ଓଡ଼ିଶା ରାଜ୍ୟ ମୁକ୍ତ ବିଶ୍ୱବିଦ୍ୟାଳୟ, ସମ୍ବଲପୁର, ଓଡ଼ିଶା
Odisha State Open University, Sambalpur, Odisha
Established by an Act of Government of Odisha.

Diploma in Management

(DIM)

DIM-6

OPERATIONS MANAGEMENT

Block

1

Unit-1

Introduction to Operations Management

Unit-2

Roles of Operations Manager

ଓଡ଼ିଶା ରାଜ୍ୟ ମୁକ୍ତ ବିଶ୍ୱବିଦ୍ୟାଳୟ, ସମ୍ବଲପୁର, ଓଡ଼ିଶା
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Unit-1

Introduction to Operations Management

Learning Objectives

After completion of the unit, you should be able to:

- Define the term operations management.
- Identify the three major functional areas of organizations and describe how they interrelate.
- Identify similarities and differences between production and service operations.
- Summarize the two major aspects of process management.
- Briefly describe the historical evolution of operations management.
- Characterize current trends in business that impact operations management.

Structure

1.1 INTRODUCTION

Operations is that part of a business organization that is responsible for producing goods and/ or services. Goods are physical items that include raw materials, parts, sub assemblies such as motherboards that go into computers, and final products such as cell phones and automobiles.

Services are activities that provide some combination of time, location, form, or psychological value. Examples of goods and services are found all around you. Every book you read, every video you watch, every e-mail you send, every telephone conversation you have, and every medical treatment you receive involves the operations function of one or more organizations. So does everything you wear, eat, travel in, sit on, and access the Internet with. The operations function in business can also be viewed from a more far-reaching perspective. The collective success or failure of companies' operations functions has an impact on the ability of a nation to compete with other nations, and on the nation's economy.

The ideal situation for a business organization is to achieve a match of supply and demand. Having excess supply or excess capacity is wasteful and costly; having too little means lost opportunity and possible customer dissatisfaction. The key functions on the supply side are operations and supply chains, and sales and marketing on the demand side.

While the operations function is responsible for producing products and/or delivering services, it needs the support and input from other areas of the organization. Business organizations have three basic functional areas : finance, marketing, and operations. It doesn't matter whether the business is a retail store, a hospital, a manufacturing firm, a car wash, or some other type of business; all business organizations have these three basic functions.

Finance is responsible for securing financial resources at favourable prices and allocating those resources throughout the organization, as well as budgeting, analyzing investment proposals, and providing funds for operations. Marketing and operations are the primary, or "line," functions. Marketing is responsible for assessing consumer wants and needs, and selling and promoting the organization's goods or services. Operations is responsible for producing the goods or providing the services offered by the organization. To put this into perspective, if a business organization were a car, operations would be its engine. And just as the engine is the core of what a car does, in a business organization, operations is the core of what the organization does.

Operations management is responsible for managing that core. Hence, operations management is the management of systems or processes that create goods and/or provide services. Operations and supply chains are intrinsically linked and no business organization could exist without both. A supply chain is the sequence of organizations—their facilities, functions, 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. Functions and activities include forecasting, purchasing, inventory management, information management, quality assurance, scheduling, production, distribution, delivery, and customer service.

Supply chains are both external and internal to the organization. The external parts of a supply chain provide raw materials, parts, equipment, supplies, and/or other inputs to the organization, and they deliver outputs that are goods to the organization's customers. The internal parts of a supply chain are part of the operations function itself, supplying operations with parts and materials, performing work on products and/or services, and passing the work on to the next step in the process.

The creation of goods or services involves transforming or converting inputs into outputs.

Various inputs such as capital, labour, and information are used to create goods or services

using one or more transformation processes (e.g., storing, transporting, repairing). To ensure that the desired outputs are obtained, an organization takes measurements at various points in the transformation process (feedback) and then compares them with previously established standards to determine whether corrective action is needed (control).

Operations management is important. It is concerned with creating the services and products upon which we all depend. And all organizations produce some mixture of services and products, whether that organization is large or small, manufacturing or service, for profit or not for profit, public or private. Thankfully, most companies have now come to understand the importance of operations. This is because they have realized that effective operations management gives the potential to improve both efficiency and customer service simultaneously. But more than this, operations management is everywhere, it is not confined to the operations function. All managers, whether they are called Operations or Marketing or Human Resources or Finance, or whatever, manage processes and serve customers (internal or external). This makes, at least part of their activities 'operations'.

Operations management is also exciting. It is at the centre of so many of the changes affecting the business world – changes in customer preference, changes in supply networks brought about by internet-based technologies, changes in what we want to do at work, how we want to work, where we want to work, and so on. There has rarely been a time when operations management was more topical or more at the heart of business and cultural shifts.

Operations management is also challenging. Promoting the creativity which will allow organizations to respond to so many changes is becoming the prime task of operations managers. It is they who must find the solutions to technological and environmental challenges, the pressures to be socially responsible, the increasing

globalization of markets and the difficult-to define areas of knowledge management.

1.2 MEANING

Operations are what must be done internally in order to deliver value to the customer, whether in goods or services. Thus, from an organizational perspective, **operations management** may be defined as the management of direct resources that are required to produce and deliver value via the organization's goods and services. So, basically **Operations Management** is the management of the conversion process that transforms inputs such as raw material and labour into outputs in the form of finished goods and services. Every function in the organization—whether marketing, finance and accounting, production, purchasing, or human resources—adds value to the customer. Keep in mind as you read through this textbook that operations management concepts can be used productively in every function of the organization.

Operations management, just as every functional area within an organization, can be defined from several perspectives: one with respect to its overall role and contribution within an organization; another focusing more on the day-to-day activities that fall within its area of responsibility.

Within the operations function, management decisions can be divided into three broad areas:

- Strategic (long-range) decisions
- Tactical (medium-range) decisions
- Operational planning and control (short-range) decisions

These three areas can be viewed as a top-down (hierarchical) approach to operations management, with the decisions made at the lower level(s) depending on those made at the higher level(s).

The strategic issues usually are very broad in nature, addressing such questions as:

- How will we make the product?
- Where should we locate the facility or facilities?
- How much capacity do we need?
- When should we add more capacity?

