NATIONAL OPEN UNIVERSITY OF NIGERIA

BUS 801

Operations Management

Module 1

BUS 801 Operations Management Module 1

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Module 1

Unit1 Production and Operations Management

1.0 Introduction

This first unit introduces you to the field of operations management. Generally, it describes the nature and scope of operations management, and how it relates to the other parts of the organisation.

2.0 Objectives

At the end of this unit you should be able to:

- define the term production/operations management (POM)
- identify the three major functional areas of organisations and describe how they interrelate
- compare and contrast service and manufacturing operations
- briefly describe the historical evolution of POM.

3.0 Main Content

3.1 Introduction to Production and Operations Management

Operations management deals with the production of goods and services that people buy and use everyday. It is the function that enables organisations to achieve their goals through efficient acquisition and utilization of resources. Manufacturers of steel, food, vehicles, computer (i.e. physical goods) need operations management. So do health care providers, banks, schools, retailers etc.

Every organisation, whether public or private, manufacturing or service, has an operations function.

To some people, the term production conjures up images of factories, machines and assembly hires. Interestingly enough, the field of production management in the past focused almost exclusively on manufacturing management, with a heavy emphasis on the methods and techniques used in operating a factory. In recent years, however, the scope of production management has broadened considerably. Production concept and technologies are applied to a wide range of activities and situations; that is, in services such as health care, food service, recreation, banking, hotel management, retail sales, education, transportation and government. This broadened scope has given the field the name production/operations

management or more simply operations management – a term that more closely reflects the diverse nature of activities to which its concepts and techniques are applied.

Formally stated, therefore, production and operations management (POM) is the management of an organisation's production system, which converts inputs into the organisation's products and services. (or the direction and control of the processes that transform inputs into finished goods and services). This function is essential to systems producing goods and services in both profit and nonprofit organisations.

3.1.1 Function within Business Organisations

A typical business organisations has three basic function: finance, marketing and production/operations. (see Figure 1.1)

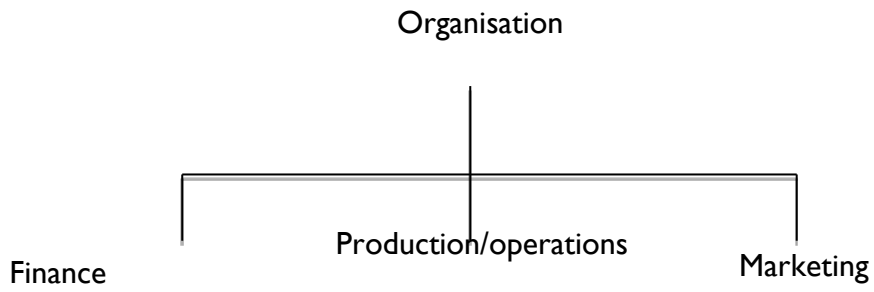


Figure 1.1: The three basic functions of business organizations

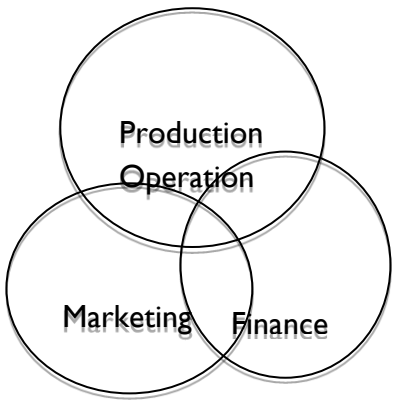


Figure 1.2: The 3 major functions of business organisation overlap

These three functions, and other supporting functions, perform different but related activities necessary for the operation of the organisation. The interdependency of the major functions is depicted by overlapping circles in figure 1.2. These functions must interact to achieve the goals and objectives of the organisation, and each makes an important contribution. Very often, the success of our organisation depends not only on how well each area performs but also on how well the areas interface with each other. For instance in manufacturing, it is essential that production and marketing work together. Otherwise, marketing may promote goods that production cannot profitably produce, or production may turn out items that have no demand. Similarly, unless finance and production people work closely, funds for expansion or new equipment may not be available when needed in

addition to the three primary functions, many organisations have a number of supporting functions, such as personnel, accounting, engineering, purchasing, public relations, distribution etc. the existence of these functions and the emphasis placed on each depend on the type of business a firm is engaged in. We will take a closer look at these functions:

3.1.2 Operations

The operational function consists of all activities directly related to producing goods or providing services. Table 1.1 provides illustrations of the diversity of operations management settings.

Table 1.1: Examples of types of operations

Type of operations	Examples
Goods producing	Farming, mining, construction, manufacturing, power generation.
Storage/transportation	Warehousing, trucking, mail service, moving taxis, buses, hotels, airlines.
Exchange	Retailing, wholesaling, banking, renting, or leasing, library loans.
Communications	Newspapers, radio and TV newscasts, telephone, satellites.
Entertainment	Films, radio & television, plays concerts, recording.

The operations function is the core of most business organisations; it is responsible for the creation of an organisation's goods or services. Inputs are used to obtain finished goods or services using one or more transformation process (e.g. storing, transporting, cutting, and cleaning). 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). Fig 1.3 shows the conversion process.

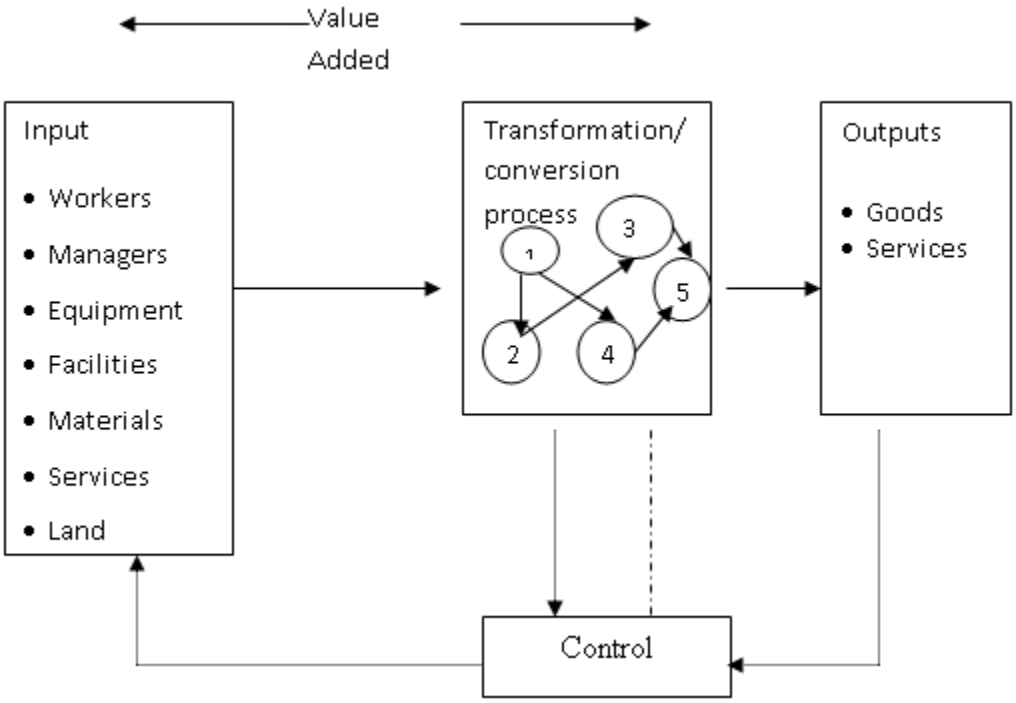


Figure 1.3: The conversion process of the operations function

Table 1.2: Provides some examples of inputs, transformation processes, and outputs

Inputs	Transformation	Outputs
Land	Processes	Goods
Human	Cutting, drilling	Houses
Physical	Transportation	Automobiles
Intellectual	Teaching	Clothing
Raw materials	Farming	Computers
Energy	Mixing	Machines
Water	Packing	TV
Chemicals	Canning	Food products
Metals	Consulting	Textbooks
Wood	Copying, faxing	Magazines
Equipment		Shoes
Machines		CD players

Computers		Services
Trucks		Health care
Facilities		Entertainment
Hospitals		Car repair
Factories		Delivery
Offices		Crift wrapping
Retail stores		Legal
Information		Banking
Time		Communication
Others		

The essence of the operations function is to add value during the transformation process: The term "value added" is used to describe the difference between the cost of inputs and the value or price of outputs. In non-profit organisations, the value of outputs (e.g. highway construction, police and fire protection services is their value to society; the greater the value added, the greater the effectiveness of these operations. In the case of profit making organisations, the value of outputs is measured by the prices that customers are willing to pay for these goods or services.

Firms use the money generated by value-added for Research and Development (R&D), investment in new plants and equipment, and profits. Consequently, the greater the value added the greater the amount of funds available for these purposes.

It is obvious that one sure way businesses can attempt to become more productive is to examine critically whether the operations performed by their workers add value. Those operations that do not add value are considered wasteful. By eliminating or improving such operations, firms can reduce the cost of inputs or processing, thereby increasing the value added. Let us use an example to buttress this point: suppose a firm discovers that it is producing an item much earlier than the scheduled delivery dates to a customer. This firm evidently requires the storage of the item without adding to the value of the item. Reducing storage time would reduce the transformation cost and, hence, increase the value – added.

3.1.3 Finance

The finance function is made up of activities related to securing resources at favourable prices and allocating those resources throughout the organisation. Generally, the finance and operations management personnel cooperate by exchanging information and expertise in such activities as budgeting, economic analysis of investment proposals and provision of funds. For instance, budgets must necessarily and periodically prepared for the planning of

financial requirements. These budgets must sometimes be adjusted, and performance relative to a budget must be evaluated. In addition, evaluation of alternative investment in plant and equipment requires inputs from both operations and finance people. Furthermore, the necessary funding of operations and the amount and timing of such funding can be important and even critical when funds are tight. Therefore, careful planning can help avoid cash flow problems.

3.1.4 Marketing

Marketing is concerned with sensing, serving, and satisfying the needs and wants of the present and potential customers of the organisation. It consists of selling and /or promoting the goods or services of the firm advertising and pricing decisions are made by the marketing people. It has been said that marketing is responsible for assessing customer needs and wants, and for communicating such to operations people (short term) and to design people (long term). Hence, operations department needs information about demand over the short to intermediate term so that it can plan accordingly (e.g purchasers' raw materials or schedule work). In addition, the design department also needs information that relates to improving current products and services and designing new ones.

In essence therefore, departments of marketing, design and production must work closely to successfully implement design changes and to develop and produce new products. Marketing usually supplies information on consumer preferences so that the design department will know the kinds of products and features needed. Operations department often supplies information about capacities, as well as assess operationality of designs. Operations department will also have advance warming if new equipment or skills will be needed for new products or services.

It is necessary to include the finance people in these exchanges so as to provide information on what funds might be available (short term), and to learn what funds might be needed for new products or services (intermediate to long term). The marketing department needs information on lead time from the operations department, so that customers can be given realistic estimates of how long it will take to fill their orders.

From our treatment of sections 3.1.1, 3.1.2 and 3.1.3, it is clear that department of marketing, operations and finance must interface on product and process design, forecasting, setting realistic schedules, quality and quantity decisions and keeping each other informed on the other's strengths and weaknesses.

3.1.5 Other Functions

Apart from the three core functions, there are a host of other supporting functions that interface with these core functional areas of operations, finance, and marketing. These are illustrated in figure 1.4.

Accounting has responsibility for preparing the financial statements, such as income statement and balance sheet. In addition, it supplies to management costs of labour, materials, and overhead, it may also provide reports on scrap, downtime and inventories. Furthermore, it must keep track of receivables, payables, and insurance costs, as well as prepare tax statements for the firm.

It is the responsibility of the purchasing department to procure materials, suppliers and equipment. The department is usually asked to evaluate vendors for quality, reliability, service, force, and ability to adjust to changing demand. In addition, the department is responsible for receiving and inspecting the purchased goods.

The personnel department is concerned with recruitment and training of personnel, labour relations, contract negotiations, wage and salary administration, assisting in manpower projections.

It is the responsibility of public relations department to build and maintain a positioned public image for the organisation. Very often, this might involve sponsoring events in sports, donating to actual events in sports, donating to actual events, and sponsoring community affairs.

Industrial engineering has the responsibility of scheduling, performance standards, work methods, quality control and materials handling.

Distribution is concerned with the movement of goods to warehouses, retail outlets or to customers.

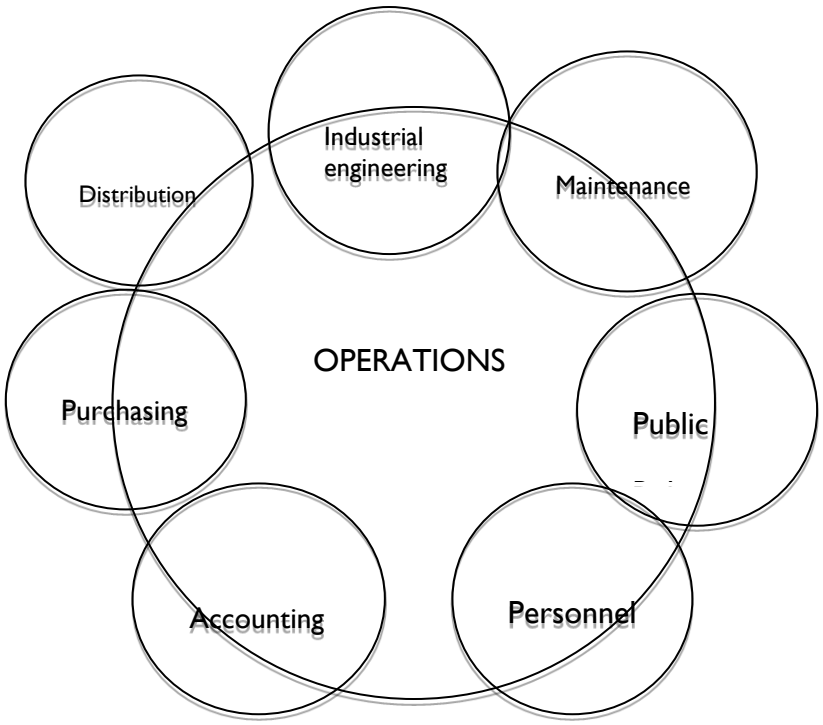


Figure 1.4: Interface of operations with supporting functions

Last, but by no means the least, the maintenance department is responsible for general upkeep and repair of equipment, building and grounds, heating and air-conditioners removing wastes; parking and, at times security.

