) its purpose, (2) how it is used to generate results, (3) how these results are interpreted and used, and (4) what assumptions and limitations apply.

Quantitative Approaches

Quantitative approaches to problem solving often embody an attempt to obtain optimum solutions to the mathematical models of managerial problems. This is sometimes done by solving a set of equations. A popular example is *linear programming*, which is

widely used for optimum allocation of scarce resources. *Queuing techniques* are useful for analyzing situations in which waiting lines form. *Inventory techniques* are widely used to control inventories. *Project scheduling techniques* such as PERT (program evaluation and review technique) are useful for planning, coordinating, and controlling large-scale projects. *Forecasting techniques* are widely used in forecasting demand. *Statistical techniques* are currently used in many areas of decision making, including quality control.

Many of these quantitative techniques require computers, and are somewhat time-consuming. In contrast, a heuristic approach is a quick way to find a good solution. For many decisions, heuristic may be the only practical solution.

Analysis of Trade-offs

One type of heuristic approach is *trade-off* analysis. For example, (a) in deciding on the amount of inventory to stock, the manager may take into account the trade-off between the increased level of customer service that the additional inventory would yield and the increased costs required to stock that inventory, (b) in selecting a piece of equipment, a manager may evaluate the merits of extra features relative to the cost of those extra features, (c) in the scheduling of overtime to increase output, the manager may weigh the value of the increased output against the higher costs of overtime (e.g., higher labour costs, lower productivity, lower quality, and greater risk of accidents).

Throughout this book you will be presented with solution methods that reflect these kinds of trade-offs. Managers sometimes deal with these decisions by listing the advantages and disadvantages—the pros and cons—of a course of action to better understand the consequences of the decisions they must make. In some instances, managers add weights to the items on their list that reflect the relative importance of various factors. This can help them "net out" the potential impacts of the trade-offs on their decision. An example of this is the factor-rating approach described in Chapter 8 on facilities location.

The Systems Approach

A **system** can be defined as a set of interrelated parts that must work together. In a business organization, the organization can be thought of as a system composed of subsystems (e.g., marketing subsystem, operations subsystem, finance subsystems), which in turn are composed of lower subsystems. The systems approach emphasizes interrelationships among subsystems. Hence, from a systems viewpoint, the output and objectives of the organization as a whole take precedence over those of any one subsystem.

system A set of interrelated parts that must work together.

The systems approach is essential whenever something is being designed, redesigned, implemented, improved, or otherwise changed. It is important to take into account the impact on all parts of the system. For example, to investigate if the upcoming model of an automobile will have antilock brakes, a designer must take into account how customers will view the change, instructions for using the brakes, chances for misuse, the cost of producing the new brakes, installation procedures, recycling worn-out brakes, and repair procedures. In addition, workers will need training to make and/or assemble the brakes, production scheduling may change, inventory procedures may have to change, quality standards will have to be established, advertising must be informed of the new features, and parts suppliers must be selected.

Establishing Priorities

In virtually every situation, managers discover that certain elements are more important than others. Recognizing this fact of life enables the managers to direct their efforts to where they will do the most good and to avoid wasting time and energy on insignificant elements.

It is axiomatic that a relatively few factors are often most important, so that dealing with those factors will generally have a disproportionately larger impact on the results achieved. This is referred to as the **Pareto phenomenon**, which means some things (a few) will be very important for achieving an objective or solving a problem, and other

Pareto phenomenon A few factors account for a high percentage of the occurrence of some event(s).

things (many) will not. The implication is that a manager should examine each situation, searching for the few factors that will have the greatest impact, and give them the highest priority. This is one of the most important and pervasive concepts in operations management. In fact, this concept can be applied at all levels of management and to every aspect of decision making, both professional and personal.

Ethics

Operations managers, like all managers, have the responsibility to make ethical decisions. Ethical issues arise in many aspects of operations management, including:

- worker safety: providing adequate training, maintaining equipment in good working condition, maintaining a safe working environment;
- product safety: providing products that minimize the risk of injury to users or damage to property or the environment;
- the environment: not doing things that will harm the environment;
- closing facilities: taking into account the impact on a community, and honouring commitments that have been made.

In making decisions, managers must consider how their decisions will affect shareholders, employees, customers, the community at large, and the environment. Finding solutions that will be in the best interests of all of these stakeholders is not always easy, but it is a goal that all managers should strive to achieve.

THE HISTORICAL EVOLUTION OF OPERATIONS MANAGEMENT

Systems for production have existed since ancient times. The Great Wall of China, the Egyptian pyramids, the ships of the Spanish empire, and the roads and aqueducts of the Romans provide examples of the human ability to organize for production. Even so, most of these examples could be classified as "public works" projects.

craft production System in which highly skilled workers use simple, flexible tools to produce small quantities of customized goods.

In the earliest days of manufacturing, goods were produced using **craft production**: highly skilled workers using simple, flexible tools produced goods according to customer specifications. Goods were produced in small shops by craftsmen and their apprentices. Under that system, it was common for one person to be responsible for making a product, such as a horse-drawn wagon or a piece of furniture, from start to finish. Only simple tools were available; the machines that we use today had not been invented.