Consequently, by necessity, the time frame for strategic decisions typically is very long, usually several years or more, depending on the specific industry.

Operations management decisions at the strategic level impact the long-range effectiveness of the company in terms of how well it can address the needs of its customers. Thus, for the firm to succeed, these decisions must be closely aligned with the corporate strategy. Decisions made at the strategic level then define the fixed conditions or constraints under which the firm must operate in both the intermediate and short term. For example, a decision made at the strategic level to increase capacity by building a new plant becomes a capacity constraint with respect to tactical and operational decisions.

At the next level in the decision-making process, tactical planning primarily addresses the issue of how to efficiently schedule material and labour over a specific time horizon and within the constraints of the strategic decisions that were previously made. Thus, some of the OM issues at this level are:

- How many workers do we need?

- When do we need them?
- Should we work overtime or put on a second shift?
- When should we have material delivered?
- Should we have a finished goods inventory?

These tactical decisions, in turn, define the operating constraints under which the operational
planning and control decisions are made.

Management decisions with respect to operational planning and control are very narrow and short term, by comparison. For example, issues at this level include:

- Which jobs do we work on today or this week?
- To whom do we assign which tasks?
- Which jobs have priority?

1.3 PRODUCTION OF GOODS Vs DELIVERY OF SERVICES

Although goods and services often go hand in hand, there are some very basic differences between the two, differences that impact the management of the goods portion versus management of the service portion. There are also many similarities between the two. Production of goods results in a *tangible output*, such as an automobile, eyeglasses, a golf ball, a refrigerator—anything that we can see or touch. It may take place in a factory, but can occur elsewhere. For example, farming produces *nonmanufactured* goods. Delivery of service, on the other hand, generally implies an *act.* A physician's examination, TV and auto repair, lawn care, and the projection of a film in a theater are examples of services. The majority of service jobs fall into these categories:

Professional services (e.g., financial, health care, legal).
Mass services (e.g., utilities, Internet, communications).
Service shops (e.g., tailoring, appliance repair, car wash, auto repair/maintenance).
Personal care (e.g., beauty salon, spa, barbershop).
Government (e.g., Medicare, mail, social services, police, fire).
Education (e.g., schools, universities).
Food service (e.g., restaurants, fast foods, catering, bakeries).
Services within organizations (e.g., payroll, accounting, maintenance, IT, HR, janitorial).
Retailing and wholesaling.
Shipping and delivery (e.g., truck, railroad, boat, air).
Residential services (e.g., lawn care, painting, general repair, remodelling, interior design).
Transportation (e.g., mass transit, taxi, airlines, ambulance).
Travel and hospitality (e.g., travel bureaus, hotels, resorts).
Miscellaneous services (e.g., copy service, temporary help).

Manufacturing and service are often different in terms of *what* is done but quite similar in terms of *how* it is done.

Consider these points of comparison:

Degree of customer contact. Many services involve a high degree of customer contact, although services such as Internet providers, utilities, and mail service do not. When there is a high degree of contact, the interaction between server and customer becomes a "moment of truth" that will be judged by the customer every time the service occurs.

Labour content of jobs. Services often have a higher degree of labour content than manufacturing jobs do, although automated services are an exception.

Uniformity of inputs. Service operations are often subject to a higher degree of variability
of inputs. Each client, patient, customer, repair job, and so on presents a somewhat unique situation that requires assessment and flexibility. Conversely, manufacturing operations often have a greater ability to control the variability of inputs, which leads to more-uniform job requirements.

Measurement of productivity. Measurement of productivity can be more difficult for service jobs due largely to the high variations of inputs. Thus, one doctor might have a higher level of routine cases to deal with, while another might have more difficult cases. Unless a careful analysis is conducted, it may appear that the doctor with the difficult cases has a much lower productivity than the one with the routine cases.

Quality assurance. Quality assurance is usually more challenging for services due to the higher variation in input, and because delivery and consumption occur at the same time. Unlike manufacturing, which typically occurs away from the customer and allows mistakes
that are identified to be corrected, services have less opportunity to avoid exposing the customer to mistakes.

Inventory. Many services tend to involve less use of inventory than manufacturing operations, so the costs of having inventory on hand are lower than they are for manufacturing. However, unlike manufactured goods, services cannot be stored. Instead, they must be provided "on demand."

Wages. Manufacturing jobs are often well paid, and have less wage variation than service jobs, which can range from highly paid professional services to minimum-wage workers.

Ability to patent. Product designs are often easier to patent than service designs, and some services cannot be patented, making them easier for competitors to copy.

There are also many similarities between managing the production of products and managing
Services. Here are some of the primary factors for both:

a. Forecasting and capacity planning to match supply and demand.
b. Process management.
c. Managing variations.
d. Monitoring and controlling costs and productivity.
e. Supply chain management.
f. Location planning, inventory management, quality control, and scheduling.

Note that many service activities are essential in goods-producing companies. These include training, human resource management, customer service, equipment repair, procurement,
and administrative services.

1.4 PROCESS MANAGEMENT

A key aspect of operations management is process management. A **process** consists of one or more actions that transform inputs into outputs. In essence, the central role of all management
is process management. Businesses are composed of many interrelated processes. Generally speaking, there are three categories of business processes:
1. **Upper-management processes.** These govern the operation of the entire organization. Examples include organizational governance and organizational strategy.
2. **Operational processes.** These are the core processes that make up the value stream. Examples include purchasing, production and/or service, marketing, and sales.
3. **Supporting processes.** These support the core processes. Examples include accounting, human resources, and IT (information technology).