3.2 Manufacturing and Service Operations

Manufacturing implies production of a tangible output (i.e. something that can be seen or touched) such as a car, tyre, bread, knife, etc. Service on the other hand, generally implies an act. Examples here include a doctor's examination, TV and auto repair, lawn care and lodging in a hotel. The majority of service jobs fall into the following categories:

Education (schools, colleges, universities, etc.)

Business services (data processing, delivery, employment agencies, etc.)

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

Health care (doctors, dentists, hospital care, etc)

Financial services (banking, stock brokerages, insurance, etc)

Wholesale / retail (clothing, food, appliances, stationeries, toys, etc)

Government (federal, state, local)

3.2.1 Differences between Manufacturing and Services

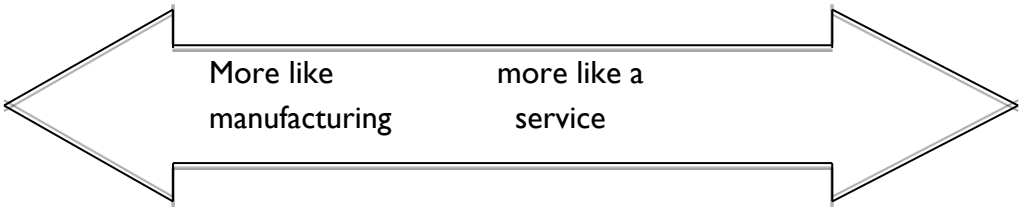
The differences between manufacturing and service operations fall into the eight categories show in figure 1.5. You should however note that these distinctions actually represent the ends of a continuum. The first distinction arises from the physical nature of the product: manufactured goods are physical, durable products. Services on the other hand are intangible, perishable product- they are usually ideas, concept, or information.

The second area of difference also relates to the physical nature of the product. For instance, manufactured goods are outputs that can be produced, stored, and transported in anticipation of future demand. This way, creating inventories allows manager to cope with fluctuations in demand by smoothing output level. On the other hand, services can't be pre-produced. To this end, service operations do not have the luxury of using finished goods inventories as a cushion against erratic customer demand.

Customer contract is the third distinction between manufacturing and service operations. Most customers for manufactured products have little or no contact with the production system. The primary customer contract is normally left to distributors and retailers. However, in the case of service firms, the customers themselves are inputs, and thus, are active participant in the process.

Another distinction is response time to customer demand. For instance, manufacturers generally have days or even weeks to meet customer demand. However, many services must be offered within minutes of customer arrival. The purchaser of a generator may be willing to wait for four weeks for delivery. By contrast, a grocery store customer may grow inpatient after waiting five minutes in a checkout line. Since customers for services usually arrive at times convenient to them, service operations may have difficulty matching capacity with demand. In addition, arrival patterns may vary daily or hourly, thus creating even more short-term demand uncertainty.

There are two distinctions with respect to location and size of an operation. Manufacturing facilities usually serve regional, national, or even international markets. Therefore, they generally require larger facilities, more automation, and greater capital investments than for service facilities. On the other hand, services cannot be moved to distant locations. Hence, service organisation requiring direct customer contact must locate relatively near the customer.



* Physical, durable product	* Intangible, perishable product
* Output can be inventoried	* Output cannot be inventoried
* Low customer contact	* High customer contact
* Long response time	* Short response time
* Large facilities	* Small facilities
* Capital intensive	* Labour intensive
* Quality easily measured	* Quality not easily measured
* Regional, national, or International markets.	* Local markets

Figure 1.5: Continuum of characteristics of manufacturing and service operations

The final distinction between manufacturing and service operations relates to the measurement of quality. Since manufacturing systems tend to have tangible products and less customer contact, quality is relatively easy to measure. However, the quality of service systems, which generally produce intangibles, is often very difficult to measure. Coupled with this, the subjective nature of individual preferences further makes the measurement of services difficult.

3.2.2 Similarities between Manufacturing and Service Operations

In spite of the differences already discussed there are compelling similarities between manufacturing and service operation: firstly both have processes that must be designed and managed effectively. Secondly, some type of technology be it manual or computerized, must be used in each process. Thirdly, both of them are usually concerned about quality, productivity and the timely response to customers. Fourthly they must make choices about

capacity, location, and layout of their facilities. Fifthly, both deal with suppliers of outside services and materials, as well as scheduling problems. Sixthly, matching staffing levels and capacities with forecasted demand is a universal problem.

3.3 The Historical Evolution of Production and Operations Management

Systems for production have existed since ancient times. The Egyptian pyramids, the Greek Parthenon, the Great Wall of China, and the aqua ducts and roads of the Roman Empire provide examples of the human ability to organise for production. But the ways that these ancient peoples produced products were quite different from the production methods of today. The production of goods for sale, at least in the modern sense, and the factory system had their roots in the industrial revolution.

3.3.1 The Industrial Revolution

The industrial Revolution started in the 1770s in England and spread to the rest of Europe as well to the United States during the nineteenth century. Before this time, product systems were often referred to as the cottage system, because the production of products took place in homes or cottages where craftsmen directed apprentices in performing handwork on products.

Under the cottage system, it was usual for one person to be responsible for making a product, such as a horse drawn wagon or a piece of furniture, for the beginning to the end. Only simple tools were available. Products were made of parts that were custom fitted to other parts. Because of this, the parts were not interchangeable. Generally, production was slow and labour- intensive.

However, the industrial revolution changed the face of production forever with two principal elements: the widespread substitution of machine power for human and water power and the establishment of the factory system. The steam engine, invented by James Watt in 1764, provided machine power for factories and stimulated other inventions of the time. For example, the availability of the steam engine and production machines allowed the gathering of workers into factories away from rivers. The large number of workers assembled into factories created the need for organising them in logical ways to produce products.

It was around this period, that Adam Smith wrote his book, the Wealth of Nationals in 1776, which touted the economic benefits of the division of labour. This meant breaking up a production process unto a series of small tasks, each of which were assigned to different workers.

Another important milestone occurred in 1790 when Eli Whitney, an American inventor, developed the concept of interchangeable parts. Whitney designed rifles to be manufactured for the U.S government on an assembly line such that parts were produced to tolerances allowing every part to fit right the very first time. This method of production ensured that the parts did not have to be custom made, they were standardised.

Consequent upon these various developments, factories began to spring up and grow rapidly, thereby providing jobs for many people who were attracted in large numbers from rural areas. Unfortunately however, working conditions were very poor in those times, and many workers actually suffered injury or death.

In spite of the major changes that took place, management theory and practice had not progressed much from early days.

3.3.2 Scientific Management

The scientific-management era brought widespread changes to the management of factories. Table 1.3 presents the main characters of the scientific management era. The movement was spearheaded by Frederick Winslow Taylor, who is often referred to as the father of scientific management. Taylor was born in 1856 in Pennsylvania, the son of a prosperous attorney. In 1878, he took a job in Philadelphia at the Midvale Steel Company, whose president believed in experimentation to improve factory work methods. Taylor began as a labourer, but within six years he rose from labourer to clerk, to machinist, to gang boss of mechanist, to foreman, to master mechanic of maintenance, and finally to chief engineer of the works.

Taylor's belief in scientific management was based on observation, measurement, analysis and improvement of work methods, and economics incentives.

Taylor's shop system, a systematic approach to improving worker efficiency, employed the following steps.

1. Skill, strength and learning ability were determined for each worker so that individuals could be placed in jobs for which they were best suited.

2. Stopwatch studies were used to precisely set standard of output per worker on each task. The expected output on each job was used for planning and scheduling work and for comparing different methods of performing tasks.

3. Instruction cards, routing sequences, and materials specifications were used to coordinate and organise the shop so that work methods and work flow could be standardised and labour output standard could be met.

4. Supervision was improved through careful selection and training. Taylor frequently pointed out that management was indeed negligent in the performance of its functions. He strongly believed that management had to accept planning, organising, controlling, and methods determination responsibilities, rather than leave these important functions to the workers.

5. Incentive pay systems were initiated to increase efficiency and to relieve foremen of their traditional responsibility or driving workers.

Each of the scientific management pioneers listed in Table 1.3 took active parts in spreading the gospel of efficiency. All of them contributed valuable techniques and approaches that eventually shaped scientific management into a powerful force to facilitate mass production.

There is no doubt that scientific management has dramatically affected today's management practices. For instance, the movement's struggle to find the one best way to operate factories leads logically to a questioning attitude on the part of managers in every phase of production systems. This questioning attitude encourages managers to attempt to build factories that operates with clockwork efficiency.

Table 1.3: Scientific Management: The Players and Their Parts

Contributor	**Life span**	**Contributions**
Fredrick Winslow Taylor	1856 -1915	Scientific management principles, exception principle, time study, method analysis, standards, planning, control
Frank B. Gilbreth	1868-1934	Motion study, methods, therbligs, construction contracting, consulting
Lillian M. Gilbreth	1878- 1973	Fatigue studies, human factor in work, employee selection and training
Henry L. Gantt	1961 -1919	Gantt charts, incentive pay system, humanistic approach to labor, training
Carl G. Barth	1860-1939	Mathematical analysis, slide rule, feeds and speeds studies, consulting to automobile industry
Harrington Emerson	1885-1931	Principles of efficiency, million –dollars –day savings in railroads, methods of control
Morris L. Cooke	1872-1960	Scientific management application to education and government

3.3.3 Human Relations and Behaviouralism

During the industrial Revolution, factory workers were largely uneducated, unskilled, and undisciplined, having come fresh from farms. These workers generally had a basic dislike for factory work. They were however forced by circumstances to take to the jobs, since there was nothing for them to live on. Factory managers often had to develop stringent controls to force them to work hard. This practice of stringent controls continued into the 1800s and early 1900s. Basic to this management method was the assumption that workers have to be placed in jobs designed to ensure that they would work hard and efficiently.

However, between World War I and World War II, there began to emerge in the United States a philosophy among managers that workers were human beings and should be treated with dignity while on the job. The human relations movement began in Illinois with the work of Elton Mayo, F. J Roethlisberger, T.N. Whitehead, and W.J Dickson at the Hawthorne, Illinois, plant of the western electric company in the 1927-1932 periods.

These Harwthorne studies were initially started by industrial engineers. The objectives of the studies were to determine the optimal level of lighting to get the most products from workers. The studies produced confusing results about the relationship between physical environment and worker efficiency. The researchers were to later realise that human factor must be affecting production. This was about the first time that researchers and managers alike recognized that psychological and sociological factors affected not only human motivation and attitude, but production as well. In this regard therefore, operations managers need to create an organisational climate that encourages employees to devote their energy, ingenuity, and skill to the achievement of organisational objectives.

Self-Assessment Exercise

1. Define POM
2. What was the industrial Revolution? When did it happen?
3. List five important differences between manufacturing and service operations.

4.0 Conclusion

Unit one has thrown light on an understanding of the term 'Production and Operations Management. You have been able to identify the three major functional areas of an organization, as well as how these functions interrelate. The unit has also enabled you to compare and contrast services and manufacturing operations. A special emphasis was placed on the historical evolution of Production and Operations Management.

5.0 Summary

This unit has introduced Operations Management as a function that enables organizations to achieve goals through efficient acquisition and utilization of resources. The unit points out that a typical business organization has three basic functions, including: Finance; production/operations; and marketing. It also point out that, apart from these three core functions, there are other functions, including: distribution, maintenance purchasing, accounting, personnel, public relations, and the like.

6.0 Self-Assessment Exercise

1. Briefly discuss each of these terms related to the historical evolution of POM:

a. Industrial Revolution

b. Scientific management

c. Interchangeable parts

d. Division of labour

2. Describe Frederick W. Taylor shop management Approach.

7.0 References/Further Reading

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Unit 2 Operations Strategy

1.0 Introduction

There is an increasing recognition that operations should assist the firm achieve a competitive position in the market place. Hence, apart from being a place to make the firm's products and services, operations should also lead to some competitive strength to the business as well. This realization is being encouraged by increased foreign competition, the need for improved productivity and increased customer demands for improved quality. Gaining a competitive advantage through improved operations performance requires a strategic response on the part of the operations function. The focus of this unit is therefore on operations strategy, which specifies how operations can help implement the firm's corporate strategy. Here, you will see how operations strategy links long and short operations decision.

2.0 Objectives

At the end of this unit, you should be able to:

- define the term strategy, and explain why it is important for competitiveness
- explain how to link marketing strategy to operations strategy, through the use of competitive priorities
- provide example of how firms use competitive priorities for competitive advantage
- compare organisation strategy and operations strategy and explain why it is important to link them.