Craft production had major shortcomings. Because products were made by skilled craftsmen who custom-fitted parts, production was slow and costly. And when parts failed, the replacements also had to be custom made, which was also slow and costly. Another shortcoming was that production costs did not decrease as volume increased; there were no *economies of scale*, which would have provided a major incentive for companies to expand. Instead, many small companies emerged, each with its own set of standards.

Prior to the 1700s, business activities in Canada were limited to fishing and fur trade. Under a practice called *mercantilism*, raw materials were exported to Europe for further processing and manufacturing. Companies such as the Hudson's Bay Company were importing British-made goods to trade with local populations. All manufactured products came from Europe. The production of goods for sale, at least in the modern sense, and the modern factory system had their roots in the Industrial Revolution.

The Industrial Revolution

The Industrial Revolution began in the 1770s in England and spread to the rest of Europe and to North America during the nineteenth century. A number of innovations changed the face of production forever by substituting machine power for human power. Perhaps

the most significant of these was the steam engine, made practical by James Watt around 1764, because it provided a source of power to operate machines in factories. The spinning jenny (1770) and power loom (1785) revolutionized the textile industry. Supplies of coal and iron ore provided material for generating power and making machinery. The new machines, made of iron, were much stronger and more durable than the simple wooden machines they replaced. Two concepts assisted in mass production: division of labour and interchangeable parts.

Division of labour, which Adam Smith wrote about in *The Wealth of Nations* (1776), means that an operation is divided up into a series of many small tasks and individual workers are assigned to one of those tasks. Unlike craft production, where each worker was responsible for doing many tasks and thus required skill, with division of labour the tasks were so narrow that virtually no skill was required.

division of labour Breaking up a production process into small tasks so that each worker performs a small portion of the overall job.

Interchangeable parts is sometimes attributed to Eli Whitney, an American inventor who applied the concept to assembling muskets in the late 1700s. The basis for interchangeable parts is to standardize parts so that any part in a batch of parts would fit. This meant that parts did not have to be custom fitted, as they were in craft production. The standardized parts could also be used for replacement parts. The result was a tremendous decrease in assembly time and cost.

interchangeable parts Parts of a product made to such precision that they do not have to be custom fitted.

Soon after their invention in Britain, the iron-making and steam engine technologies were imported into North America. In Canada, a few small mills began operating in the first half of the 1800s. By the second half of the 1800s, canals and railways were built, and timber was being exported.

The discovery of electricity by Edison in the late 1800s allowed replacement of electricity for steam as a power source, improving the efficiency and working environment of factories.

Despite the major changes that were taking place, management theory and practice had not progressed much from early days. What was needed was an enlightened and more systematic approach to management.

Scientific Management

The scientific management era brought widespread changes to the management of factories. The movement was spearheaded by the American efficiency engineer and inventor Frederick Taylor, who is often referred to as the father of scientific management. Taylor believed in a "science of management" based on observation, measurement, analysis and improvement of work methods, and economic incentives. He studied work methods in great detail to identify the best method for doing each job. Taylor also believed that management should be responsible for planning, carefully selecting and training workers, finding the best way to perform each job, achieving cooperation between management and workers, and separating management activities from work activities.

Taylor's methods emphasized maximizing output. They were not always popular with workers, who sometimes thought the methods were used to unfairly increase output without a corresponding increase in compensation. Certainly some companies did abuse workers in their quest for efficiency. Eventually, the public outcry reached the halls of the U.S. Congress, and hearings were held on the matter. Taylor himself was called to testify in 1911, the same year in which his classic book *The Principles of Scientific Management* was published. The publicity from those hearings actually helped scientific management principles to achieve wide acceptance in industry.

A number of other pioneers also contributed heavily to this movement, including the following:

Frank Gilbreth was an industrial engineer who is often referred to as the father of motion study. He developed the principles of motion economy that could be applied to incredibly small portions of a task.

Lillian Gilbreth, a psychologist and the wife of Frank Gilbreth, worked with her husband, focusing on the human factor in work. (The Gilbreths were the subject of a classic 1950s film, *Cheaper by the Dozen*.) Many of her studies in the 1920s dealt with worker fatigue.

Henry Gantt recognized the value of nonmonetary rewards to motivate workers, and developed a widely used system for scheduling, called Gantt charts.

Henry Ford, the great industrialist, employed scientific management techniques in his factories.

During the early part of the twentieth century, automobiles were just coming into vogue in North America. Ford's Model T was such a success that the company had trouble keeping up with orders for the cars. In an effort to improve the efficiency of operations, Ford adopted the scientific management principles espoused by Frederick Taylor. He also introduced the *moving assembly line*.

mass production System in which lower-skilled workers use specialized machinery to produce high volumes of standardized goods.