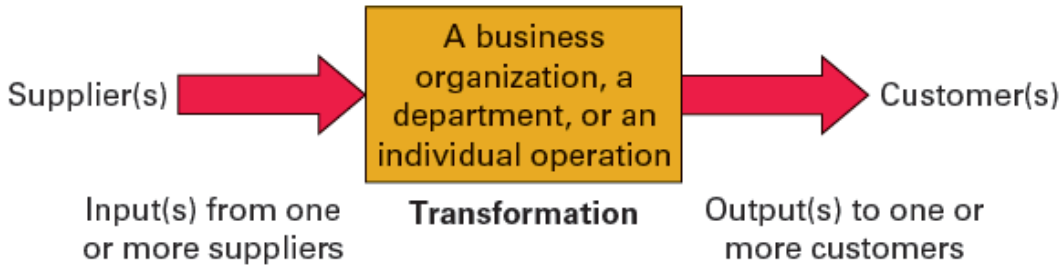
Business processes, large and small, are composed of a series of supplier–customer relationships, where every business organization, every department, and every individual operation is both a customer of the previous step in the process and a supplier to the next step in the process. Figure 1.1 illustrates this concept.
A major process can consist of many sub processes, each having its own goals that contribute
to the goals of the overall process. Business organizations and supply chains have many
such processes and sub processes and they benefit greatly when management is using a process perspective. Business process management (BPM) activities include process design, process execution, and process monitoring. Two basic aspects of this for operations and supply chain management are managing processes to meet demand and dealing with process variability.

Managing a Process to Meet Demand
Ideally, the capacity of a process will be such that its output just matches demand. Excess capacity is wasteful and costly; too little capacity means dissatisfied customers and lost revenue. Having the right capacity requires having accurate forecasts of demand, the ability
to translate forecasts into capacity requirements, and a process in place capable of meeting
expected demand. Even so, process variation and demand variability can make the achievement of a match between process output and demand difficult. Therefore, to be effective, it is also necessary for managers to be able to deal with variation.

Process Variation
Variation occurs in all business processes. It can be due to variety or variability. For example, random variability is inherent in every process; it is always present.

In addition, variation can occur as the result of deliberate management choices to offer customers variety.
There are four basic sources of variation:
1. **The variety of goods or services being offered.** The greater the variety of goods and services, the greater the variation in production or service requirements.
2. **Structural variation in demand.** These variations, which include trends and seasonal variations, are generally predictable. They are particularly important for capacity planning.
3. **Random variation.** This natural variability is present to some extent in all processes, as well as in demand for services and products, and it cannot generally be influenced by managers.
4. **Assignable variation.** These variations are caused by defective inputs, incorrect work methods, out-of-adjustment equipment, and so on. This type of variation can be reduced
or eliminated by analysis and corrective action.

Fig 1.1
Business Processes form a sequence of suppliers and customers



Variations can be disruptive to operations and supply chain processes, interfering with optimal functioning. Variations result in additional cost, delays and shortages, poor quality, and inefficient work systems. Poor quality and product shortages or service delays can lead to dissatisfied customers and damage an organization's reputation and image. It is not surprising, then, that the ability to deal with variability is absolutely necessary for managers. An important aspect of being able to deal with variation is to use metrics to describe it. Two widely used metrics are the *mean* (average) and the *standard deviation.* The standard deviation quantifies variation around the mean.

1.5AN OPERATIONAL PERSPECTIVE

The day-to-day activities within the operations management function focus on adding value to the organization through a **transformation process** (as illustrated in Exhibit 1.2), sometimes referred to as the *technical core,* especially in manufacturing organizations.
Some examples of the different types of transformations are:

- Physical, as in manufacturing
- Locational, as in transportation
- Exchange, as in retailing

Exhibit 1.2
The Transformation Process within OM

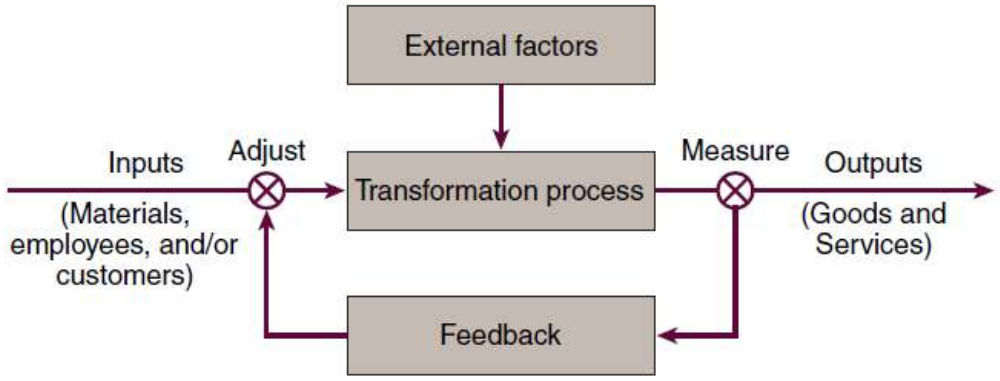


Exhibit 1.3

Input–Transformation–Output Relationships for Typical Systems

System	Inputs	Primary Transformation Function(s)	Typical Desired Output
Hospital	Patients, medical supplies, MDs, nurses, equipment	Health care (physiological)	Healthy individuals
Restaurant	Hungry customers, food, chef, waitstaff, environment	Well-prepared food, well served; agreeable environment (physical and exchange)	Satisfied customers
Automobile factory	Sheet steel, engine parts, tools, equipment, workers	Fabrication and assembly of cars (physical)	High-quality cars
College or university	High school graduates, books, teachers, classrooms	Imparting knowledge and skills (informational)	Educated individuals
Department store	Shoppers, stock of goods, displays, salesclerks	Attract shoppers, promote products, fill orders (exchange)	Sales to satisfied customers
Distribution centre	Stockkeeping units (SKU), storage bins, stockpickers	Storage and redistribution	Fast delivery, availability of SKUs

- Storage, as in warehousing
- Physiological, as in health care
- Informational, as in telecommunications

The inputs are customers and/or materials which undergo the transformation. Also part of the transformation process is a variety of components supplied by the organization, such as labour, equipment, and facilities, which convert the inputs into outputs. Every transformation process is affected by external factors, which are outside the control of management. External factors include random, unexpected events such as natural disasters, economic cycles, changes in government policies and laws, as well as changes in consumer preferences and tastes. These external factors can also include anticipated changes, such as seasonality, over which management has little or no control.

Another important role of the operations management function is the measurement and control of the transformation process. This consists of monitoring the outputs in various ways, including quality and quantity, and then

using this information as feedback to make the necessary adjustments that will improve the process.

The various transformations that take place are not mutually exclusive. For example, a department store can (*a*) allow shoppers to compare prices and quality (informational), (*b*) hold items in inventory until needed (storage), and (*c*) sell goods (exchange). Exhibit 1.3 presents sample input–transformation–output relationships for a wide variety of processes. Note that only the direct components are listed; a more complete system description would also include managerial and support functions.