3.0 Main Content

3.1 Definition of Operations Strategy

Let us start by giving a working definition of operations strategy as follows:

> *"Operations strategy is a vision for the operations function that sets an overall direction or thrust for decision making. This vision should be integrated with the business strategy and is often, but not always, reflected in a formed plan. The operations strategy showed result in a consistent pattern of decision making in operations and a competitive advantage for the company"*
>
> *(Shroeder, 1993)*

There are many definitions of operations strategy in the literature, and these help to amplify and expand on the above definition. We will examine three of such definitions: The first, by Shroeder, Anderson, and Cleveland (1986) define operations strategy as consisting of four components: Mission, distinctive competence, objectives and policies. These four components assist us in defining what goals operations should accomplish and how it should

achieve those goals. The resulting strategy should then guide decision making in all phases of operations.

The second definition we shall examine is given by Hayes and Wheelwright (1984). They define operations strategy as a consistent pattern in operations decision. The more consistent those decision are, and the greater the degree to which they support the business strategy, the better. They go on to define how major decisions in operations should be made and integrated with each other. While Hayes and Wheelwright emphasize the result of operations strategy i.e a consistent pattern in decision making, Schroader et al, emphasize operations strategy as an antecedent to decision making. However, both agree that a consistent pattern of decision making must be the result.

In our third definition, Skinner (1985) defines operations strategy in term of the linkage between decision in operations and corporate strategy. He observes that when operations are out of step with the corporate strategy, operations decisions are often inconsistent and short range in nature. Consequently, operations are divorced from the business and the linkage with corporate strategy is weak. To remedy this unpleasant situation, Skinner recommends the development of an operations strategy, derived from the corporate strategy, which defines a primary task (i.e. what operations must do well for the business to succeed), and a consistent set of operations policies to guide decision making.

In addition to the three definitions just examined, Hill (1989) has also developed an innovative approach to defining and developing operations strategy. He shows how to link operations decisions. This is a customer-driven approach to focus operations on what the customer requires. From this perspective, quality, process, capacity, inventory and work-force decisions then follow from the customer requirement.

These various approaches we just examined should give us some insight into what operations strategy is, and how the strategy can be developed or improved.

3.2 Relationship between Operations Strategy and Corporate Strategy

Developing a customer driven operations strategy begins with market analysis, which categorizes the firm's customers, identifies their needs and assesses competitors' strength. You should note that this analysis accompanies an analysis of the external environment. In the second phase, the firm formulates its corporate strategy, which constitutes the organisation's overall goals. After the firm has determined which customers it wants to serve, it then goes on to develop its competitive priorities, or the capabilities and strength that the firm must possess to meet customer demand.

The competitive priorities and the future directions the form will take, such as global strategies, and new products or services, provide input for functional strategies or the goals and long-term plans of each functional area. By making use of its strategies planning process, each functional area is responsible for identifying ways to develop the capabilities it will need to carry out functional strategies and achieve corporate goals. This input, along with the current status and capability of each area, is fed back into the corporate strategic planning process to indicate whether corporate strategy should be modified. (See Figure 2.1).

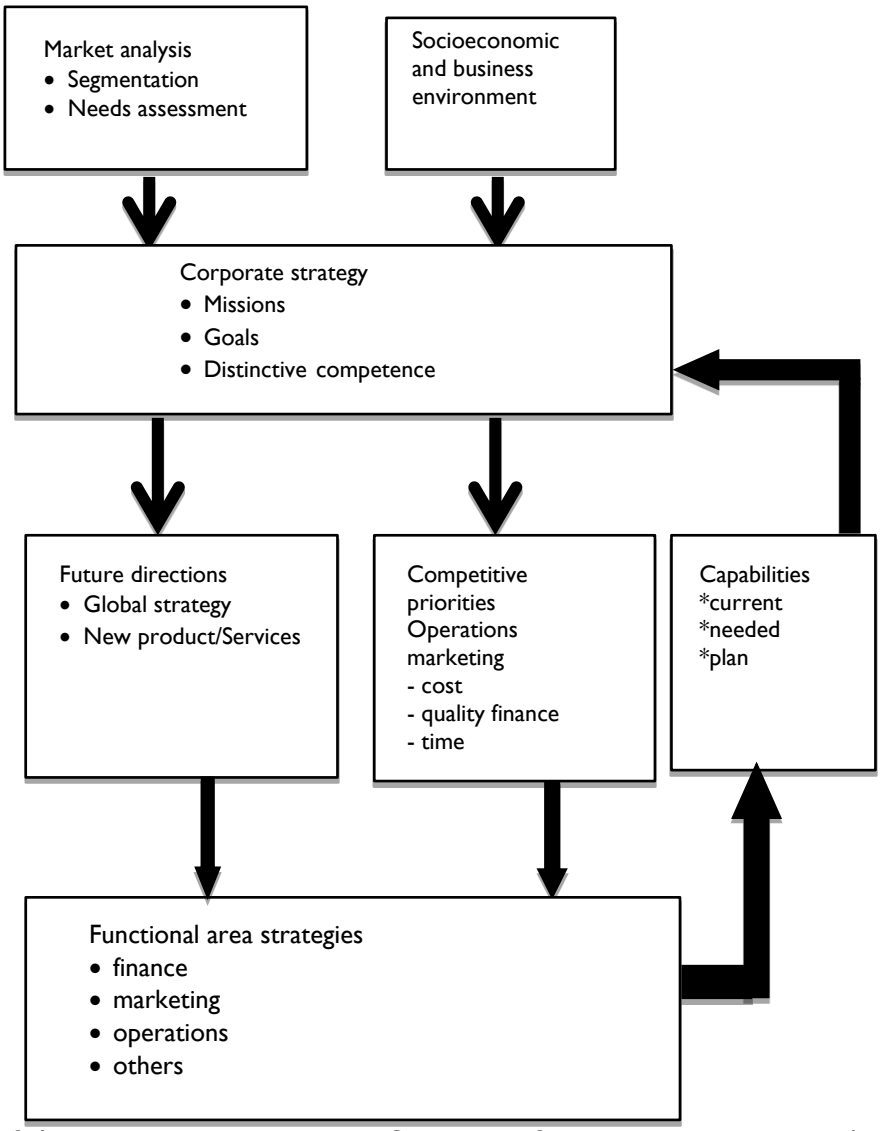

Figure 2.1: Priorities: Link Between Corporate Strategy and Functional Area Strategies

Corporate Strategy

In any business organisation, it is the responsibility of top management to plan the organisation's long-term future. In this regard therefore, corporate strategy defines the businesses that the company will pursue, new threats and opportunities in the environment, and the growth objectives that it should achieve. Also addressed, is business strategy, i.e how a firm can differentiate itself from the competition. The various alternatives could include producing standardized products instead of customized products or competing on the basis of cost advantage versus responsive delivery. Thus, corporate strategy provides an overall direction that serves as the framework for carrying out all the organisation's functions. In the sections that follow, we shall discuss the basic alternatives involved in corporate strategy and how global markets affect strategic planning.

3.2.1 Strategic Alternatives

As you already know, corporate strategy defines the direction of the organisation over the long term and determines the goals that must be achieved for the firm to be successful. Corporate strategy is set by management via three strategic alternatives:

i. determining the firm's mission;

ii. monitoring and adjusting to changes in the environment ; and

iii. identifying and developing the firm's core competencies

Let us try to look into these three alternatives more closely:

(a) Determining the firm's mission

An organisation's mission is the basis of the organisation, i.e the reason for its existence. Note that missions vary from organisation to organisation, depending on the nature of their business. It is important that an organisation have a clear and simple mission statement, one which answers several fundamental questions such as:

- What business are we in?
- Where should we be ten years from now?
- Who are our customers (or clients)?
- What are our basic beliefs?
- What are the key performance objectives, such as profits, growth or market share, by which we measure success?

The mission statement should serve to guide formulation of strategies for the organisation, as well as decision making at all levels. In addition, an understanding of the firm's mission helps managers generate ideas and design new products and services. If its mission is too broadly defined, the firm could enter areas in which it has no expertise. On the other hand, if the mission is too narrowly defined the firm could miss promising growth opportunities. Hence, without a clear mission, an organisation is unlikely to achieve its true potential because there is little direction for formulating strategies.

(b) Monitoring and adjusting to change in the Environment

The external business environment in which a firm competes changes continually for this reason, an organisation needs to adapt to those changes. Usually, adaptation begins with environmental scanning.

Environment scanning is the considering of events and trends that present either threats or opportunities for the organisation. Generally, these include:

- Competitor's activities;
- Changing consumer needs;
- Legal, economic, political and environmental issues;
- The potential for new markets; etc.
- Technological changes
- Social changes (such as attitudes toward work)
- Availability of vital resources and
- Collective power of customers or suppliers.

Depending on the nature of an organisation and the locations of its customers, the issues raised above may be looked at on global, national, regional or local basis.

A crucial reason for environmental scanning is to stay ahead of the competition. For instance, competitors may be gaining an edge by broadening product lines, improving quality, or lowering costs. In addition, new entrants into the market or competitors who offer substitutes for the firm's product or service may threaten continued profitability.

(c) Identifying and developing the firm's core competencies

Core competencies are those special attributes or abilities possessed by an organisation that gives it a competitive edge. They reflect the collective learning of the organisation, especially in how to coordinate diverse processes and integrate multiple technologies. In effect core competencies relate to the ways that organisations compete.

Competitiveness is an important factor in determining whether a company prospers, barely gets by, or fails. Business organisations compete with themselves in a variety of ways. Key among them are price, quality, product or service differentiation, flexibility, time to perform certain activities, workforce, facilities, market and financial know-how and systems, and technology.

(i) **Price:** Price is the amount a customer must pay for the product or service. If all other factors are equal, customers will choose the product or services that has the lower price. Organisations that compete on price may settle for lower profit margins. However, they must focus on lowering production costs.

(ii) **Quality:** This refers to materials and workmanship as well as design. Generally, it relates to the buyer's perceptions of how well the product or service will serve its purpose.

(iii) **Product differentiation:** Product differentiation refers to any special features (.e.g design, cost, quality, case of use, convenient location, warrants etc) that cause a product or service to be perceived by the buyers is more suitable than a competitor's product or service.

(iv) **Flexibility:** This is the ability to respond to changes. The better a company or department is at responding to changes, the greater its competitive advantage one another company that is not as responsive. The changes might relate to increases or decreases in volume demanded, or to changes in product mix.

(v) **Time:** This refers to a number of different aspects of an organisation's operations. There are at least three examples here: one is how quickly a product or service is delivered to a customer. Two, is how quickly new product or services are developed and brought to the market. Thirdly, is the rate at which improvements in products or services are made.

(vi) **Workforce:** A well-trained and flexible work force is an advantage that allows organisations to respond to market needs in a timely fashion. This competency is particularly important in service organisation where the customer comes in direct contact with the employees.

(vii) **Facilities:** Having well-located facilities – offices, stores, and plants –is a primary advantage because of the long lead time needed to build new ones. For instance, expansion into new products or services may be accomplished quickly. Furthermore, facilities that are flexible and can handle a variety of products or services at different levels of volume provide a competitive advantage.

(viii) **Market and Financial know-how:** An organization that can easily attract capital from stock sales, market and distribute its products has a competitive edge.

3.3 Strategies and Tactics

As you are already aware, a mission statement provides a general direction for an organisation and gives rise to organizational goals, which provide substance to the overall mission. For example, one goal of an organisation may be to capture a certain percentage of market shares for a product; another goal may be to achieve a certain level of profitability. Taken together, the goals and the mission establish a destination for the organisation.

Strategies are plans for achieving goals. If we have already likened goals to destinations, then, strategies may be seen as road maps for reaching the destination. Strategies provide focus for decision making. organisations usually have overall strategies referred to as organisation strategies (i.e. Corporate Strategies), which relate to the entire organisation. They also have functional strategies, which relate to each of the functional areas of the organisation.

Tactics are the methods and actions used to accomplish strategies. They are more specific in nature than strategies, and they provide guidance and direction for carrying out actual operations, which need the most specific and detailed plans and decision making in an organisation. One may think of tactics as the "how to" part of the process (e.g. how to reach the destination, following the strategy road map) and operation as the actual "doing: part of the process. Please note that the overall relationship that exists from the mission down to actual operations is hierarchical in nature. This is illustrated in Figure 2.2.