Among Ford's many contributions was the introduction of **mass production** to the automotive industry, a system of production in which large volumes of standardized goods are produced by low-skilled or semiskilled workers using highly specialized, and often costly, equipment. Ford was able to do this by taking advantage of a number of important concepts. Perhaps the key concept that launched mass production was interchangeable parts. Ford accomplished this by standardizing the gauges used to measure parts during production and by using newly developed processes to produce uniform parts. A second concept used by Ford was the division of labour. Together, these concepts enabled Ford to tremendously increase the production rate at his factories using readily available inexpensive labour.

The Industrial Revolution and scientific management allowed some industrialization in Canada in the beginning of the twentieth century. These changes allowed for more effective exploitation of Canada's resources, such as minerals and agriculture. The National Policy import tariffs encouraged foreign entrepreneurs and companies, mainly Americans, to set up factories and sales offices in Canada; the transfer of technology helped both countries. For an example, see the book *Harvest Triumphant*, which describes the establishment and growth of Massey Ferguson as one of the world leaders in agricultural harvesting machinery. The United States replaced Britain as the largest trading partner and investor in Canada in 1926.

The Human Relations Movement

Both Taylor and Ford expected workers to perform like robots. This paved the way for the human relations movement. Whereas the scientific management movement heavily emphasized the technical aspects of work design, the human relations movement emphasized the importance of the human element in job design. In the following decades, there was much emphasis on motivation. During the 1930s, Elton Mayo conducted studies at the Hawthorne division of Western Electric. His studies revealed that in addition to the physical and technical aspects of work, giving special attention to workers is critical for improving productivity. During the 1940s, Abraham Maslow developed motivational theories, which Frederick Hertzberg refined in the 1950s. Douglas McGregor added to this in the 1960s. In the 1970s, William Ouchi combined the Japanese approach, with such features as lifetime employment, employee problem solving, and consensus building, and the traditional Western approach that features short-term employment, specialists, and individual decision making and responsibility.

Decision Models and Computers

The factory movement was accompanied by the development of several quantitative techniques. F. W. Harris developed one of the first models in 1915: a mathematical model for inventory management. In the 1930s, three co-workers at Bell Telephone Labs developed statistical procedures for sampling and quality control.

At first, these quantitative models were not widely used in industry. However, the onset of the Second World War changed that. The war generated tremendous pressures on manufacturing output, and specialists from many disciplines combined efforts to achieve advancements in the military and in manufacturing. This area became known as operations research. After the war, efforts to develop and refine quantitative tools for decision making continued, facilitated by the advent of the mainframe computer in 1951.

This resulted in decision models for forecasting, production planning (using the linear program of Dantzig), project management, and other areas of operations management.

During the 1960s and 1970s, quantitative techniques were highly regarded (these modelling and solutions for business are called *management science*); in the 1980s, they lost some favour. However, the widespread use of personal computers (invented in the late 1970s by Apple Computers) and user-friendly software in the workplace is causing a resurgence in the popularity of these techniques. In 1975, Orlicky proposed Material Requirements Planning (MRP), mainly for assembly operations.

In the middle to late 1980s, network computing began to increase, with applications such as electronic data interchange (EDI) and the ability to instantaneously receive point-of-sale data. This has led to more cooperation with the suppliers in the form of partnering, and formation of supply chains. In the mid-1990s, the Internet began to play a major role in business operations, and more and more companies are using enterprise resources planning (ERP) software to coordinate their sales, materials management, production planning/manufacturing, and accounting/finance activities.

The Influence of Japanese Manufacturers

A number of Japanese manufacturers developed or refined management practices that increased the productivity of their operations and the quality of their products. This made them very competitive, sparking interest in their approaches by companies outside Japan. Their approaches emphasized quality and continual improvement, worker teams and empowerment, and achieving customer satisfaction. The Japanese can be credited with spawning the "quality revolution" that occurred in industrialized countries, and with generating widespread interest in just-in-time production.

The influence of the Japanese on North American manufacturing and service companies has been enormous and promises to continue for the foreseeable future. Because of that influence, this book will provide considerable information about Japanese methods and successes.

Lean production systems are so named because they use much less of certain resources than mass production systems use—less space, less inventory, and fewer workers—to produce a comparable amount of output. Lean production systems use a

lean production System that uses minimal amounts of resources to produce a high volume of high-quality goods with some variety.

New Balance Athletic Shoe, Inc., Lawrence, Massachusetts facility. This facility handles the entire manufacturing process, from cutting raw materials to assembly. While New Balance employs more than 2,400 associates over 120 countries, it is the only company manufacturing athletic shoes in the U.S.

www.newbalance.com

highly skilled workforce and flexible equipment. In effect, they incorporate advantages of both mass production (high volume, low unit cost) and craft production (variety and flexibility). And quality is higher than in mass production. Lean production is a broad approach to just-in-time.

The skilled workers in lean production systems are more involved in maintaining and improving the system than their mass production counterparts. They are taught to stop production if they discover a defect, and to work with other employees to find and correct the cause of the defect so that it won't recur. This results in an increasing level of quality over time, and eliminates the need to inspect and rework at the end of the line.