1.6 THE HISTORICAL EVOLUTION OF OPERATIONS MANAGEMENT

Systems for production have existed since ancient times. 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 the United States during the 19th century. Prior to that time, 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 in use today had not been invented. Then, a number of innovations in the 18th century changed the face of production forever by substituting machine power for human power. Perhaps the most significant of these was the steam engine, because it provided a source of power to operate machines in factories. Ample supplies of coal and iron ore provided materials 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.

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. 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. A major change occurred that gave the Industrial Revolution a boost: the development of standard gauging systems. This greatly reduced the need for custom-made goods. Factories began to spring up and grow rapidly, providing jobs for countless people who were attracted in large numbers from rural areas. 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 efficiency engineer and inventor Frederick Winslow 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 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 principles of motion economy that could be applied to incredibly small portions of a task.

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

Harrington Emerson applied Taylor's ideas to organization structure and encouraged the use of experts to improve organizational efficiency. He testified in a congressional hearing that railroads could save a million dollars a day by applying principles of scientific management.

Henry Ford, the great industrialist, employed scientific management techniques in his factories. During the early part of the 20th century, automobiles were just coming into vogue in the United States. 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 Winslow Taylor. He also introduced the *moving assembly line,* which had a tremendous impact on production methods in many industries. 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,** sometimes attributed

to Eli Whitney, an American inventor who applied the concept to assembling muskets in the late 1700s. The basis for interchangeable parts was to standardize parts so that any part in a batch of parts would fit any automobile coming down the assembly line. 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. 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,** which Adam Smith wrote about in *The Wealth of Nations* (1776). Division of labour means that an operation, such as assembling an automobile, 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.

Together, these concepts enabled Ford to tremendously increase the production rate at his factories using readily available inexpensive labour. Both Taylor and Ford were despised by many workers, because they held workers in such low regard, expecting them to perform like robots. This paved the way for the human relations movement.

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. 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. 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, worker motivation is critical for improving productivity.

During the 1940s, Abraham Maslow developed motivational theories, which Frederick Hertzberg refined in the 1950s. Douglas McGregor added Theory X and Theory Y in the 1960s. These theories represented the two ends of the spectrum of how employees view work. Theory X, on the negative end, assumed that workers do not like to work, and have to be controlled—rewarded and punished—to get them to do good work.

This attitude was quite common in the automobile industry and in some other industries, until

the threat of global competition forced them to rethink that approach. Theory Y, on the other
end of the spectrum, assumed that workers enjoy the physical and mental aspects of work and
become committed to work. The Theory X approach resulted in an adversarial environment,
whereas the Theory Y approach resulted in empowered workers and a more cooperative spirit.
In the 1970s, William Ouchi added Theory Z, which 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 Management Science

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 order size. In the 1930s, three coworkers at Bell Telephone Labs, H. F. Dodge, H. G. Romig, and W. Shewhart, developed statistical procedures for sampling and quality control. In 1935, L.H.C. Tippett conducted studies that provided the groundwork for statistical-sampling theory.
At first, these quantitative models were not widely used in industry. However, the onset
of World War II 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. After the war, efforts to develop and refine quantitative
tools for decision making continued, resulting in decision models for forecasting, inventory
management, project management, and other areas of operations management.
During the 1960s and 1970s, management science techniques were highly regarded; in the
1980s, they lost some favour. However, the widespread use of personal computers and user-friendly software in the workplace contributed to resurgence in the popularity of these techniques.

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, due in part to the influence of Americans W. Edwards Deming and Joseph Juran. 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 lean production.

The influence of the Japanese on U.S. 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. Table 1.4 provides a chronological summary of some of the key developments in the evolution of operations management.

1.7 OPERATIONS TODAY

Advances in information technology and global competition have had a major influence on operations management. While the *Internet* offers great potential for business organizations, 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.

The word **technology** has several definitions, depending on the context. Generally, *technology* refers to the application of scientific discoveries to the development and improvement of goods and services. It can involve knowledge, materials, methods, and equipment. The term *high technology* refers to the most advanced and developed machines and methods. Operations management is primarily concerned with three kinds of technology: product and service technology, process technology, and information technology (IT). All three can have a major impact on costs, productivity, and competitiveness.

Product and service technology refers to the discovery and development of new products and services. This is done mainly by researchers and engineers, who use the scientific approach to develop new knowledge and translate that into commercial applications.

Fig 1.4 Historical Summary of Operations Management

Approximate Date	Contribution/Concept	Originator
1776	Division of labor	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 ordering	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, IBM
1950s	Automation	Numerous
1960s	Extensive development of quantitative tools	Numerous
1960s	Industrial dynamics	Jay Forrester
1975	Emphasis an manufacturing strategy	W. Skinner
1980s	Emphasis on flexibility, time-based competition, lean production	T. Ohno, S. Shingo, Toyota
1980s	Emphasis on quality	W. Edwards Deming, J. Juran, K. Ishikawa
1990s	Internet, supply chain management	Numerous
2000s	Applications service providers and outsourcing	Numerous

Process technology refers to methods, procedures, and equipment used to produce goods and provide services. They include not only processes within an organization but also supply chain processes.

Information technology (IT) refers to the science and use of computers and other electronic

equipment to store, process, and send information. Information technology is heavily ingrained in today's business operations. This includes electronic data processing, the use of bar codes to identify and track goods, obtaining point-of-sale information, data transmission, the Internet, e-commerce, e-mail, and more.

Management of technology is high on the list of major trends, and it promises to be high well into the future. For example, computers have had a tremendous impact on businesses in many ways, including new product and service features, process management, medical diagnosis, production planning and scheduling, data processing, and communication. Advances in materials, methods, and equipment

also have had an impact on competition and productivity. Advances in information technology also have had a major impact on businesses. 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.

1.8 KEY ISSUES FOR TODAY'S BUSINESS OPERATIONS

There are a number of issues that are high priorities of many business organizations. Although not every business is faced with these issues, many are. Chief among the issues are the following:

Economic conditions. The lingering recession and slow recovery in various sectors of the economy has made managers cautious about investment and rehiring workers that had been laid off during the recession.