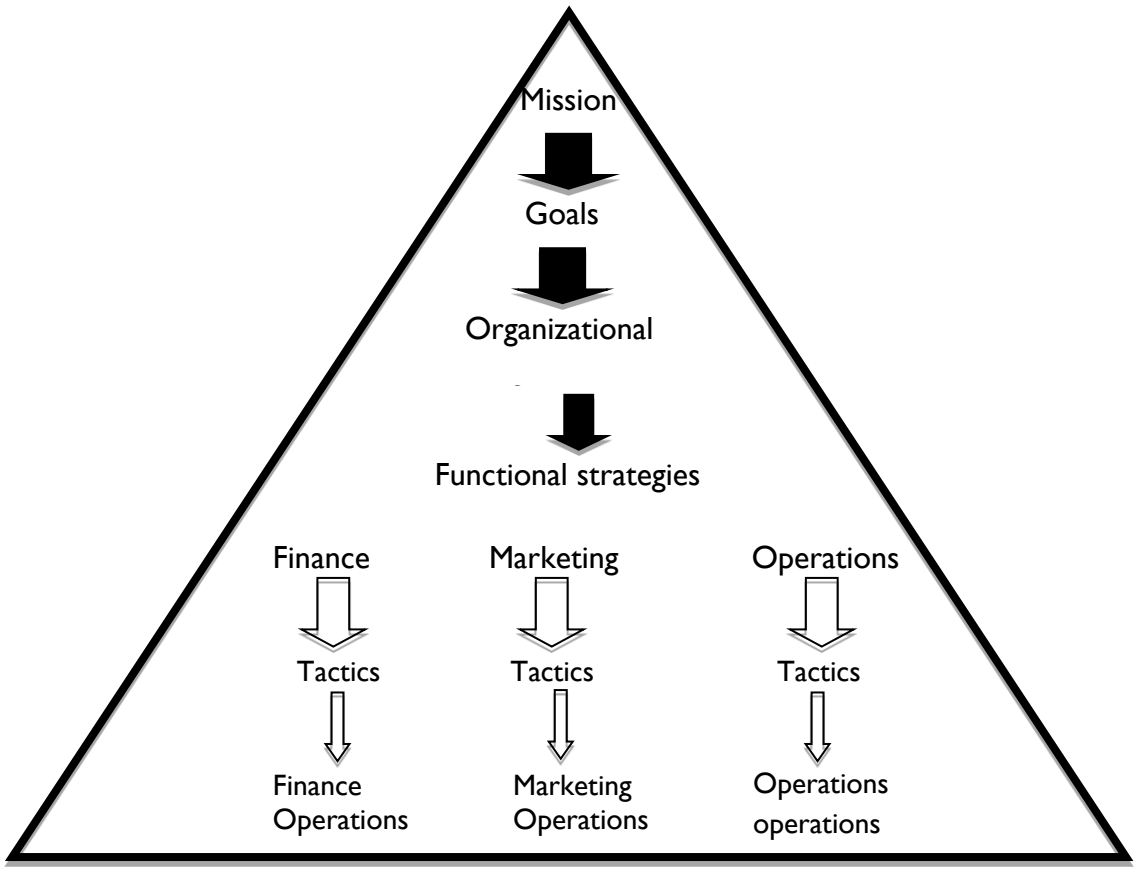

Figure 2.2: Planning and decision making in Hierarchical Organizations

3.4 Operations Strategy

You have seen that corporate strategy provides the overall direction for the organisation. It is broad in scope, covering the entire organisation. Operations strategy on the other hand is narrower in scope, dealing primarily with the operations aspect of the organisation. It relates to products, processes, methods, operating resources, quality, costs, lead times and scheduling.

It is often very important to link operations strategy to corporate strategy, so as to make it truly effective. This means that the two should not be formulated independently. In this regard, therefore, formulation of corporate strategy should always consider the realities of operations' strengths and weaknesses what is normally done is to capitalise on strengths and deal squarely with weaknesses. Similarly, operations strategy must be consistent with the overall strategy of the organisation, and formulated to support the goals of the organisation.

In conformity with the principles above, Figure 2.3 shows that operations strategies are derived directly from the corporate mission and business strategy.

Operations strategy can have a major influence on the competitiveness of an organisation. For instance, if it is well formulated and well executed, there is a strong possibility that the

organisation will be successful. Conversely, if it is poorly designed or excited, the chances are much less that the organisation will be successful.

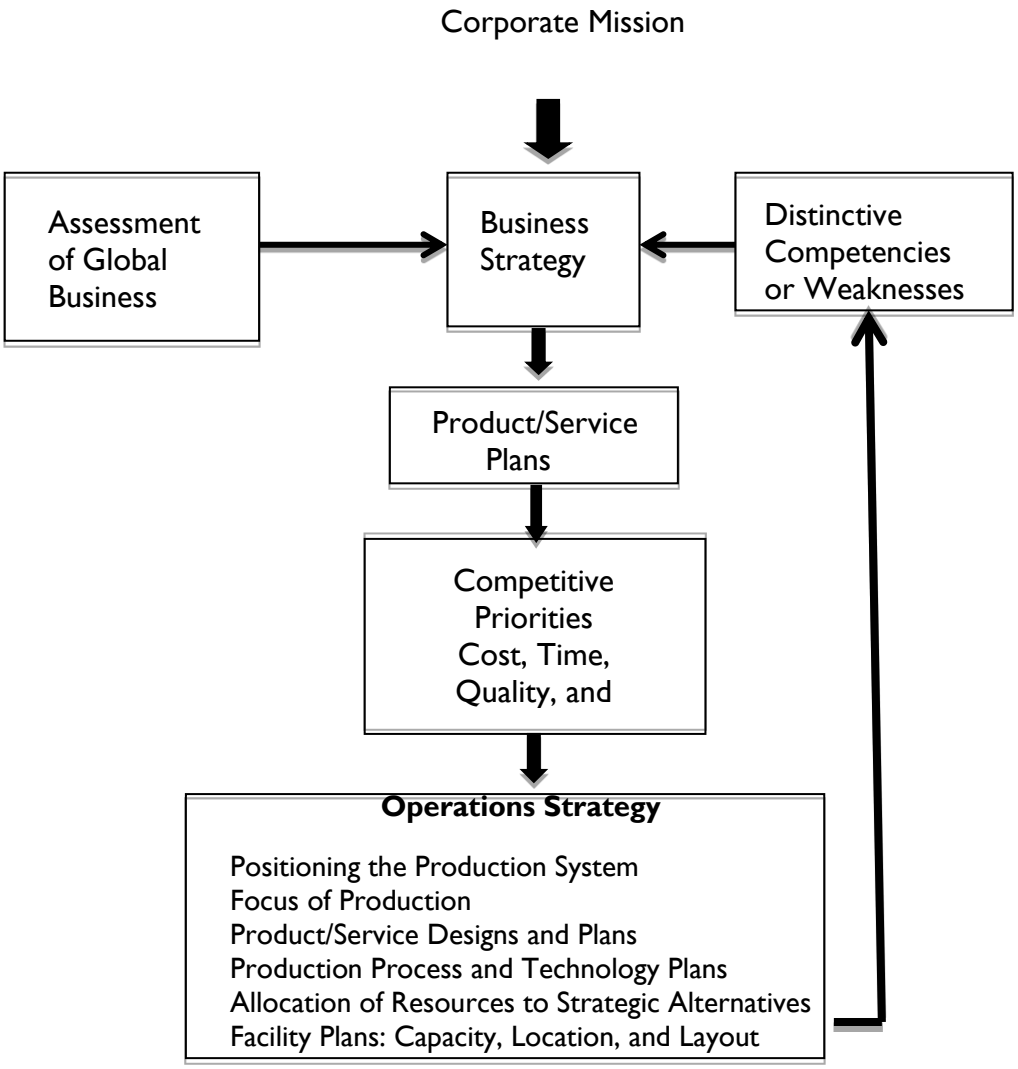

Figure 2.3: Developing Operations Strategy

3.4.1 Elements of Operations Strategy

We shall break our discussion on operation strategy under the following units: (1) positioning the production system, (2) focus of production (3) product/ service plans, (4) production process and technology plans, (5) allocation of resources to strategic alternatives, and (6) facility plans: capacity, location and layout.

Positioning the Production System

Positioning the production system in manufacturing generally means selecting the type of product design, type of production processing system, and type of finished – goods inventory policy for each product group in the business strategy.

With regard to product design, there are usually tow basic types: custom and standard. Custom products are designed according to the need of individual customers. The consequence of choosing this type of product is that there will be many products, each being produced in small batches. It should be clear to you that flexibility and on-time delivery are the competitive priorities needed for this type of product. In case of standard products, only a few product models are produced, either continuously or in very large batches. Fast delivery and low production cost are usually needed for this type of product.

There are also two basic types of production process: product-focused and process-focused. Product – focused production is also called line flow production, production lines and assembly lives. Here, both the machines and workers needed to produce a product are grouped together. This type of product is appropriate where there are only a few standard products, each with a high volume. Since such systems are usually difficult and expensive to change to other product designs and production volumes, they are not very flexible. Process-focused production is usually best when producing many unique products, each with a relatively low volume. Each production department ordinarily performs only one type of process, such as painting. All products that need such services are then transported to that particular department. Custom products usually require this form of production because process-focused systems are relatively easy and inexpensive to change to other products and volumes, thereby offering great flexibility. Hence, if a business strategy calls for custom products whose market strategy requires the competitive priorities of flexibility and on-time delivery, then process-focused production is usually preferred.

Again, there are two types of finished – goods inventory policies: produce to –stock and produce to order. In the case of the produce-to-stock policy, products are produced ahead of time and then placed in inventory. Later, when orders for the products are received, the products are then shipped immediately from inventory. For the produce-to-order policy, operations managers usually wait until they have the customer's order in hand before they produce the products.

With the proper selection of an appropriate product design, production process and finished – goods inventory policy for a product, much of the structure required of a factory may have been established.

3.4.1.1 Focus of Production

Another important element of operations strategy is the plan for each production facility to be specialized in some way. This idea of the specialized factory has been labeled "focused factory" by Skinner (1974). According to him "a factory that focuses on a narrow product mix for a particular market niche will outperform the conventional plant which attempts a broader mission. Because its equipment supporting system and procedures can concentrate on a limited task for one set of customers, its costs and especially its overheads are likely to be lower than those of the conventional plant. But, more important, such a plant can become a competitive weapon because its entire apparatus is focused to accompany the particular manufacturing task demanded by the company's overall strategy and marking objective.

How can factories and service facilities become more focused? This can be done in two major ways: specializing in only a few product models or a few production processes.

Graither (1996) submits that it is desirable for factories and service facilities to be specialised in some way, so that they will not be vulnerable to smaller and more specialized competitors that can provide a particular set of customers with a better set of cost, delivery, quality and customer service performance. However, this is not to say that smaller facilities are always better. Actually, economies of scale have to be considered while choosing the size of production facilities.

3.4.1.2 Product/Service Plans

Plans for new products and services to be designed, developed and introduced are also an important part of business strategy. Operations strategy is directly influenced by product/service plans because:

(i) As products are designed, all the detailed characteristics of each product are established;

(ii) Each product characteristics directly affects how the product can be made or produced; and

(iii) How the product is made determines the design of the production system, which is the heart of operations strategy.

3.4.1.3 Production Process and Technology Plans

Another important part of operations strategy is the determination of how products will be produced. This entails planning every detail of production process and facilities. You should note here, that the range of production technologies available to produce both products and service is great and is continuously increasing. For instance, combining high-technology production equipment with conventional equipment, and devising effective overall production schemes are indeed challenging.

3.4.1.4 Allocation of Resources to Strategic Alternative

Allocation of resources constitutes a common type of strategic decision to be made by operations managers.

For example, almost all companies today have limited resources available for production. For instance, cash and capital funds, capacity, research laboratories, workers, engineers, machines, materials and other resources are scarce in varying degrees to each firm. Shortages of these resources generally have serious impacts on production systems. These resources must be divided among, or allocated to product, business units, projects, or profit opportunities in ways that maximize the achievement of the objectives of operations.

3.4.1.5 Facility Plans: Capacity, Location and Layout

Another critical part of setting operations strategy is how to provide the long-range production capacity to produce the products/services for a firm. Huge capital investment is required to make production capacity available. For instance, land and production equipment may need to be bought, and specialized production technologies may have to be developed. In addition, new production equipment may need to be made or purchased and installed, and new factories may need to be located and built.

It is obvious that the decisions involved here have long-lasting effects and are subject to great risk. For example, if poor decisions are made or if circumstances change after the company has commuted to a choice of alternatives, it has to live with the results of such decision for quite sometime. Relevant decisions in these areas are therefore treated under long-range planning and Facility Location.

Market Analysis

One important key to success in formulating a customer-driven operations strategy is understanding what the customer wants and how to provide it better than the competitor does. This clearly means that the market must be analyzed. Market analysis first divides the firm's customers into market segments and then identifies the need of each segment. In the sections that follow, we shall define and discuss the concept of market segmentation and needs assessment.

3.4.1.6 Market Segmentation

This is the process of identifying groups of customers with similar characteristics to warrant the design and provision of products or services that the larger group wants and needs. In general, in order to identify market segments, the analyst must determine the characteristics that clearly differentiate each segment. After this, a sound marketing programme can be devised and an effective operating system developed to support the marketing plan.

Having identified a market segment, the firm can then incorporate the needs of customers into the design of the product or service as well as the operations systems for its production. The following characteristics are among those that can be used to determine market segments:

(i) **Demographic factors:** age, income, educational level, occupation and geographical locations are examples of factors that can differentiate markets.

(ii) **Psychological factors:** factors such as pleasure, fear, innovativeness, and boredom can be said to segment markets. For example, people with a fear of crime constitute a market segment that has led to the creation of new products and services for protection.

(iii) **Industry factors:** Customers may make use of specific technologies (e.g. electronics, robotics, or microwave telecommunications), use certain materials (e.g. rubber, oil or wool) or participate in a particular industry (e.g. banking health, care or automotive). These factors are used for market segmentation when the firm's customers use its goods or services to produce other goods or services for sale.

3.4.2 Needs Assessment

The second step in market analysis is to make a needs assessment. Needs assessment seeks to identify the needs of each segment, and assess how well competitors are addressing those needs. One important advantage of the needs assessment is that it allows the firm to differentiate itself from its competitors.

Usually, the needs assessment include both the tangible and the intangible product attributes and features a customer desires. The attributes and features are commonly referred to as

the customer benefit package, and they consist of a core product or service and a set of peripheral products or services. Note that the customer often views the customer benefit package as a whole. For example, when you buy a personal computer (PC), the core product is the PC itself i.e. its features and qualities. However, the peripheral services offered by the dealer play an important role in your decision to purchase the PC. These include the manner in which you are treated by the sales person, the availability of credit facility, and the quality of after-sales services at the dealership. Hence, the customer benefit package is the PC together with the services provided by the dealership. Generally, customers will not be completely satisfied unless they receive the entire customer benefit package.

By understanding the customer benefit package for a market segment, management is able to identify ways of gaining competitive advantage in the market. Each market segment has market needs that can be related to product/service process or demand attributes. Market needs has been grouped as follows:

(a) Product/Service needs i.e. attributes of the product or service, such as price, quality and degree of customization desired.