Because lean production systems operate with lower amounts of inventory, additional emphasis is placed on anticipating when problems might occur *before* they arise, and avoiding those problems through careful planning. Even so, problems still occur at times, and quick resolution is important. Workers participate in both the planning and correction stages. Technical experts are still used, but more as consultants rather than substitutes for workers. The focus is on designing a system (products and process) so that workers will be able to achieve high levels of quality and quantity.

Compared to workers in traditional systems, much more is expected of workers in lean production systems. They must be able to function in teams, playing active roles in operating and improving the system. Individual creativity is much less important than team success. Responsibilities also are much greater, which can lead to pressure and anxiety not present in traditional systems. Moreover, a flatter organizational structure means career paths are not as steep in lean production organizations. Workers tend to become generalists rather than specialists, another contrast to more traditional organizations.

Unions often oppose conversion from a traditional system to a lean system because they view the added responsibility and multiple tasks as an expansion of job requirements without comparable increases in pay. In addition, workers sometimes complain that the company is the primary beneficiary of employee-generated improvements.

Table 1–5 provides a comparison of craft production, mass production, and lean production. Keep in mind that all three of these modes of production are in existence today.

Table 1–6 provides a chronological summary of some of the key developments in the evolution of operations management.

TABLE 1–5

A comparison of craft, mass, and lean production

	Craft Production	Mass Production	Lean Production
Description	High variety, customized output, with one or a few skilled workers responsible for an entire unit of output.	High volume of standardized output, emphasis on volume. Capitalizes on division of labour, specialized equipment, and interchangeable parts.	Moderate to high volume of output, with more variety than mass production. Fewer mass production buffers such as extra workers, inventory, or time. Emphasis on quality. Employee involvement and teamwork are important.
Examples of Goods and Services	Home remodelling and landscaping, tailoring, portrait painting, diagnosis and treatment of injuries, surgery.	Automobiles, computers, calculators, sewing machines, compact discs, mail sorting, cheque clearing.	Similar to mass production.
Advantages	Wide range of choice, output tailored to customer needs.	Low cost per unit, requires mostly low-skilled workers.	Flexibility, variety, high quality of goods.
Disadvantages	Slow, requires skilled workers, few economies of scale, high cost, and low standardization.	Rigid system, difficult to accommodate changes in output volume, product design, or process design. Volume may be emphasized at the expense of quality.	No safety nets to offset any system breakdowns, fewer opportunities for employee advancement, more worker stress, requires higher-skilled workers than mass production.

TABLE 1–6

Historical summary of operations management

Approximate Date	Contribution/Concept	Originator
1764	Steam engine	James Watt
1776	Division of labour	Adam Smith
1790	Interchangeable parts	Eli Whitney
1911	Principles of scientific management	Frederick W. Taylor
1911	Motion study; use of industrial psychology	Frank and Lillian Gilbreth
1912	Chart for scheduling activities	Henry Gantt
1913	Moving assembly line	Henry Ford
1915	Mathematical model for inventory management	F. W. Harris
1930	Hawthorne studies on worker motivation	Elton Mayo
1935	Statistical procedures for sampling and quality control	H. F. Dodge, H. G. Romig, W. Shewhart, L. H. C. Tippett
1940	Operations research applications in warfare	Operations research groups
1947	Linear programming	George Dantzig
1951	Commercial digital computers	Sperry Univac
1960s	Computer-aided automation	Numerous
1970s	Personal computers	Apple
1975	Material requirements planning	Orlicky
1980s	Emphasis on quality and time-based competition	Japanese manufacturers, especially Toyota, and Taiichi Ohno
1990s	Internet, supply chains	Numerous
2000s	E-business	Numerous

TRENDS IN BUSINESS

Businesses must constantly monitor current trends and take them into account in their strategies and operations management. In this section we touch on some of the key trends that are occurring in businesses around the world.

Major Trends

1. *The Internet and e-business*. The *Internet* offers great potential for business organizations, but the potential as well as the risks must be clearly understood in order to determine if and how to exploit this potential. In many cases, the Internet has altered the way companies compete in the marketplace.

Electronic business, or **e-business**, involves the use of the Internet to transact business. E-business is changing the way business organizations interact with their customers and their suppliers. Most familiar to the general public is e-commerce, consumer–business transactions such as buying online or requesting information. However, business-to-business transactions, such as e-procurement, represent an increasing share of e-business. E-business is receiving increased attention from business owners and managers in developing strategies, planning, and decision making.

e-business Use of the Internet to transact business.

2. *Technology and technology management*. Technological advances have led to a vast array of new products and processes. Undoubtedly the computer has had—and will continue to have—the greatest impact on business organizations. It has revolutionized the way companies operate. Applications include product design, processing technology, information processing, and communication. Obviously there have been—and will continue to be—many benefits from technological advances. However, technological advance also places a burden on management. For example, management must keep abreast of changes and quickly assess both their benefits and risks. Predicting advances can be tricky at best, and new technologies often carry a high price tag and usually a high cost to operate or repair. And in the case of computer operating systems, as new systems are introduced, support for older versions is discontinued, making periodic upgrades

necessary. Conflicting technologies can exist that make technological choices even more difficult. Technological innovations in both *products* and *processes* will continue to change the way businesses operate, and hence, require continuing attention.