Innovating. Finding new or improved products or services are only two of the many possibilities that can provide value to an organization. Innovations can be made in processes,

the use of the Internet, or the supply chain that reduce costs, increase productivity, expand markets, or improve customer service.

Quality problems. This relates to product design and testing, oversight of suppliers, risk assessment, and timely response to potential problems.

Risk management. The need for managing risk is underscored by recent events that include the crisis in housing, product recalls, oil spills, and natural and man-made disasters, and economic ups and downs. Managing risks starts with identifying risks, assessing vulnerability and potential damage (liability costs, reputation, demand), and taking steps to reduce or share risks.

Competing in a global economy. Low labour costs in third-world countries have increased pressure to reduce labour costs. Companies must carefully weigh their options, which include outsourcing some or all of their operations to low-wage areas, reducing costs internally, changing designs, and working to improve productivity.

Three other key areas require more in-depth discussion: environmental concerns, ethical conduct, and managing the supply chain.

Environmental Concerns

Concern about global warming and pollution has had an increasing effect on how businesses

operate. Stricter environmental regulations, particularly in developed nations, are being imposed. Furthermore, business organizations are coming under increasing pressure to reduce their carbon footprint (the amount of carbon dioxide generated by their operations and their supply chains) and to generally operate sustainable processes. **Sustainability** refers to service

and production processes that use resources in ways that do not harm ecological systems that
support both current and future human existence. Sustainability measures often go beyond
traditional environmental and economic measures to include measures that incorporate social
criteria in decision making.
All areas of business will be affected by this. Areas that will be most affected include product and service design, consumer education programs, disaster preparation and response, supply chain waste management, and outsourcing decisions. Note that outsourcing of goods production increases not only transportation costs, but also fuel consumption and carbon released into the atmosphere. Consequently, sustainability thinking may have implications for
outsourcing decisions. Because they all fall within the realm of operations, operations management is central to dealing with these issues. Sometimes referred to as "green initiatives," the possibilities include reducing packaging, materials, water and energy use, and the environmental impact of the supply chain, including buying locally. Other possibilities include reconditioning used equipment (e.g., printers and copiers) for resale, and recycling.

Ethical Conduct

The need for ethical conduct in business is becoming increasingly obvious, given numerous examples of questionable actions in recent history. In making decisions, managers must consider how their decisions will affect shareholders, management, 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. Furthermore, even managers with the best intentions will sometimes make mistakes. If mistakes do occur, managers should act responsibly to correct those mistakes as quickly as possible, and to address any negative consequences.
Operations managers, like all managers, have the responsibility to make ethical decisions. Ethical issues arise in many aspects of operations management, including

- Financial statements: accurately representing the organization's financial condition.
- 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.
- Quality: honouring warranties, avoiding hidden defects.
- The environment: not doing things that will harm the environment.
- The community: being a good neighbour.
- Hiring and firing workers: avoiding false pretences (e.g., promising a long-term job when that is not what is intended).
- Closing facilities: taking into account the impact on a community, and honouring commitments that have been made.
- Workers' rights: respecting workers' rights, dealing with workers' problems quickly and
fairly.

Many organizations have developed *codes of ethics* to guide employees' or members' conduct.

Ethics is a standard of behavior that guides how one should act in various situations.

The Markula Center for Applied Ethics at Santa Clara University identifies five principles for thinking ethically:

• The **Utilitarian Principle** is that the good done by an action or inaction should outweigh any harm it causes or might cause. An example is not allowing a person who has had too much to drink to drive.

• The **Rights Principle** is that actions should respect and protect the moral rights of others. An example is not taking advantage of a vulnerable person.

• The **Fairness Principle** is that equals should be held to, or evaluated by, the same standards. An example is equal pay for equal work.

• The **Common Good Principle** is that actions should contribute to the common good of the community. An example is an ordinance on noise abatement.

• The **Virtue Principle** is that actions should be consistent with certain ideal virtues. Examples include honesty, compassion, generosity, tolerance, fidelity, integrity, and self-control.

The center expands these principles to create a framework for ethical conduct. An **ethical framework** is a sequence of steps intended to guide thinking and subsequent decisions or actions. Here is the one developed by the Markula Center for Applied Ethics:

1. Recognize an ethical issue by asking if an action could be damaging to a group or an individual. Is there more to it than just what is legal?
2. Make sure the pertinent facts are known, such as who will be impacted, and what options are available.
3. Evaluate the options by referring to each of the preceding five ethical principles.
4. Identify the "best" option and then further examine it by asking how someone you respect would view it.
5. In retrospect, consider the effect your decision had and what you can learn from it.

1.9 LET'S SUM UP

Operations management is a multi-disciplinary field that focuses on managing all aspects of an organization's operations. "The typical organization consists of the integration of many different functions, " wrote Howard J. Weiss and Mark E. Gershon in *Production and Operations Management.* "The two most obvious functions are to provide the product or service and to sell the product or service. Operations management focuses on the function of providing the product or service. It is concerned with the planning and controlling of all activities necessary for the provision of the firm's product or service." Aspects of operations management, then, include products or services to emphasize; facility size and

location with respect to customers and suppliers; marketing strategies to attract clients/customers; techniques and equipment to use to make the goods or to provide the services; work force management and training; and measurements of quality assurance. Operations managers apply ideas and technologies to increase productivity and reduce costs, improve flexibility to meet rapidly changing customer needs, enhance product quality, and improve customer service.

To understand operations and how they contribute to the success of an organization, it is important to understand the strategic nature of operations; the value-added nature of operations, the impact technology can have on performance, and the globally competitive marketplace.

Efficient organization operations are a vital tool in achieving competitive advantage in the daily contest for customers/clients. What factors influence buying decisions for these entities? For most services and goods, price, quality, product performance and features, product variety, and availability of the product are critical. All these factors are substantially influenced by actions taken in operations. For example, when productivity increases, product costs decline and product price can be reduced. Similarly, as better production methods are developed, quality and variety may increase.

By linking operations and operating strategies with the overall strategy of the organization (including engineering, financial, marketing, and information system strategy) synergy can result. Operations become a positive factor when facilities, equipment, and employee training are viewed as a means to achieve organizational objectives, rather than as narrowly focused departmental objectives. In recognition of this evolving viewpoint, the criteria for judging operations is changing from cost control (a narrowly defined operating objective) to global performance measurements in such areas as product performance and variety, product quality, delivery time, customer service, and operational flexibility.