(b) Delivery system needs i.e. attributes of the process and the supporting systems and resources needed to deliver the product or service, such as availability, convenience, courtesy, safety, delivery speed and delivery dependability

(c) Volume needs i.e attributes of the demand for the product or service, such as high or low volume, degree of variability in volume and degree of predictability in volume.

(d) Other need i.e other attributes not directly relating to operations, such as reputation and number of years in business, technical after sales support, accurate and reliable billing and accounting systems, ability to invest in international financial markets, competent legal services and product/services design capability.

Self-Assessment Exercise

Understanding the customer benefit package enables management to identify ways to gain competitive advantage in the marketplace. What do you consider to be the components of the customers benefit package in the provision of:

a) a car

b) an airline flight

Suppose that you were conducting a market analysis for a new textbook about Business management. What factors would you consider in order to identify a market segment? How would you make a need assessment?

4.0 Conclusion

This unit has taken you through operations strategy, which is embodied in the long-range production plan. This plan specifies positioning strategies, focus of production, product and production process and technology plans, allocation of resources to strategic alternatives,

and facility planning. Once these issues have been decided and set in place, the fundamental structure of the operations function is established.

5.0 Summary

Strategies are the basic approaches used by an organisation to achieve its goals. Strategies provide focus for planning and decision making. Organisations typically have overall strategies that pertain to the entire organisation, and strategies for each of the functional areas. Functional strategies are narrower in scope and should be linked to overall strategy.

6.0 Self-Assessment Exercise

1. Why should a firm not attempt to excel in all the areas of competitive priorities?

2. What determines the choice of the competitive priorities that a company should emphasize?

7.0 References/Further Reading

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Unit 3 Forecasting in POM

1.0 Introduction

This unit introduces you to forecasting in production and operations management (POM). Planning is an integral part of a manager's job, and if uncertainties becloud the planning horizon, managers will find it difficult to plan effectively. Forecasts help managers by reducing some of the uncertainties, thereby enabling them to develop more meaningful plans. In a nutshell, a forecast is statement about the future.

2.0 Objectives

At the end of this unit, you should be able to:

- describe at least four qualitative forecasting techniques and the advantages and limitations of each
- compare and contrast qualitative and quantitative approaches to forecasting
- identify the five basic demand patterns that combine to produce some series
- choose an appropriate forecasting technique for a given decision problem.

3.0 Main Content

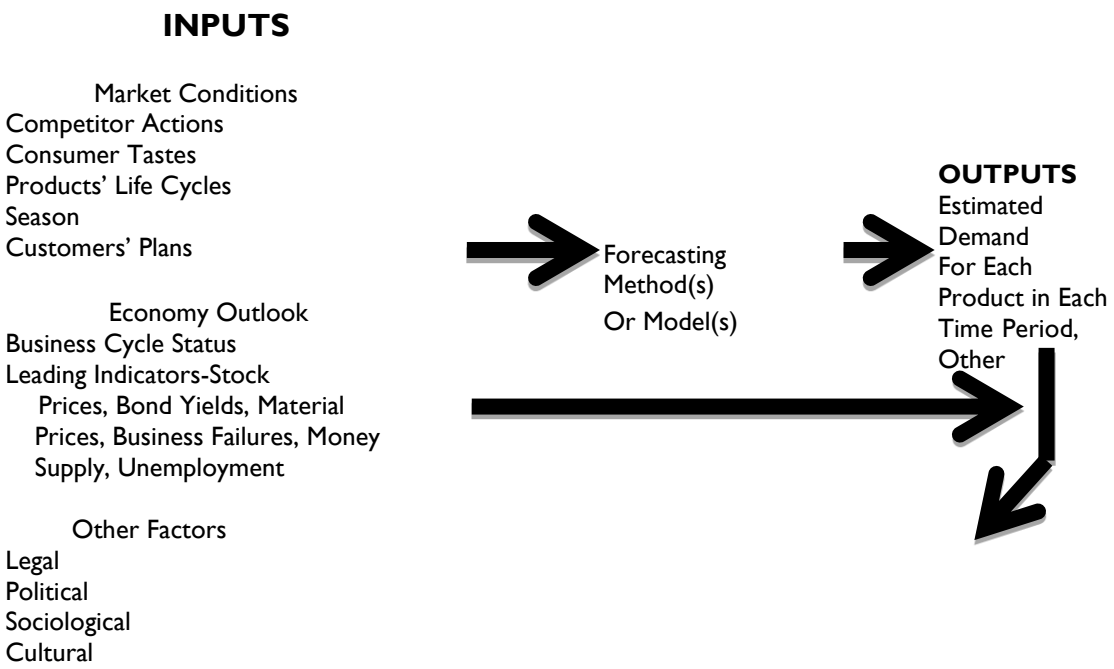
3.1 Introduction to Forecasting in POM

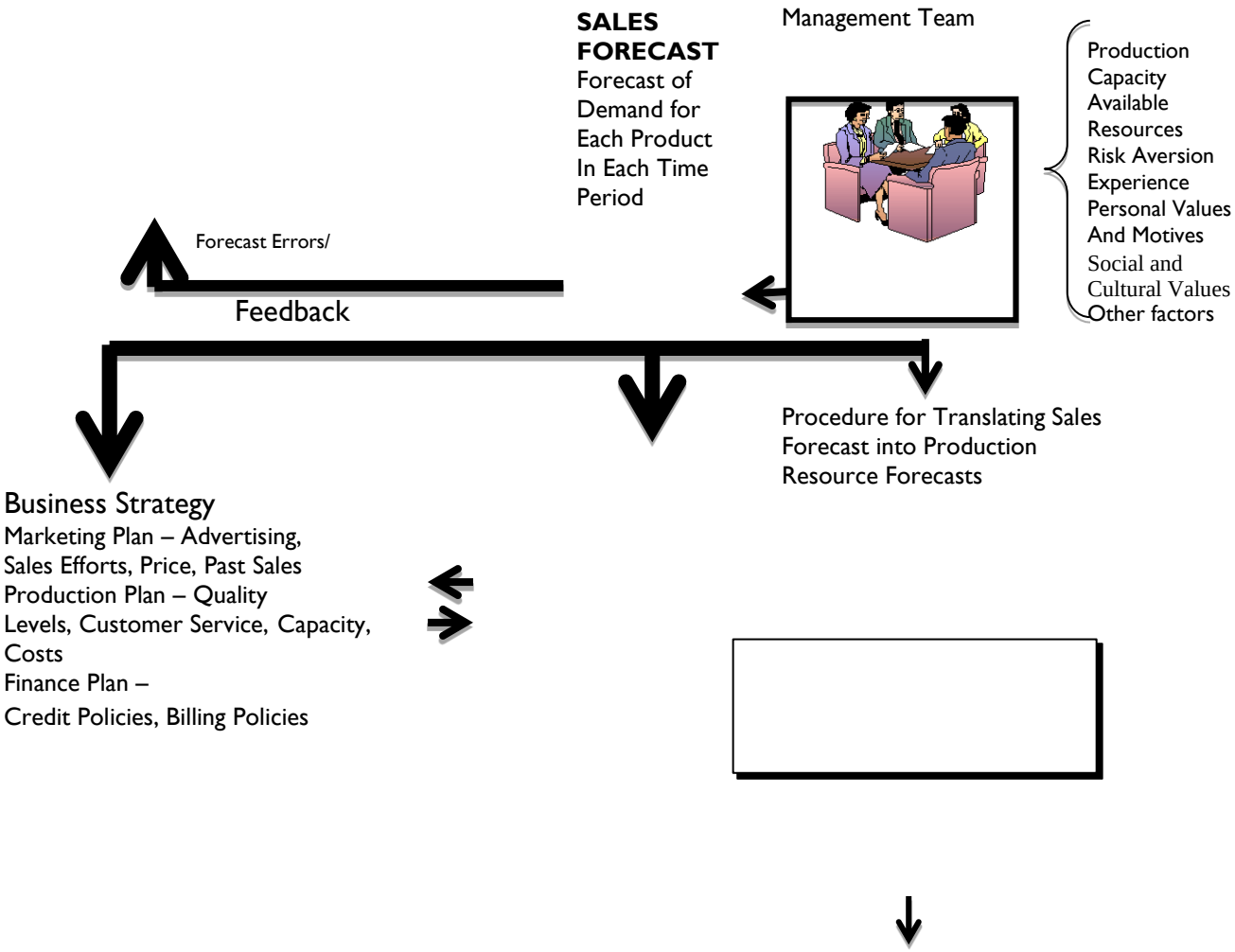
Customer demand is the backbone of all enterprises. Occasionally, however, customers appear unexpectedly, without prior notice. This sudden situation very often throws organisations off balance to the extent that the quality of their products, response time and customer service are badly affected. But this shouldn't be allowed to happen. A well-managed enterprise will make efforts to forecast demand, which normally allows it to be reasonably prepared when the demand actually occurs. Broadly speaking, well-managed businesses strive to manage demand, and this normally includes:

- Planning for demand
- Recognizing and accounting for all sources of demand
- Pre-processing of demand.

From the foregoing therefore, it is important that organisations have effective approaches to forecasting. In addition, forecasting should be an integral part of their business planning. Figure 3.1 is an illustration that forecasting is an integral part of business planning. The figure shows that the major inputs from various market conditions, economic outlook and other factors such as legal, political, sociological and cultural forces are processed through forecasting models or methods to develop demand estimates. You must however note that these demand estimates are not the sales forecasts. They are just the starting point for

management teams to develop sales forecast. The sales forecasts in turn become inputs to both business strategy and production resource forecasts. Actually, when managers plan, they are merely trying to determine in the present, what causes of action they will take in the future. The first step in planning is therefore forecasting or better still, estimating the future demand for products and services and the resources necessary to produce these outputs. Estimates of the future demand for products are usually referred to as sales forecasts. These are the starting point for all the other forecasts in POM. Can you now guess why forecasting is so essential to POM? Anyway, let us look at this together: Operations managers need long-range forecasts to make strategic decisions about products, process, and facilities. They will also need short-range forecasts to assist them in making decisions about product issues that span only the next few weeks.





PRODUCTION RESOURCE FORECASTS		
Long-Range	Medium-Range	Short-Range
Factory Capacities Capital Funds Facility Needs Other	Work Force Department Capacities Purchased Materials Inventories Other	Labor by Skill Class Machine Capacities Cash Inventories Other

Figure 3.1: Forecasting as an Integral Part of Business Planning

Source: Adapted From Gaither, N. (1996), Belmont, Duxury Press, p.64.

3.2 Importance of Forecasting in POM

Some of the reasons why forecasting is very essential in POM are given below:

1. **New Facility Planning:** It usually takes as long as five years to design and build a new factory or design and implement a new production process. Such strategic activities in POM require long-range forecasts of demand for existing and new products so that operations managers can have the necessary lead time to build factories and install processes to produce the products and services when needed.

2. **Production Planning:** Usually, demands from products continue to vary from month to month and from one season to the other. Hence production rates need to be scaled up or down to meet these varying demands. We should also note that it can take some months to alter the capacities of production processes. Therefore, operations managers need medium-range forecasts so that they can have the lead time necessary to provide the production capacity to produce there variable monthly demands.

3. **Work Force Scheduling:** Demands for products and services may actually vary from week to week. In order to remain on an efficient or profitable level of operation, the work force must, out of necessity be scaled up or down to meet these demands by using various methods, such as reassignment, overtime, layoffs, or hiring. In this regards, operations managers need short-range forecasts so that they can have the lead time necessary to provide work force changes for the production of weekly demands.

3.3 An Overview of Demand Measurement:

We need to realize right from here, that demand management is a shared responsibility. Usually, a master planning team, composed of experts in Marketing, Finance and Operations is responsible for taking care of, and coordinating demand management activities. This team has at least three important roles to play. These are to:

- Account for all sources of demand: historical demand patterns, sales force estimates, actual orders and direct selling, within – company (i.e. division-to-division) demands, and economic influences.

- Influence demand, e.g. through special promotions

- Evaluate the impact of any demand management plan on capacity and cash flow.

3.4 Time Horizon in Forecasting

From our previous discussion, you will have observed that forecasts can be made over any time horizon. However, the shorter the period being considered, the more accurate is the forecasts, since one is more certain of the variables involved. Descriptions of forecast elements over three time horizon include short-range, medium-range and long-range. Each time frame is discussed below with examples of some of the things usually forecasted:

3.4.1Short Range

A short-range forecast is one for a time span of a few weeks, up to say about three months. It would include forecasting such items as:

- purchase transactions;
- cash requirements;
- work scheduling;
- workforce levels;
- job assignments; and
- production levels.

3.4.1 Medium Range

The medium-range forecast covers between about three months and up to one year. Items usually included here are:

- capacity plan;
- operating cash budgets;
- production plans;
- sales plans; and
- Subcontractor needs.

3.4.3 Long Range

A long-range forecast usually spans a year up to about five years, and would include:

- new investments;
- capital expansion plans;
- facility location;
- new product development
- strategic plans;
- acquisition;
- implementing new technology; and

- research and development programmes.

3.5 Importance of Sales Forecast

What we have been stressing all along is that an estimate of demand, typically in the form of a sales forecast, is critical to the successful functioning of most businesses. It is one of the most important pieces of data used by management and takes a central stage in most companies' planning efforts. Its importance spreads across the following areas: as shown in Table 3.1.

Table 3.1: Different Areas of Application of Sales forecasts within an organization

User within the organization	Areas of application
Top management	* Allocating resources among functional areas * Control of operations of the firm
Finance Department	* Projection of cash flows * Deciding capital appropriations * Establishing operating budgets
Production Department	* Determination of production quantities * Determination of production schedules * Control of inventory.
Personnel Department	* Planning manpower requirements * As an input in collective bargaining
Purchasing Department	* Planning the firm's overall material requirements * Scheduling materials' arrival.
Marketing Department	* Planning marketing strategies and soles programmes * Allocation of resources among various marketing activities * Planning and evaluating the personal selling efforts * Setting sales quota * As an input into compensation plan * Evaluating the field sales force.