3. *Globalization*. Global competition, global markets, global supply chains, and global operations are having a growing impact on the strategies and operations of businesses, large and small, around the world. The General Agreement on Tariffs and Trade (GATT) of 1994 and later agreements of the World Trade Organization reduced the tariffs and subsidies in many countries, expanding world trade.

In addition, the Free Trade Agreement and NAFTA have increased trade with the U.S. to as much as 80 percent of total foreign trade of Canada. The implication is the need for improved efficiency and increased quality. However, occasionally there is protectionism, such as U.S. tariffs on Canadian softwood lumber.

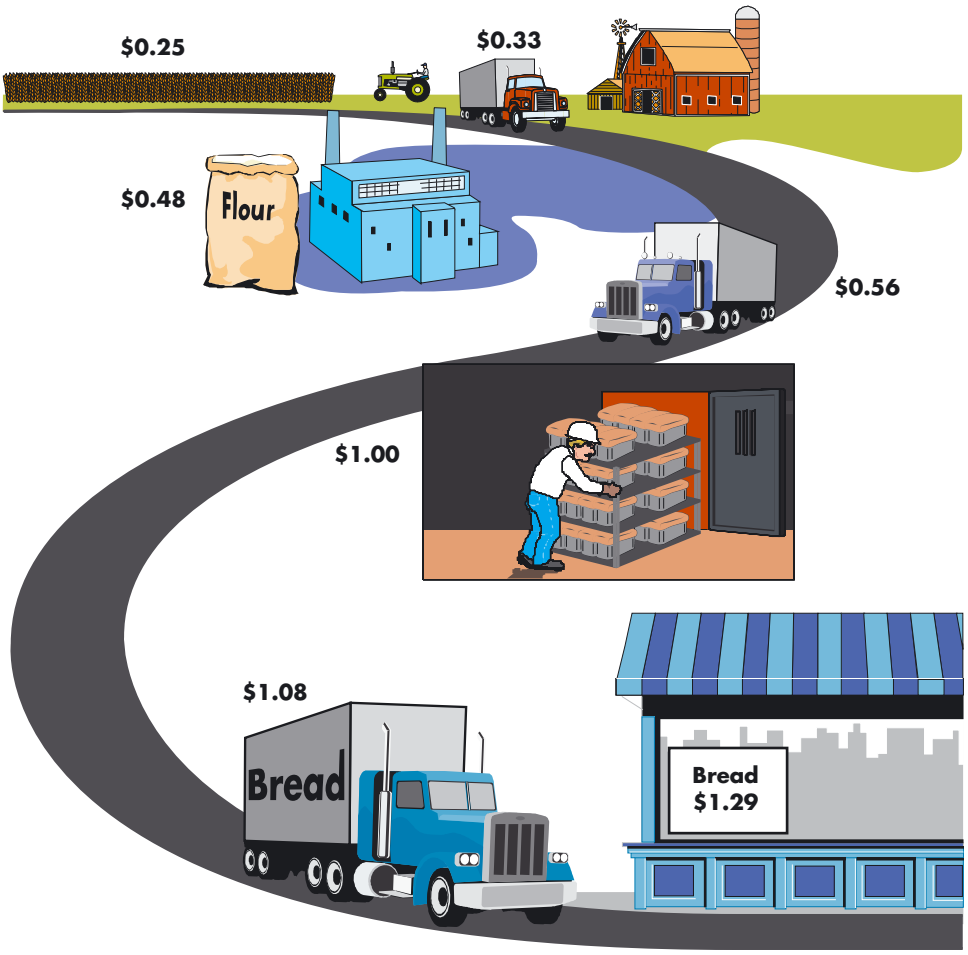
supply chain A sequence of activities and organizations involved in producing and delivering a good or service.

4. *Supply chain management.* A **supply chain** is the sequence of organizations—their facilities and activities—that are involved in producing and delivering a product or service. The sequence begins with basic suppliers of raw materials and extends all the way to the final customer. Facilities might include warehouses, factories, processing centres, offices, distribution centres, and retail outlets. Activities include forecasting, purchasing, inventory management, information management, quality assurance, scheduling, production, distribution, delivery, and customer service.

Figure 1.7 provides an illustration of a supply chain: a chain that begins with wheat growing on a farm and ends with a customer buying a loaf of bread in a supermarket. Notice that the value of the product increases as it moves through the supply chain.

FIGURE 1–7

A supply chain for bread



A growing aspect of supply chain management is *outsourcing*—that is, buying goods or services rather than producing goods or performing services within the organization.

5. *Agility* is the ability of an organization to respond quickly to demands or opportunities. The Toyota production system (just-in-time) and rapid new product development are examples of agility. A major requirement for this is flexibility.

agility The ability of an organization to respond quickly to demands or opportunities.

6. *Quality and process improvement*. Given a boost by the "quality revolution" of the 1980s and 1990s, quality is now ingrained in business. Where once quality was a criterion for being an "order winner," it has now become a criterion for being an "order qualifier." Some businesses use the term *total quality management* (*TQM*) to describe their quality efforts which emphasize *customer satisfaction* and involve *teamwork*. Process improvement can result in improved quality, cost reduction, and *time reduction*.