In today's business environment, a key component of operational flexibility in many industries is technological knowledge. Advances in technology make it possible to build better products using fewer resources. As technology fundamentally changes a product, its performance and quality often increases dramatically, making it a more highly valued commodity in the marketplace. But the growth in high-tech business applications has created new competitors as well, making it important for businesses to try to register advantages in any and all areas of operations management.

Over time, operations management has grown in scope and increased in importance. Today, it has elements that are strategic, it relies on behavioural and engineering concepts, and it utilizes management science/operations research tools and techniques for systematic decision making and problem-solving. As operations management continues to develop, it will increasingly interact with other functional areas within the organization to develop integrated answers to complex interdisciplinary problems. Indeed, such interaction is widely regarded as

essential to long-term business success for small business establishments and multinational corporations alike.

1.10 KEY POINTS

1.The operations function is that part of every business organization that produces products and/or delivers services.
2. Operations consists of processes that convert inputs into outputs. Failure to manage those processes effectively will have a negative impact on the organization.
3. A key goal of business organizations is to achieve an economic matching of supply and demand. The operations function is responsible for providing the supply or service capacity for expected demand.
4. All processes exhibit variation that must be managed.
5. Although there are some basic differences between services and products that must be taken into account from a managerial standpoint, there are also many similarities between the two.
6. Environmental issues will increasingly impact operations decision making.
7. Ethical behavior is an integral part of good management practice.

1.11 KEY TERMS

- **Craft production** - System in which highly skilled workers use simple, flexible tools to produce small quantities of customized goods.
- **Division of labour** - The breaking up of a production process into small tasks, so that each worker performs a small portion of the overall job.
- **e-business** - Use of the Internet to transact business.
- **e-commerce** - Consumer-to business transactions.
- **Ethical framework** - A sequence of steps intended to guide thinking and subsequent decision or action.
- **Ethics** - A standard of behaviour that guides how one should act in various situations.
- **Goods** - Physical items produced by business organizations.
- **Interchangeable parts** - Parts of a product made to such precision that they do not have to be custom fitted.
- **Mass production** - System in which low-skilled workers use specialized machinery to produce high volumes of standardized goods.
- **Operations management** - The management of systems or processes that *create goods and/ or provide services.*
- **Process** - One or more actions that transform inputs into outputs.
- **Services** - Activities that provide some combination of time, location, form, and psychological value.
- **Supply chain** - A sequence of activities and organizations involved in producing and delivering a good or service.
- **Sustainability** - Using resources in ways that do not harm ecological systems that support human existence.
- **Technology** - The application of scientific discoveries to the development and improvement of goods and services.

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

1.12 SELF ASSESSMENT 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. List five important differences between goods production and service operations; then list five important similarities.
4. 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
5. Describe each of these systems: craft production, mass production.
6. List and briefly explain the four basic sources of variation, and explain why it is important for managers to be able to effectively deal with variation.
7. Why do people do things that are unethical?
8. Explain the term *value-added.*
9. Discuss the term *sustainability,* and its relevance for business organizations.

1.13 FURTHER READINGS

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Unit-2

Roles of Operations Manager

Learning Objectives

After completion of the unit, you should be able to:

- Understand the core responsibilities / role of an Operations Manager.
- Explain the key aspects of operations management decision making.
- Describe the scope of Operations Management.

Structure

1.1 INTRODUCTION and MEANING

An operations manager has a broad role, and the specific responsibilities will vary between different companies, but generally it includes monitoring and analysing the current system of production or provision to check it's effective, and working out a strategy for improving if necessary.

By managing day-to-day activities, analysing statistics and reading and writing reports, operations managers play a vital role in any company.

Operations managers also have to do a lot of liaising with other team members, including interacting with managers of different areas of the organization, presenting findings to stakeholders and higher management as well as training and supervising new employees and tracking and measuring staff performance.

Other duties and responsibilities include:

- Planning and controlling change.
- Managing quality assurance programmes.
- Researching new technologies and alternative methods of efficiency.
- Setting and reviewing budgets and managing cost.
- Overseeing inventory, distribution of goods and facility layout.

An operations manager is a senior role which involves overseeing the production of goods and/or provision of services. It's an operations manager's job to make sure an organisation is running as well as it possibly can, with a smooth efficient service that meets the expectations and needs of customers and clients.
An operations manager fills a pivotal role in a business, government or other organization. The precise tasks of an operations manager depend in large part upon the nature and size of the enterprise, but she / he needs a wide range of business and interpersonal skills to succeed. In general, an operations manager plans, oversees and smoothes communication.

1.2 CORE RESPONSIBILITIES / ROLE OF AN OPERATIONS MANAGER

Policy Formulation

Formulating policy is one of the core duties of an operations manager. Companies must operate and function on a daily basis within a prescribed set of guidelines. These guidelines are generally established by operations managers. These can include how different departments within the company or organization communicate and cooperate with one another. Policies can also include disciplinary actions taken when employees break company rules.

Management of Resources

Operations managers play a leading role in managing both raw materials and personnel. Oversight of inventory, purchasing and supplies is central to the job. Human resources tasks include determining needs, hiring employees, overseeing assignment of employees and planning staff development.

Financial Management

Operations managers play a key role in budgeting, controlling costs and keeping the organization on track financially. Their management of the supply chain and other resources helps minimize costs of production. They study business forecasts, sales reports and financial statements to find ways to maximize results. They use methods such as cost-benefit analysis to improve efficiency. Modern operations management even includes sustainability in the financial equation.

Goal-setting

Operations managers set goals and objectives and establish policies for various departments in the organization. For example, operations manager duties include sales forecasting and planning of sales promotions. In cooperation with other managers, they help establish procedures and put them into effect.

Planning

The planning of various company operations and activities is another major concern of the operations manager. Operations managers tend to determine which products are bought and sold, what prices they are bought or sold for and to whom they will be marketed, according to O*NET Online. The operations manager also helps plan and coordinate activities between various departments such as determining what types of sales promotions the company will engage in.