3.6 Sales Forecasting Methods

There are two main classes of forecasting methods: Qualitative (or subjective) and Quantitative (or objective). The qualitative or subjective methods rely primarily on judgment to produce sales forecasts. The quantitative or objective methods, in contrast, involve the application of statistical techniques of varying degrees of sophistication. The different techniques under each main class are shown in Figure 3.2. We will consider these methods at some length in the sections that follow.

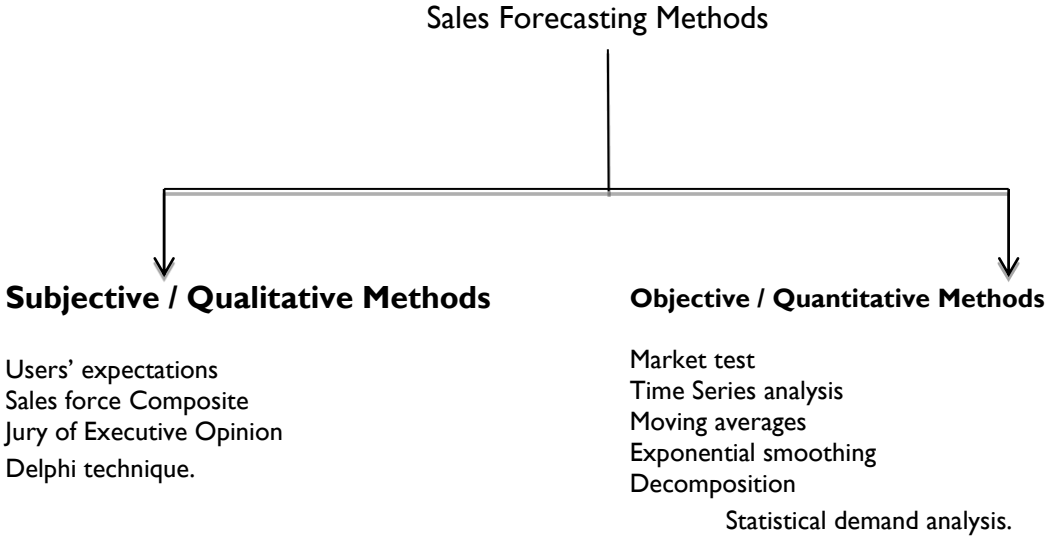


Figure 3.2: Classification of Sales Forecasting Methods

3.6.1 Subjective or Qualitative Methods

The subjective methods are based on assumptions, or intuitive estimates of those in the firm that are familiar with the market. This may include sales personnel, purchasing representatives or management people who all have close contact with customers. Some of their techniques may involve several levels of sophistication. An example here is an opinion survey that has been scientifically conducted. Others are merely intuitive hunches about future events. The accuracy of a particular subjective approach depends on the good judgment, honesty and philosophy of the individuals concerned. We shall attempt to examine each of the subjective techniques indicated in Figure 3.2

3.6.1.1 Users' Expectations

The users' expectations method is also known as the buyers' intentions methods since it relies on responses from customers with regard to their expected consumption or purchase of a product. The customers may be surveyed in person, over the telephone, or by mail. In some particular situations, the respondents in a users' expectations survey do not necessarily have to be the ultimate consumers. Rather, the firm may find it advantageous to secure the reactions of wholesalers and retailers that serve the channel.

Advantages

(i) The users' expectations method offers several advantages. These include the following:

(ii) The forecast is based on estimates obtained directly from firms whose buying actions will actually determine the sales of the product.

(iii) The way through which the information was obtained i.e. projected product use by customers, allows preparation of forecasts in great detail e.g. by product, by customer, or by sales territory.

(iv) The method may often provide some insight into the buyer's thinking and plan. Therefore, it could be helpful in planning the marketing strategy.

(v) It is particularly useful to solicit opinions from prospective buyers about a new product that is just coming to the market.

Disadvantages of Users' expectations are as enumerated below:

(i) The method is limited to situations in which the potential customers for the product are few and well defined. The method could be difficult to adopt and can actually result in grave errors when there are many customers that cannot be easily identified.

(ii) The method also depends on the sophistication of the potential customers in appreciating their needs. Here, we should remember that buyer intentions are subject to change, thus the method does not work particularly well for consumer goods.

(iii) It is often difficult to determine the firmness of intentions to purchase, particularly when the person being interviewed is not literate or uncooperative.

(iv) The method requires a considerable expenditure of money, time and manpower.

3.6.1.2 Sales Force Composite

The sales force composite is a specific judgmental forecast for which opinions are solicited from line sales personnel and sales managers. Each person states how much he or she expects to sell during the forecast period. The usual technique is to ask sales people to forecast sales for their districts and have these estimates reviewed by the regional sales manager and then by the head office sales manager. This method is based on the belief that those closest to the sales people have the best knowledge of the market.

Advantages

(i) A primary advantage of the sales force composite method is that it uses the specialised knowledge of the people closest to the market.

(ii) It has also been argued that the size of the sample used to develop the forecast tends to produce estimates that are fairly accurate.

(iii) The method lends itself to the easy development of customer; product, territory, or sales force breakdowns. These are particularly important in controlling the sales effort.

Disadvantages

(i) Sales representatives are often seen to be notoriously poor estimates. For instance, they tend to be overly optimistic when the economy is booming and overly pessimistic when things are not so good.

(ii) Salesmen usually are not trained forecasters and are ill-informed on the factors influencing sale.

(iii) The approach makes no provision for bringing the systematic consideration of uncontrollables into the analysis.

(iv) The approach does not provide for discovery of important facts through statistical analysis of historical data.

3.6.1.3 Jury of Executive Opinion

The jury of executive opinion method is about the oldest and simplest method of making sales forecast. The method either formally or informally polls the top executives of the company for their assessment of sales possibilities. The separate assessments are then combined into a sales forecast for the company.

This is sometimes often done by simply averaging the individual judgments. Disparate views are resolved through group discussions. In some cases, the process amounts to little more than group guessing. In other cases however, it involves the careful judgment of experienced executives who have studied the underlying factors influencing their company's sales.

Advantages

(i) Ease and quickness with which it can be made.

(ii) Does not require elaborate statistics.

(iii) The method brings together a variety of specialised viewpoints. The resulting "collective wisdom" reflects the thinking of the top people in the company.

(iv) When there is an absence of adequate data or experience, such as with innovative products, the jury of executive opinion method may be the only means of sales forecasting available to the company.

Disadvantages

(i) The forecasts are based on opinions rather than on facts and analysis.

(ii) Averaging opinions reduces responsibility for accurate forecasting.

(iii) The method is expensive because of the large amounts of highly paid executives' time it consumes.

(iv) The forecast may not properly weight the expertise of those most informed.

3.6.1.4 Delphi Technique

This method is used to achieve consensus within a committee. The Delphi technique uses repeated measurements and controlled feedback instead of direct confrontation and debate among the experts preparing the forecast. The way this method is employed is illustrated by Figure 3.3. The following steps are involved. First, each individual prepares a forecast using whatever facts, figures and general knowledge of the environment he or she has at his or her disposal. Second, the forecasts made are collected, and the person supervising the process prepares an anonymous summary. Third, the summary is distributed to each person who participated in the initial phase. Usually, the summary indicates each forecast figure, the average and some other summary measure of the spread of the estimates. Those whose initial estimates fell outside the mid-range of responses are asked to express their reasons for these extreme positions. The explanations offered are then incorporated into the summary. Those participating in the exercise are asked to study the summary and submit a revised forecast. The process is then repeated.

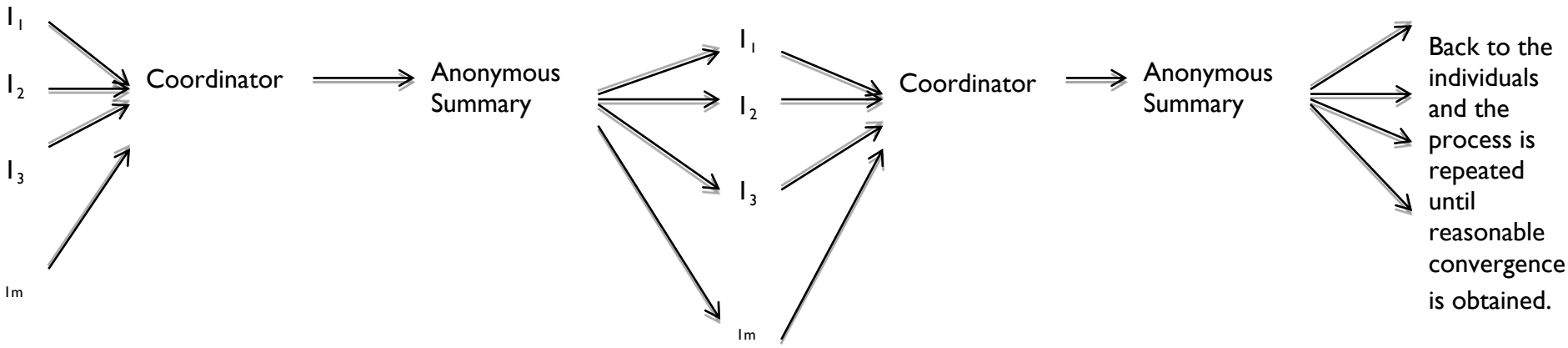


Figure 3.2: Operation of Delphi Process

The method is based on the following two premises:

(a) The range of responses will decrease, and the estimates will converge with repeated measurements

(b) The total group response or median will move successively toward the "correct" or "true" answer.

Advantages

(i) The strategy of forcing those whose forecasts lie at the ends of the distribution to justify their estimates seems to have benefits in that "informed" experts have greater opportunity to influence the final forecast.

(ii) Those who might have a deviant opinion, but with good reason, can defend that position, rather than going in to group pressure.

(iii) The method can result in forecasts that most participants have ultimately agreed to in spite of their initial disagreement.

Disadvantages

(i) The process of iteration and feedback in the Delphi often takes a long time

(ii) The method can also be very expensive.

3.6.2 Objective of Quantitative Methods

As we have already noted, the objectives or quantitative methods of forecasting are statistical in nature. They range in complexity from relatively simple trend extrapolations to the use of sophisticated mathematical models. A lot of organisations are tending toward the use of advanced methods in which the computer correlates a host of relationships. Let us now go into the treatment of the quantitative techniques earlier shown in Figure 3.

3.6.2.1 Market Test

Market testing is a relatively recent phenomenon in demand estimation and is mostly used to assess the demand for new products. The essential feature of a market test is that it is a controlled experiment, done in a limited but carefully selected part of the marketplace, whose aim is to predict the sales or profit consequences, either in absolute or relative terms, of one or more proposed marketing actions. It therefore goes beyond estimating the potential sales of a new product.

It is necessary for us to note that market testing methods differ in the testing of consumer and industrial products. For instance, when testing consumer products, the company wants to estimate the major determinants of sales, such as trial, first repeat, adoption, and purchase frequency. The major methods of consumer goods market testing include sales-wave research, simulates store technique, controlled test marketing and test markets. However, we are not going into their details here. You will learn more about them under Marketing Research.

Test marketing is not typically used in the case of industrial products. For instance, it will be too expensive to produce a sample of airplanes; ships etc, let alone put them up for sale in a select market to see how well they will sell. Marketing research firms have actually not built the test-market systems that are found in consumer markets. Therefore, goods industrial manufacturers have to resort to other methods to research the market's interest in a new industrial product. The most common method adopted is product-use test. A second common market test is to introduce the new industrial product at trade shows. A new industrial product can also be tested in a distributor and dealer display rooms. The details of these methods are under Marketing Research.

Advantages

(i) Market testing can indicate the product's performance under actual operating conditions.

(ii) It can also show the key buying influences and the best market segment

(iii) It provides ultimate test of consumers' reactions to the product

(iv) It allows the assessment of the effectiveness of the total marketing programme

(v) It is very useful for new and innovative products.

Disadvantages

(i) It allows competitors know what the firm is doing; hence they may jam the experiment by creating artificial situations so that the results of the test may not be meaningful.

(ii) It invites competitive reaction

(iii) It is expensive and time consuming.

(iv) Often takes a long time to accurately assess level of initial and repeat demand.

3.6.2.2 Time Series

This approach to sales forecasting rely on the analysis of historical data to develop a prediction for the future. The depth and sophistication of these analyses often vary widely. At one extreme, the forecaster might just forecast next year's sales to be equal this year's sales. This forecast might be reasonably accurate for a mature industry that is experiencing little growth. However, if there is some growth, the forecaster might allow for it by predicting the same percentage increase for next year that the company experience this year. Still further along the continuum, the forecaster might attempts to break historical sales into basic components by isolating that portion due to trend, cyclical, seasonal and irregular influences.

The first component, trend (T), is the result of basic developments in population, capital formation, and technology. It is found by fitting a straight or curved line through pass sales. The second component, cycle (C), captures the wavelike movement of sales. Many sales are affected by swings in general economic activity, which tends to be somewhat periodic. The cyclical component can be useful in medium-range forecasting. The third component, season (S), refers to a consistent pattern of sales movement within the year. The term season, describes any recurrent hourly, weekly, monthly, or quarterly sales pattern. The seasonal

component may be related to weather factors, holidays, and trade customs. The seasonal pattern provides a norm for forecasting short-range sales. The fourth component, erratic events (E), includes strikes, blizzards, fads, riots, fires, war scares, and other disturbances. These erratic components are by definition unpredictable, and should be removed from past data to see the more normal behaviour of sales.