7. *Environmental issues*. Pollution control and reduction in waste and energy use are key issues managers must contend with. There is increasing emphasis on reducing waste, using less-toxic chemicals (e.g., lawncare services shifting to environmentally friendly approaches), recycling, making it easier for consumers to recycle products (e.g., including a shipping container for returning used laser printer cartridges), and designing products and parts that can be reused (remanufacturing products such as copying machines). The term *environmentally responsible manufacturing* is sometimes used to describe these policies.

Canada is a signatory to the Kyoto agreement which is to reduce greenhouse gases, including CO_2, to 6 percent below the 1990 level, by the year 2012. Some companies such as Dofasco Steel have implemented voluntary measures to achieve this.

8. *Working with fewer resources* due to layoffs, corporate downsizing, and general cost cutting is forcing managers to make trade-off decisions on resource allocation, and to place increased emphasis on cost control and productivity improvement.

Cost control has always been at least somewhat important, but lately it has taken on added significance due to a combination of economic pressures and increased competition. And *productivity*—output relative to input—is gaining added attention as organizations attempt to remain competitive while they tighten their belts.

9. *Ethical issues* are commanding increased attention of management at all levels. Accounting scandals, stockbrokers releasing misleading information of stocks, product liability claims, breaches in privacy and security of computer files, and sharing personal customer information among financial and other businesses are just some of the behaviours that have led to public outcries and government investigations.

These trends are having a major influence on business (including accounting, finance, international business, marketing, and MIS), as well as on operations management. Their impact on operations management is discussed throughout this text.

SUMMARY

Operations management is that part of an organization responsible for planning and coordinating the use of the organization's resources to convert inputs into outputs. The operations function is one of three primary functions of business organizations; the other two are marketing and finance.

The operations function is present in both service and product-producing organizations. Operations decisions involve design decisions and operation decisions. Design decisions relate to capacity planning, product design, process design, layout of facilities, and selecting locations for facilities. Operation decisions relate to quality assurance, production planning and scheduling, inventory management, and project management.

The chapter provides a brief discussion of the historical evolution of operations management and recent trends in the field. Among those trends are e-business and supply chain management; increasing emphasis on quality; integrating technology into production systems; global competition; increasing attention to environmental issues; and increasing emphasis on agility, cost reduction, and ethical issues.

KEY TERMS

agility, 23
craft production, 16
division of labour, 17
e-business, 21
interchangeable parts, 17
lead time, 8
lean production, 19
mass production, 18
model, 14
operations management, 3
Pareto phenomenon, 15
supply chain, 22
system, 15
value-added, 7

DISCUSSION AND REVIEW QUESTIONS

1. Briefly describe the term *operations management*.
2. Identify the three major functional areas of business organizations and briefly describe how they interrelate.
3. Describe the operations function and the nature of the operations manager's job.
4. List five important differences between producing goods and performing services.
5. Briefly discuss each of these terms related to the historical evolution of operations management:
   a. Industrial Revolution
   b. Scientific management
   c. Interchangeable parts
   d. Division of labour
6. Why are services important? Why is manufacturing important?
7. What are models and why are they important?
8. Can you think of a business that doesn't need operations management?
9. List the trade-offs you would consider for each of these decisions:
   a. Driving your own car versus public transportation.
   b. Buying a computer now versus waiting for an improved model.
   c. Buying a new car versus buying a used car.
   d. Speaking up in class versus waiting to get called on by the instructor.
10. Describe each of these systems: craft production, mass production, and lean production.
11. Pick any business/organization you are familiar with, for example a restaurant or a store. State its name and the products or services it provides. Briefly describe the operations management activities necessary to design and operate this business/organization. You may use Table 1–3 on p. 10 as a source of ideas (there's no need to answer each basic question in the table).
12. How have technological changes affected you? Are there any downsides to technological change? Explain.
13. Identify some of the current trends in operations management and relate them to recent news or to your personal experience.
14. Why do people do things that are unethical?
15. Explain the term *value-added*.
16. Load the DVD that accompanies this book. Which items do you think will be most useful to you?

TAKING STOCK

This item appears at the end of each chapter. It is intended to focus your attention on three key issues for business organizations in general, and operations management in particular. Those issues are trade-off decisions, collaboration among various functional areas of the organization, and the impact of technology. You will see three or more questions relating to these issues. Here is the first set of questions:

1. What are trade-offs? Why is careful consideration of trade-offs important in decision making?
2. Why is it important for the various functional areas of a business organization to collaborate?
3. In what general ways does technology have an impact on operations management decision making?

CRITICAL THINKING EXERCISE

This item also will appear in every chapter. It allows you to critically apply information you learned in the chapter to a practical situation. Here is the first exercise:

Many organizations offer a combination of goods and services to their customers. As you learned in this chapter, there are some key differences between production of goods and delivery of services. What are the implications of these differences relative to managing operations?

INTERNET EXERCISE

This item will appear in most chapters. It allows you to use the Internet to gain additional knowledge about chapter material. Here is the first exercise.