Controlling Resources

Controlling major company resources is yet a third major function of an operations manager. Operations managers oversee the implementation of payroll policies and procedures, how much employees are paid, how funds are allocated for benefits packages and how other funds are spent to keep the company operating smoothly on a day-to-day basis. Operations managers regularly review financial statements to ensure that the company is operating as efficiently and as profitably as possible.

Communication

A final core responsibility of an operations manager is communicating with other management professionals within the organization to keep the company running smoothly, and communicating with other companies and organizations with which the company does business. Operations managers are responsible for putting together reports and financial statements that are essential for other top executives within the company or organization.

1.3 THE SCOPE OF OPERATIONS MANAGEMENT

The scope of operations management ranges across the organization. Operations management
people are involved in product and service design, process selection, selection and management of technology, design of work systems, location planning, facilities planning, and quality improvement of the organization’s products or services.
The operations function includes many interrelated activities, such as forecasting, capacity
planning, scheduling, managing inventories, assuring quality, motivating employees, deciding where to locate facilities, and more.
We can use an airline company to illustrate a service organization’s operations system. The system consists of the airplanes, airport facilities, and maintenance facilities, sometimes spread out over a wide territory. The activities include:

Forecasting such things as weather and landing conditions, seat demand for flights, and the growth in air travel.
Capacity planning, essential for the airline to maintain cash flow and make a reasonable profit. (Too few or too many planes, or even the right number of planes but in the wrong places, will hurt profits.)
Facilities and layout, important in achieving effective use of workers and equipment.
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 foods and beverages, first-aid equipment, inflight magazines, pillows and blankets, and life preservers.
Assuring quality, essential in flying and maintenance operations, where the emphasis is on
safety, and important in dealing with customers at ticket counters, check-in, telephone and
electronic reservations, and curb service, where the emphasis is on efficiency and courtesy.
Motivating and training employees in all phases of operations.
Locating facilities according to managers' decisions on which cities to provide service
for, where to locate maintenance facilities, and where to locate major and minor hubs.

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 also might do some of the *fabrication* work itself, forming frames, making the gears and chains, and it might buy mainly raw materials and a few parts and materials such as paint, nuts and bolts, and tires. Among the key 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 activities, motivating employees, ordering and managing supplies, selecting and maintaining equipment, satisfying quality standards, and—above all—satisfying customers. And in both businesses, the success of the business depends on short- and long-term planning.
The operations function consists of all activities *directly* related to producing goods or providing services. Hence, it exists both in manufacturing and assembly operations, which are *goods-oriented,* and in areas such as health care, transportation, food handling, and retailing, which are primarily *service-oriented.*

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* of the system.

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. These decisions usually, but not always, require long-term commitments. Moreover, they are typically *strategic* decisions. *System operation* involves management of personnel, inventory planning and control, scheduling, project management, and quality assurance. These are generally *tactical* and *operational* decisions. Feedback on these decisions involves *measurement* and *control.* 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 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.
A number of other areas are part of, or support, the operations function. They include purchasing, industrial engineering, distribution, and maintenance.

Purchasing has responsibility for procurement of materials, supplies, and equipment. 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, reliability, service, price, and ability to adjust to changing demand. Purchasing is also involved in receiving and inspecting the purchased goods.
Industrial engineering is often concerned with scheduling, performance standards, work methods, quality control, and material handling.
Distribution involves the shipping of goods to warehouses, retail outlets, or final customers.
Maintenance is responsible for general upkeep and repair of equipment, buildings and grounds, heating and air-conditioning; removing toxic wastes; parking; and perhaps security.

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.* The same thing can be said for the job of any operations manager regardless of the kinds of goods or services being created.

1.4 OPERATIONS MANAGEMENT AND DECISION MAKING

The chief role of an operations manager is that of planner/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. Most decisions

involve many possible alternatives that can have quite different impacts on costs or profits. Consequently, it is important to make *informed* decisions. Operations management professionals make a number of key decisions that affect the entire organization. These include the following:
What: What resources will be needed, and in what amounts?
When: When will each resource be needed? When should the work be scheduled? When should materials and other supplies be ordered? When is corrective action needed?
Where: Where will the work be done?
How: How will the product or service be designed? How will the work be done (organization, methods, equipment)? How will resources be allocated?
Who: Who will do the work?

Now, we shall 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 methods, analysis of trade-offs, establishing priorities, ethics, and the systems approach. Models are often a key tool used by all decision makers.

Models
A **model** is an abstraction of reality, a simplified representation of something. For example, a child's toy car is a model of a real automobile. It has many of the same visual features (shape, relative proportions, wheels) that make it suitable for the child's learning and playing. But the toy does not have a real engine, it cannot transport people, and it does not weigh 2,000 pounds.
Other examples of models include automobile test tracks and crash tests; formulas, graphs and charts; balance sheets and income statements; and financial ratios. Common statistical models include descriptive statistics such as the mean, median, mode, range, and standard deviation, as well as random sampling, the normal distribution, and regression equations.

Models are sometimes classified as physical, schematic, or mathematical:
Physical models look like their real-life counterparts. Examples include miniature cars, trucks, airplanes, toy animals and trains, and scale-model buildings. The advantage of these models is their visual correspondence with reality.
Schematic models are more abstract than their physical counterparts; that is, they have less resemblance to the physical reality. Examples include graphs and charts, blueprints, pictures, and drawings. The advantage of schematic models is that they are often relatively simple to construct and change. Moreover, they have some degree of visual correspondence.
Mathematical models are the most abstract: They do not look at all like their real-life counterparts. Examples include numbers, formulas, and symbols. These models are usually the easiest to manipulate, and they are important forms of inputs for computers and calculators.
The variety of models in use is enormous. Nonetheless, all have certain common features:
They are all decision-making aids and simplifications of more complex real-life phenomena. Real life involves an overwhelming amount of detail, much of which is irrelevant for any particular problem. Models omit unimportant details so that

attention can be concentrated on the most important aspects of a situation. Because 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.
The last point is particularly important because virtually every model has an associated set of assumptions or conditions under which the model is valid. Failure to satisfy all of the assumptions will make the results suspect. Attempts to apply the results to a problem under such circumstances can lead to disastrous consequences.
Managers use models in a variety of ways and for a variety of reasons. Models are beneficial
because they
1. Are generally easy to use and less expensive than dealing directly with the actual situation.
2. Require users to organize and sometimes quantify information and, in the process, often indicate areas where additional information is needed.
3. Increase understanding of the problem.
4. Enable managers to analyze what-if questions.
5. Serve as a consistent tool for evaluation and provide a standardized format for analyzing a problem.
6. Enable users to bring the power of mathematics to bear on a problem.