Time series analysis consists of decomposing the original sales series, Y, into the components, T, C, S, and E. Then these components are recombined to produce the sales forecast. The following is an example.

A company sold 12,000 units of its main product this year. It now wants to predict next year's December sales. The long-term trend shows a 5% sales growth rate per year. This alone suggests sales next year of 12,600. (i.e. 12,000 x 1.05). However, a business recession is expected next year and will probably result in total sales achieving only 90% of the expected trend-adjusted sales. Therefore, sales next year will more likely be 11,340 (i.e. 12, 600 x 0.90). If sales were the same each year, monthly sales would be 945 (i.e. 11,340 – 12). However, December is an above-average month for that particular product, with a seasonal index of 1.30. Therefore, December sales may be as high as 1,228.5 (i.e. 945 x 1.30). No erratic events such as strikes or new product regulations are. Therefore, the best estimate of new product sales next December is 1,228.5.

A newer time-series technique called exponential smoothing is now available. This is being used by a firm with hundreds of items in its product line, and wants to produce efficient and economical short-run forecasts. In its simplest form, exponential smoothing requires only three pieces of information: this period's actual sales, Qt; this periods smoothed sales, $\overline{Q}_t$; and a smoothing parameter, α . The sales forecast for next period's sales is then given by:

$$Q_{t+1} = \alpha Q_t + (1 - \alpha)\overline{Q}_t$$

Where:

$\overline{Q}_{t+1}$ = sales forecast for next period

α = the smoothing constant, where $0 \leq \alpha \leq 1$

Q_t = current sales in period t

$\overline{Q}_t$ = smoothed sales in period t.

Example:

Suppose the smoothing constant is 0.3, current sales are N600, 000, and smoothed sales are N500, 000.

Then sales forecast is:

$$\overline{Q}_{t+1} = 0.3\ (N600,\ 000) + 0.7\ (N500,\ 000)$$

$$= N180,\ 000 + N350,\ 000$$

$$= N530,\ 000.$$

You will observe that the sales forecast is always between (or at an extreme of) current sales and smoothed sales.

Another technique under time series analysis is the method of moving averages. This is conceptually simple. Let us consider the forecast that next year's sales will be equal to this year's sales. Such a forecast might be subject to large error, if there is a great deal of fluctuation in sales from one year to the next. To allow for such randomness, we might want to consider making use of some kind of recent values. For example, we might average the last two years sales, the last three years' sales, etc. The forecast would simply be the average that resulted. The term moving average is used because a new average can be computed and used as a forecast as each new observation becomes available.

Table 3.2 presents 15 years of historical data for a manufacturer of shirts, together with the resulting forecast for a number of years using two-year and four-year moving averages.

Table 3.2: Annual and Forecasted sales for a manufacturer of shirts

Year	Actual Sales	Forecasted Two-Year Moving Average	Sales Four-Year Moving Average
1974	4,200		
1975	4,410		
1976	4,322	4,305	
1977	4,106	4,366	
1978	4,311	4,214	4,260
1979	4,742	4,209	4,287
1980	4,837	4,527	4,370
1981	5,030	4,790	4,730
1982	4,779	4,934	4,847
1983	4,970	4,905	4,904
1984	5,716	4,875	5,128
1985	6,116	5,343	5,395
1986	5,932	5,916	5,684
1987	5,576	6,024	5,835
1988	5,465	5,754	5,772
1989		5,520	

As earlier explained, the calculation of moving averages is relatively simple. For instance, the entry 4305 for 1976 under the two-year moving average method, for example, is the average of the sales of 4,200 units in 1974 and 4,410 units in 1975. In the same vein, the forecasts of 5520 units in 1989 represent the average of the number of units sold in 1987 and 1988. You may attempt to verify other forecast in the table.

Advantages

(i) The time series approach to sales forecasting provides a systematic means for making quantitative projections of sales.

(ii) The method is objective in the sense that two analysts working on the same data series using the same forecasting technique and the same model should produce the same forecast.

Disadvantages

(i) It is not useful for new or innovative products

(ii) Factors for trend, cyclical, seasonal, or product life-cycle phase must be accurately assessed and included

(iii) Technical skill and good judgement required.

(iv) Final forecast may be difficult to break down into individual territory estimates.

3.6.2.3 Statistical Demand Analysis

Statistical demand analysis is a set of statistical procedures designed to discover the most important real factors affecting sales and their relative influence. The factors most commonly analysed are price, income, population and promotion.

The method consists of expressing sales (Q) as a dependent variable and trying to explain sales as a function of a number of independent demand variables X_1, X_2, …, X_n; that is:

$$Q = f(X_1, X_2, \ldots, X_n)$$

By making use of multiple regression analysis, various equation forms can be statistically fitted to the data in the search for the best predicting factors and equation.

Let us make use of the work of Palda (1964), who tried to measure cumulate advertising effects of a vegetable product. He found that the following demand equation gave a fairly good fit to the historical sales of the product in question between the years 1908 and 1960:

$$Y = -3649 + 0.665X_1 + 1180 \log X_2 + 774 X_3 + 32X_4 - 2.83X_5$$

Where:

Y = Yearly sales in thousands of dollars

X_1 = yearly sales (lagged one year) in thousands of dollars

X_2 = yearly advertising expenditures in thousands of dollars

X_3 = a dummy variable, taking on the value 1 between 1908 and 1925 and 0

from 1926 on

X_4 = year (1908 = 0, 1909 = 1, etc)

X_5 = disposable personal income in billions of current dollars.

It was found that all the five independent variables accounted for 94% of the yearly variation in the sale of the commodity under investigation between 1908 and 1960. How can we use

this demand equation as a sales forecasting equation for the five independent variables? It follows thus:

- Sales in 1960 should be put in X_1;
- The log of the company's planned expenditures for 1961 should be put in X_2;
- 0 should be put in X_3;
- The numbered year corresponding to 1961 should be put in X_4; and
- Estimated 1961 disposable personnel income should be put in X_5.

The result of multiplying these numbers by the respective coefficients and summing them gives a sales forecast (Y) for 1961.

Advantages

(i) It has great intuitive appeal

(ii) Requires quantification of assumptions underlying the estimates. This makes it easier for management to check the results

(iii) It provides a means of discovering factors affecting sales which intuitive reasoning may not uncover.

(iv) The method is objective in the results can be reproduced by different analysts using the same model and variables.

Disadvantages

(i) It presumes that historical relationships will continue into the future, hence the analysts may have a false sense of security in this regard.

(ii) It requires technical skill and expertise

(iii) Some managers are reluctant to use the method due to its sophistication.

4.0 Conclusion

In this unit, you have learned that planning is an integral part of a manager's job. If uncertainties cloud the planning horizon, managers will find it difficult to plan effectively. Forecasts help managers by reducing some of the uncertainties, thereby enabling them to develop more meaningful plans.

5.0 Summary

Forecasts are vital inputs for the design and the operation of the productive systems because they help managers to anticipate the future. Forecasting techniques are generally classified as qualitative or quantitative. Qualitative techniques rely on judgement, experience, and expertise to formulate forecasts; quantitative techniques rely on the use of historical data, or associations among variables to develop forecasts. Some of the techniques are

simple, while others are complex. Some work better than others, but no technique works all the time.

6.0 Self-Assessment Exercise

1. Given the following data:

Period	Number of complaints
1	60
2	65
3	55
4	58
5	64

Prepare a forecast using each of these approaches:

a. The naïve approach

b. A 3 – period moving average

c. Exponential smoothing with a smoothly constant of 0.40.

7.0 References/Further Reading

Bowerman, B.L. and Connell, R.T.O. (1993). *Forecasting and Time Series*: An Applied Approach (3rd ed). Belmont, Calif: Duxbury Press.

Hanke, J.E. and Reitsch, A.G. (1992). *Business Forecasting* (4th Ed.). Boston: Allyn & Bacon.

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Unit 4 Process Management

1.0 Introduction

This unit discusses process management, which is very essential in the design of a production system. Deciding on process involves many different choices in selecting human resources, equipment, as well as materials. Processes are involved in how the marketing department prepares a market analysis; how a retail store provides services on the sales floor; and how a manufacturing plant performs its assembly operations.

2.0 Objectives

At the end of this unit, you should be able to:

- describe each of the main process decisions and how they must relate to volume
- discuss how process choice implements flow strategy and how the five choices differ
- explain when less vertical integration and more outsourcing are appropriate and how resource flexibility supports competitive priorities
- describe the different ways that customer contact can affect a process.

3.0 Main Content

3.1 The Meaning of Process Management

Let us start by first defining what a process is: A process involves the use of an organisation's resources to provide something of value. You should understand that no product can be made and no service can be provided without a process. On the other hand too, no process can exist without a product or service.

Two implications of this definition come out very clearly:

(i) Processes underline all work activity and are found in all organisations, as well as all functions of an organisation.

(ii) Processes are nested within other processes along an organisation's supply chain. A firm's supply chain (also called the value chain) is an interconnected set of linkages among suppliers of materials and services that spans the transformation process that convert ideas and raw materials into finished goods and services for a firm's customers.

We can now go ahead to define process management as the selection of the inputs, operations, work flows, and methods that transforms input into outputs. Usually input selection begins by deciding which processes are to be done in-house, and which processes are to be done outside, as well as purchased materials and services. Process decisions also deal with the proper mix of human skills and equipment and which parts of the processes are to be performed by each. You should also note that decisions about processes must be consistent with the organisation's flow strategy, and the organisation's ability to obtain the resources necessary to support that strategy.

When should process decisions be made? It is always better to take the necessary decisions whenever:

(i) A new or substantially modified product or service is being offered.

(ii) Quality must be improved;

(iii) Competitive priorities have changed;

(iv) Demand for a product or service is changing;

(v) Current performance is inadequate;

(vi) Competitors are gaining by using a new process or technology, or

(vii) The cost or availability of inputs has changed.

However, not all these situations will result to changes in current processes. Very often, process decisions must recognize costs, and sometimes the cost of change outweighs its benefits.

In addition, process decisions must take other choices into account, especially those concerning quality, capacity, layout, and inventory. Furthermore, process decisions depend on competitive priorities and on flow strategy. Ethics and the environment are similarly considered.

3.2 Major Types of Process Decisions

Operations managers usually consider five common process decisions. These are discussed in the sections that follow:

3.2.1 Process Choice

Choosing a process that best supports an organisation's flow strategy is one of the first decisions a manager makes in order to design a well-functioning operation. There are five process types, which form a continuum, and from which the manager can choose:

(a) Project,

(b) Job,

(c) Batch,

(d) Line, and

(e) Continuous process.

A close look at Figure 4.1 should reveal to you that the best choice depends on the volume and degree of customisation. It is important to note that a process choice might apply to an entire facility or just one segment of its overall process. For example, a process segment might best be characterised as a job process and another segment as a line process.

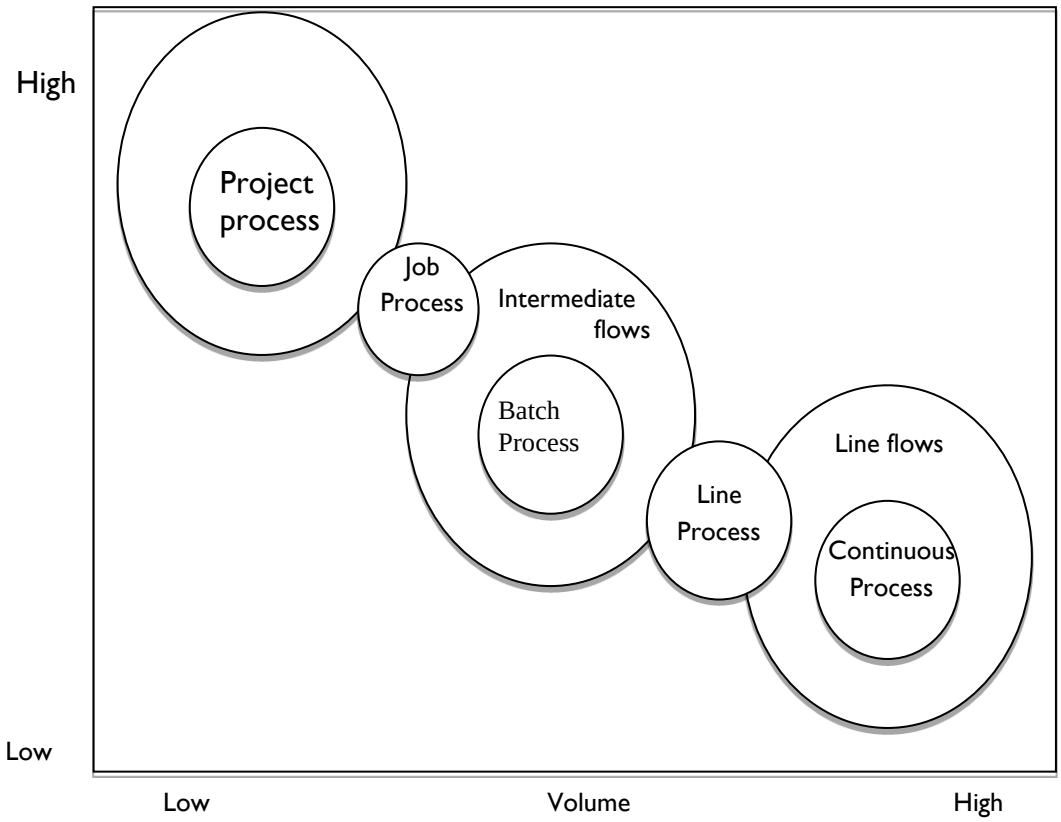

Figure 4.1:

3.2.1.1 Project Process

A project process is characterised by a high degree of job customisation, the large scope of each project, and the release of substantial resources once a project is completed. A project process lies at the high – customisation, low-volume end of the process choice continuum. The sequence of operations and the process involved in each one are unique to each project, thereby creating one-of-a-kind products or services made specifically to customer order.