Visit the Web page of one of the associations listed on pp. 5, 6 and briefly list the targetted members and the services that they provide to their members.

MINI-CASE

Lynn

Lynn had worked for the same major Canadian company for almost 15 years. Although the company had gone through some tough times, things were starting to turn around. Customer orders were up, and quality and productivity had improved dramatically from what they had been only a few years earlier due to a companywide quality improvement program. So it came as a real shock to Lynn and about 400 of her co-workers when they were suddenly terminated following the new CEO's decision to downsize the company.

After recovering from the initial shock, Lynn tried to find employment elsewhere. Despite her efforts, after eight months of searching she was no closer to finding a job than the day she started. Her funds were being depleted and she was getting more discouraged. There was one bright spot, though: She was able to bring in a little money by mowing lawns for her neighbours. She got involved quite by chance when she heard one neighbour remark that now that his children were on their own, nobody was around to cut the grass. Almost jokingly, Lynn asked him how much he'd be willing to pay. Soon Lynn was mowing the lawns of five neighbours. Other neighbours wanted her to work on their lawns, but she didn't feel that she could spare any more time from her job search.

However, as the rejection letters began to pile up, Lynn knew she had to make an important decision in her life. On a rainy Tuesday morning, she decided to go into business for herself—taking care of neighbourhood lawns. She was relieved to give up the stress of job hunting, and she was excited about the prospect of being her own boss. But she was also fearful of being completely on her own. Nevertheless, Lynn was determined to make a go of it.

At first, business was a little slow, but once people realized Lynn was available, many asked her to take care of their lawns. Some people were simply glad to turn the work over to her; others switched from professional lawn care services. By the end of her first year in business, Lynn knew she could earn a living this way. She also performed other services such as fertilizing lawns, weeding gardens, and trimming shrubbery. Business became so good that Lynn hired two part-time workers to assist her and, even then, she believed she could expand further if she wanted to. During winter months (January and February), Lynn takes her vacation in Florida.

Questions

1. Lynn is the operations manager of her business. Among her responsibilities are forecasting, inventory management, scheduling, quality assurance, and maintenance.
   a. What kinds of things would likely require forecasts?
   b. What inventory items does Lynn probably have? Name one inventory decision she has to make periodically.
   c. What scheduling must she do? What things might occur to disrupt schedules and cause Lynn to reschedule?
   d. How important is quality assurance to Lynn's business? Explain.
   e. What kinds of maintenance must be performed?
2. What are some of the trade-offs that Lynn probably considered relative to:
   a. Working for a company instead of for herself?
   b. Expanding the business?
   c. Launching a Web site?
3. Lynn decided to offer the students who worked for her a bonus of $25 for ideas on how to improve the business, and they provided several good ideas. One idea that she initially rejected now appears to hold great promise. The student who proposed the idea has left, and is currently working for a competitor. Should Lynn send that student a cheque for the idea?

OPERATIONS TOUR

Sobeys

www.sobeys.com

Up until 1998, Sobeys was a privately owned chain of grocery stores in the Atlantic provinces. Sobeys grew out of a butcher shop in Stellarton, Nova Scotia, opened by the Sobey family in 1907. When Loblaw, Canada's largest national grocery chain, expanded into Sobeys' territories, competition heated up. Sobeys' directors decided on a bold move in order to gain sufficient economies of scale to be able to compete with Loblaw. Sobeys took over the larger Oshawa Group (at a purchase price of $1.5 billion), then Canada's second largest national grocery chain, which included (mostly franchised) IGA and Price Chopper stores and the wholesale food distribution company SERCA.

Since 1998, Sobeys has worked hard and successfully to integrate the supermarket chains. It has divided the country into four regions (Atlantic, Quebec, Ontario, and the West), has aligned each store's size and merchandise to its market, centralized purchasing and merchandising, improved its logistics and distribution, and focused on its core grocery retailing business by selling SERCA to Sysco, the giant food distribution company. Sobeys now manages more than 1,300 grocery stores, has annual revenue of more than $11 billion, and employs 75,000 people. Sobeys' strategy is to emphasize ready-to-serve, quality food and fresh produce along with exceptional customer service in attractive stores.

Sobeys operates grocery stores of varying sizes in every region of Canada with a range of services suitable for the market. It runs more than 290 full-service supermarkets under the names Sobeys, Garden Market IGA (in Western Canada), and IGA Extra (in Quebec). These stores are over 60,000 square feet in size and feature farm-fresh produce, full-line bakeries, extensive home-style meal selections, and a variety of innovative in-store retail services such as photo finishing, florist, Western Union money wiring, dry-cleaning and banking (TD Canada Trust). They usually have between 12 and 16 checkout lanes. A Sobeys store of this size typically employs from 200 to 250 people.

IGA stores (approximately 400) are designed primarily for mid-sized communities with store sizes in the range of 15,000–40,000 square feet. The emphasis in these stores is on fresh produce, meat, dairy, and bakery goods, and on highly personalized service. Stores of this size often have 10 to 12 checkout lanes and employ 50 to 120 people. Price Choppers stores (more than 100) are also approximately the same size as IGA stores, but are for value-conscious consumers.