This impressive list of benefits notwithstanding, models have certain limitations of which
you should be aware. The following are three of the more important limitations:
1. Quantitative information may be emphasized at the expense of qualitative information.
2. Models may be incorrectly applied and the results misinterpreted. The widespread use of computerized models adds to this risk because highly sophisticated models may be placed in the hands of users who are not sufficiently knowledgeable to appreciate the subtleties of a particular model; thus, they are unable to fully comprehend the circumstances under which the model can be successfully employed.
3. The use of models does not guarantee good decisions.

Quantitative Approaches
Quantitative approaches to problem solving often embody an attempt to obtain mathematically optimal solutions to managerial problems. *Linear programming* and related mathematical techniques are widely used for optimum allocation of scarce resources. *Queuing techniques* are useful for analyzing situations in which waiting lines form. *Inventory models* are widely used to control inventories. *Project models* such as PERT (program evaluation and review technique) and CPM (critical path method) are useful for planning, coordinating, and controlling large-scale projects. *Forecasting techniques* are widely used in planning and scheduling.
Statistical models are currently used in many areas of decision making.
In large measure, *quantitative approaches* to decision making in operations management (and in other functional business areas) have been accepted because of calculators and computers capable of handling the required calculations.

Computers have had a major impact on operations management. Moreover, the growing availability of software packages for quantitative techniques has greatly increased management's use of those techniques. Although quantitative approaches are widely used in operations management decision making, it is important to note that managers typically use a combination of qualitative and quantitative approaches, and many important decisions are based on qualitative approaches.

Performance Metrics

All managers use metrics to manage and control operations. There are many metrics in use,
including those related to profits, costs, quality, productivity, flexibility, assets, inventories,
schedules, and forecast accuracy.

Analysis of Trade-Offs

Operations personnel frequently encounter decisions that can be described as *trade-off* decisions. For example, in deciding on the amount of inventory to stock, the decision maker must 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.

Decision makers 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, decision makers 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.

Degree of Customization

A major influence on the entire organization is the degree of customization of products or services being offered to its customers. Providing highly customized products or services such as home remodelling, plastic surgery, and legal counselling tends to be more labour intensive than providing standardized products such as those you would buy "off the shelf " at a mall store or a supermarket or standardized services such as public utilities and Internet services. Furthermore, production of customized products or provision of customized services is generally more time consuming, requires more highly skilled people, and involves more flexible equipment than what is needed for standardized products or services. Customized processes tend to have a much lower volume of output than standardized processes, and customized output carries a higher price tag. The degree of customization has important implications for process selection and job requirements. The impact goes beyond operations and supply chains. It affects marketing, sales, accounting, finance, and information systems.

A Systems Approach

A systems viewpoint is almost always beneficial in decision making. 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 subsystem), which in turn are composed of lower subsystems. The systems

approach emphasizes interrelationships among subsystems, but its main theme is that *the whole is greater than the sum of its individual parts.* Hence, from a systems viewpoint, the output and objectives of the organization as a whole take precedence over those of any one subsystem. An alternative approach is to concentrate on efficiency within subsystems and thereby achieve overall efficiency. But that approach overlooks the facts that organizations must operate in an environment of scarce resources and that subsystems are often in direct competition for those scarce resources, so that an orderly approach to the allocation of resources is called for.

A 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, if the upcoming model of an automobile will add 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. Global competition and outsourcing are increasing the length of companies' supply chains, making it more important than ever for companies to use a systems approach to take the "big picture" into account in their decision making.

Establishing Priorities

In virtually every situation, managers discover that certain issues or items are more important

than others. Recognizing this enables the managers to direct their efforts to where they will do the most good. Typically, a relatively few issues or items are very important, so that dealing with those factors will generally have a disproportionately large impact on the results achieved. This well-known effect is referred to as the **Pareto phenomenon.** 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.

1.5 LET'S SUM UP

Today's operations managers, those responsible for producing and delivering the goods and services that we use every day, face a wide variety of challenges in the twenty-first century. The highly competitive business environment that currently exists, caused in large part by the globalization of the world's economies in conjunction with the growth in e-commerce, has

shifted the balance of power from the producers to the consumers. As a result, consumers are now demanding increased value for their money. To put it simply, they want more for less.

From an operations management perspective this means providing continuously higher-quality products with shorter delivery times and better customer service

while simultaneously reducing labour and material costs and increasing the utilization of existing facilities—all of which translates into higher productivity.

To accomplish all of this, operations managers are turning to a wide variety of technologies. These include the use of robotics on assembly lines and automation, which can take the form of ATMs and vending machine purchases with cell phones. In the forefront is the increasing use of information technology, driven by an improved telecommunications infrastructure, which also is providing faster service at lower costs. Examples here include the Internet and customer support centres, which now can be located in any corner of the world.

Firms that ignore the important role of operations management within an organization pay a price: failure, as evidenced by the many dot-com bankruptcies that have occurred in recent years. Many of these firms were virtual in every sense. All they had were Web sites with no operational infrastructure to support them. (This can be compared to putting up wallpaper without having a wall behind it!) Stories abound of Christmas shoppers who could not get deliveries on time (and couldn't even speak to someone about the problem) and virtual banks that were incapable of providing customers with something as simple as deposit slips. In every case, these customers took their business elsewhere as a result of their bad experience, never to return.

1.6 KEY TERMS

- **System - A** set of interrelated parts that must work together.
- **Pareto phenomenon -** A few factors account for a high percentage of the occurrence of some event(s).

1.7 SELF ASSESSMENT QUESTIONS

1. What are models and why are they important?
2. Why is the degree of customization an important consideration in process planning?
3. 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.
    e. A small business owner having a Web site versus newspaper advertising.
4. Describe the core responsibilities of an Operations Manager.
5. What are trade-offs? Why careful consideration of trade is-offs important in decision making?

1.8 FURTHER READINGS

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