In smaller communities, Sobeys runs over 300 stores under the banners Foodland, Food Town, Les Marchés Tradition, and Marché Boni choix, which offer consumers convenient, full-service supermarkets on a smaller scale.

Sobeys also runs 128 Needs Convenience Stores, and 58 Lawton's Drugstores in Atlantic Canada. Recently, Sobeys bought 15 Commisso's stores in the Niagara region.

Produce

A full-service Sobeys store's produce department is set up in a farmers' market style, with most of its produce unpacked and available for customer evaluation and selection. Its produce is sourced mainly nationally, but sometimes locally. As part of its wide produce selection, Sobeys also sells organically grown foods. Two features of the store's deli are the hot case foods, such as Grade A whole chickens, and the service case, which holds a wide variety of fresh salads and sliced meats. In addition, it carries a wide variety of international cheeses and sliced meats.

One characteristic of its East Coast origin is Sobeys' fresh seafood market. It stocks a number of fresh fish and seafood delicacies such as whole, portioned, and fillet fish, shellfish, store-made chowder ingredients, and live lobster cooked at a customer's request. Sobeys offers a wide assortment of premium-cut meats available from the service case and boxed meats that it sells under its private label. As well, a meat cutter is on duty to provide personalized service for special-order needs. Years ago Sobeys raised the standard of quality beef by introducing the "Aged for Flavour" program. It has gone a step further with its new "Canadian Select Beef." Sobeys now provides only the highest quality Certified AAA and AA grades of beef.

Sobeys' private-label products number more than 3,500, bringing in 20 percent of sales. Sobeys' premium private

label is "Our Compliments," adopted from IGA. Its value private label is "Smart Choice," also adopted from the IGA stores.

The Meals Made Easy program offers time-pressed shoppers a variety of ready-to-serve, home-cooked meals. At the Courtyard Café, shoppers can take the time to sample an appetizing range of premium-quality foods including fresh baked pizza, rotisserie chicken, hot and cold pasta entrées, a wide selection of fruit and vegetables, gourmet coffees, and a variety of desserts.

Technology and Operations

At Sobeys, using new technology is part of its approach to doing business. In the 1990s, both Sobeys and IGA started using Electronic Data Interchange (EDI) to communicate with their major suppliers, food manufacturers. This helped with information accuracy and speed. The acquisition of IGA stores has provided Sobeys the opportunity of streamlining all operations. Sobeys renovated the Milton warehouse (west of Toronto) and built a large state-of-the-art warehouse in Whitby (east of Toronto), closed five old warehouses in Ontario, installed a warehouse management system (Exceed, by EXE) in its warehouses, used automated ordering systems, used productivity standards in the warehouses, reduced costs of transportation and distribution to its more than 25 regional distribution centres by using a truck-route optimization software by Manugistics, started using multi-temperature trucks to save on number of trips, and outsourced operations of the Milton and Whitby distribution centres to Axis (a member of Tibbett & Britten) and Ryder Logistics, respectively. Deliveries vary from one to two a week for the smaller stores to daily for the largest stores.

In 2000, Sobeys tried to install SAP's Enterprise Resources Planning software to integrate all its stores, warehouses, and headquarters. However, the system crashed in late November 2000 for five days, resulting in lost sales of more than $20 million. As a result, Sobeys' new CEO Bill McEwan decided to discontinue use of SAP (for more information on SAP, see Chapter 13).

First launched in 1997, the IGA Cybermarket is Canada's first home grocery shopping site on the Internet (www.iga.net), with the trial participation of some 130 stores in the province of Quebec. This service provides a new level of convenience by allowing customers to place their orders from home or work, with the local IGA store serving as the point of pick-up or delivery.

Recently, Sobeys has agreed to supply all inventory needs of Grocery Gateway, the independent Toronto-area e-tailer (Internet-based retailer).

In addition to its store services, Sobeys maintains a Web site that features much useful information including information on health and body, recipes, weekly flyer, and store locations. (www.sobeys.ca).

Questions

1. What are the inputs, processes, outputs, and feedback/control for a grocery store such as Sobeys or IGA?
2. What are the operations decisions involved in running a grocery store such as Sobeys or IGA?

Sources: Sobeys Annual Reports, 1999–2004; "Sobeys Reports Efficiencies from EDI," *Canadian Grocer* 109(7), July 95, p. 5; P. D'Souza and S. Silcoff, "On Special This Week: Supermarkets," *Canadian Business* 71(21), December 24, 1998–January 8, 1999, pp. 32–40; R. Robertson "Delivering Food Value," *Materials Management and Distribution* 45(4), May 2000, p. 18; M. Evans, "Grocery Gateway Inks Supply Deal with Sobeys: 'It Allows Us to Be Aggressive,'" *Financial Post* (*National Post*), October 23, 2002, p. FP4; J. Tutunjian, "The Passion of Bill McEwan," *Canadian Grocer* 118(4), May 2004, pp. 22–23.

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