Very often, firms with project processes sell themselves on the basis of their capabilities rather than on specific products or services. One attribute of project is that they tend to be complex, take a long time, and be large. Also, many interrelated tasks must be completed, and these usually require close coordination. Projects usually make heavy use of certain skills and resources at particular stages, and then have little use for them till the end of the time. A project process is based on a flexible flow strategy, with work flows re-defined with each new project.

Examples of a project process: Building a shopping centre, forming a project team to do a task, running a political campaign, doing management consultancy work, or developing a new technology or product.

3.2.1.2 Job Process

A job process creates the flexibility needed to produce a variety of products or services in significant quantities. Very often, customisation is relatively high and volume for any one product or service is low. However, the volume here is larger than in the case of project process. Note that by definition, a project process does not produce in quantity. The work force and equipment are flexible and can handle various tasks.

Organisations choosing the job process usually bid for work. Since the specific needs of the next customer is unknown, and the timing of repeat orders from the same customer is unpredictable, products are made to order and never ahead of time.

Thus, each new job is handled as a single unit, i.e. as a job. A job process primarily involves the use of a flexible flow strategy, with resource organised around the process.

Examples of a job process: Providing emergency room care, courier services, making customised cabinets etc.

3.2.1.3 Batch Process

A batch process differs from the job process with respect to volume, variety and quantity. For instance, volumes are higher in the case of batch process since the same or similar products or services are provided repeatedly. However, a narrower range of products and services is provided with respect to quantity, production lots, or customer groups are handled in larger quantities (or batches) then they are with job processes. A batch of one product or customer grouping is processed, and production is later switched to the next one. Invariably, the first product or service is produced again.

Examples of a batch process: Scheduling air travel for a group (pilgrims, students, holiday makers), making components that feed an assembly line, and manufacturing capital equipment.

3.2.1.4 Line Process

A line process lies between the batch and continuous process on the continuum, volumes are high, and products or services are standardised, thus allowing resources to be organised around a product or service. In this process, materials move linearly from one operation to the next according to a fixed order, and little inventory being held between operations.

Unlike project and job processes, production orders are not directly linked to customer orders. Manufacturers with line processes usually follow a make-to-stock strategy, with standard products held in inventory so that they are ready when a customer places an order. Note that the use of a line process is also referred to as mass production. It is possible to have product variety by carefully controlling the addition of standard options to the main product or service. Very often, a line process fits primarily with the line flow strategy, although it can overlap into the intermediate flow strategy when mass customisation or assemble-to-order strategies are pursued.

Examples of a line process: Vehicle assembly plants, Electrical and electronic manufacturing companies, garment factories etc.

3.2.1.5 Continuous Process

A continuous process is the extreme and of high-volume, standardised production with rigid line flows. Usually, one primary material, such as a liquid, gas, or powder, moves without stopping through the facility. Typically this process is capital intensive and operated round the ch to maximize utilization and to wid expensive shutdowns and start-ups. They are used almost exclusively in manufacturing and fit perfectly a line flow strategy.

3.2.2 Degree of Vertical Integration

Another important issue to resolve when developing production process designs is the determination of how much of the production of products or services a company should bring under its own roof. Vertical integration is the amount of the production and distribution chain, from suppliers of components to the delivery of products and services to customers that is brought under the ownership of a company.

Usually, management decides the level of vertical integration by looking at all the activities performed between acquisition of raw materials or outside services and delivery of finished products or services. The more processes in the supply chain that the organisation performs itself, the more vertically integrated it is. If the organisation does not perform some processes itself, then it must rely on outsourcing. Decisions such as these are often called make-or-buy decisions. A make decision translates to more integration, while a buy decision essentially means more outsourcing.

The make-or-buy decisions are not always simple. But the starting point is to determine whether the cost of making components is less than that of buying them from suppliers. Unless there are clear cost advantages to making components in-house, such issues as the following are not likely to be as important. Is enough investment capital available to expand production capacity to make the components?. Does the company have the technological capability to make the components? Are there high-quality suppliers available? Is there a risk that suppliers will become competitors?

Whatever decision is taken, management must find ways to coordinate and integrate the various processes and suppliers involved.

Because of shortages of both capital and production capacity, small firms and start-up ventures ordinarily choose to have a very low degree of vertical integration.

3.2.3Resource Flexibility

Usually, the choices that management makes with respect to competitive priorities determine the degree of flexibility required of a company's resources (i.e. its employees, facilities, and equipment).

With respect to human resources, operations managers must decide whether to have a flexible work force or an inflexible one. Members of a flexible workforce are capable of doing many tasks. However this flexibility has its costs. For example, it requires greater skills and thus more training and education. On the other hand, worker flexibility provides an opportunity to achieve reliable customer service and alleviate capacity bottlenecks.

When a firm's product or service has a short life cycle and a high degree of customisation, low production volumes suggest that the firm should select flexible, general-purchase equipment.

3.2.4 Customer Involvement

The extent to which customers interact with the process is another important process decision to consider. The amount of customer involvement ranges from self-service to customisation of product, to deciding the time and place that the service is to be provided.

3.2.5 Degree of Automation

A key issue in designing production processes is determining how much automation to integrate into the production system. Usually, automation projects are not under-taken lightly since the equipment is very expensive and managing the integration of automation into existing or new operation is difficult.

Automation can reduce labour and related costs. In many applications however, the huge capital investment required by automation projects cannot be justified on labour savings alone. It is the goals of improving product quality and product flexibility that motivate companies to make the huge investments in automation projects. Apart from anything else, the degree of automation appropriate for producing a product or service must be driven by the operations strategy of the firm. For instance, if those strategies call for high product quality and product flexibility, automation can be an important element of operations strategy.

3.2 Designing Processes

Having broadly examined the five main process decisions, the manager should determine exactly how each process will be performed. There are two different, but complementary approaches for designing process: process re-engineering and process improvement.

3.3.1 Process Re-engineering

Re-engineering is the fundamental rethinking and radical redesign of processes to improve performance dramatically in terms of cost, quality, service, and speed. It is all about reinvention, rather than an incremental improvement. Though reengineering can make a company more competitive, its side effects, especially on employees are often very harsh. For example, it usually leads to massive lay-offs. The company also coughs out large cash outflows for investment in information technology. The following points are useful guidelines for reengineering:

3.3.1.1 Critical Processes

Normally, a process selected for reengineering should be a core process, rather than functional departments (such as purchasing or marketing). By focusing on processes, managers may discover opportunities to eliminate unnecessary work and supervisory activities. Hence, reengineering should be reserved for essential processes, such as new-product development or customer services, because of the time and energy involved.

3.3.1.2 Strong Leadership

It has also been suggested that senior executives must provide strong leadership for reengineering to be successful. If this is not effectively and efficiently done, cynicism, resistance and boundaries between functional areas can block such a radical change. Resistance can be over-come by providing the clout necessary to ensure that the project proceeds within a strategic choice.

3.3.1.3 Cross-Functional Teams

Usually, a team, made up of members from each functional area affected by the process change should be charged with carrying out a reengineering project.

3.3.1.4 Information Technology

Information technology is absolutely necessary for a successful reengineering. This is because most reengineering projects design processes around information flows such as customer order fulfillment.

3.3.1.5 Clean Slate Philosophy

A "clean slate" philosophy means starting with the way the customer wants to deal with the company. A customer-driven orientation necessitates that the cross-functional teams start with internal and external customer objectives for the process. What the teams usually do is to first establish a price target for the product or service, subtract the desired profit, and then find an appropriate process that will provide what the customer wishes to pay. It is thus a common practice for Reengineers to start from the future and work backward, usually unconstrained by current approaches.

3.3.1.6 Process Analysis

In spite of the clean slate philosophy discussed above, a reengineering team must understand things about the current process. For instance, what it does, how well it performs, and what factors affect it. A critical analysis of such details can highlight areas in which new thinking will provide the biggest payoff. It is therefore necessary for the team to examine every procedure involved in the process throughout the organisation, recording each step, questioning why it is done, and then eliminating it, if it is not necessary.

3.3.2 Process Improvement

This is the systematic study of the activities and flows of each process to improve it. The major objective of process improvement is to "learn the number", understand the process, and dig out the details. The idea here is that once a process is really understood, it can be improved. Please note that process improvement goes on, whether or not a process is reengineered. In actual fact, the relentless pressure to provide better quality at a lower price means firms must always review all aspects of their operations.

There are two basic techniques for analyzing processes: flow diagrams and process charts. These are already treated. As discussed in that unit, these techniques involve the systematic observation and recording of process details to allow better understanding of it. Thereafter,

the analysis can highlight tasks to be simplified, or where productivity can otherwise be improved.

Self-Assessment Exercise

An automobile service station is having difficulty providing oil changes in the 29 minutes or less mentioned in its advertisement.

You are to analyse the process of changing automobile engine oil and also provide the summary. The subject of the study is the service mechanic. The process begins when the mechanic directs the customer's arrival, and ends when the customer pays for the services.

The process chart is given in Figure 4.2.

SUMMARY

Process: *Changing engine oil*

Subject: *Mechanic*

Beginning *Direct customer arrival*

Ending: *Total charges, receive payment*

Activity		Number of steps	Time (Min)	Distance (ft)
Operation	●	7	16.5	-
Transport	➡	8	5.5	420
Inspect	■	4	5.0	-
Delay	D	1	0.7	-
	▼			

Step No.	Time (min)	Distance (ft)	●	➡	■	▼	Step description
1	0.8	50		X			Direct customer into service bay
2	1.8		X				*Record name and desired service*
3	2.3						*Open hood, verify engine type,*
4	0.8			X	X		*inspect hoses, check fluid levels*
5	0.6	30	X				*Walk to customer in waiting area*

6	0.7	70					
7	0.9			X			Wait for customer decision
8	1.9		X				*Walt to storeroom*
9	0.4						*Look up filter number(s), find filter(s)*
10	0.6	50		X	X		*Check filter number(s)*
11	4.2	40	X			X	Perform under-car services
12	0.7			X			*Climb from pit, walk to automobile*
13	2.7		X				*Fill engine with oil, start engine*
14	1.3						*Inspect for leaks*
15	0.5	40		X	X		*Walk to pit*
16	1.0	80	X		X		Inspect for leaks
17	3.0						*Clean and organize work area*
18	0.7		X				*Return to auto, drive from bay*
19	0.3				X		*Park the car*
20	0.5	60		X			*Walk to customer waiting area*
21	2.3		X				*Total charges, receive*

Figure 4.2:

Answer to Self-Assessment Exercise

The process is broken into 21 steps. A summary of the number of steps times and distances traveled is presented below:

Summary

Activity	Number of Steps	Time (min.)	Distance (ft)
Operation	7	16.5	-
Transport	8	5.5	420
Inspection	4	5.0	-
Delay	1	0.7	-
Store	1	0.3	-
TOTAL	21	28.0	420

Source: Figure 4.2

The times add up to 28 minutes, which does not allow much room for error if the 29 minutes guarantee is to be met, and the mechanic travels a total of 420 feet.

4.0 Conclusion

You have learned in this unit that process decisions affect what the firm achieves with the competitive priorities of quality, flexibility, time, and cost. For example, firms can improve their ability to compete on the basis of time by examining each step of their processes and then finding ways to respond more quickly to their customers.

5.0 Summary

This unit has demonstrated that process decisions are strategic and can affect an organisation's ability to compete over the long-run. We started by defining five basic process decisions: process choice, degree of vertical integration, resource flexibility, customer involvement, and degree of automation. We also discussed how each process will be performed.

6.0 Self-Assessment Exercise

Refer to the self-Assessed Question. What improvements can you make in the process shown in Figure 4.2?

7.0 References/Further Reading

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Unit 5 Job Design

1.0 Introduction

The importance of work system is underscored by the organisation's dependence on human efforts. (i.e work) to accomplish its goals. Work design is one of the oldest fields of operations management. In the past, it has often been de-emphasised in operations management courses in favour of other topics. In recent years, however, renewed interest has taken place, and it has come from an entirely different direction: some of the interest has resulted from studies that reveal a general dissatisfaction felt by workers with their jobs. It is therefore important for management to make design of work systems a key element of its operations strategy. This unit examines the important areas of job design as specified in the objectives below.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the importance of job design
- describe the two basic approaches to job design
- rationalise the advantages of job specialisation, or its alternatives, for a particular situation.

3.0 Main Content

3.1 Introduction to Job Design

Job design entails matching tasks or work activities to individuals or task groups. This is usually done by specifying a job's content, the employee skills and training needed to perform that job, and the degree of specialisation appropriate for the job. The ultimate intention here, is to increase efficiency of an organisation, with the parallel goal of making working conditions more agreeable. In addition, job design improves productivity through consideration of technical and human factors. It also increases the quality of the final product or service.

Let us pause for a moment to answer this question: Who are job designers? Job designers are concerned with who will do a job, how the job will be done, and where the job will be done. Stevenson (1969) has suggested four parameters for a successful job design. To him, the job design must be:

i. Carried out by experienced personnel who have the necessary training and background;

ii. Consistent with the goals of the organisation;

iii. In written form; and

iv. Understood and agreed to by both management and employees.

You need to realise that the factors that affect job design and the implications of various alternatives are often so complex, that a person without a good background in job design is likely to overlook important aspects of it. It is also necessary to consult workers and managers alike in order to take advantage of their knowledge, as well as keep them informed.

Since employees are particularly intimately involved with the work, they are veritable sources of ideas for job improvement. Management support for job design equally depends on the commitment and involvement of managers. Once these two important groups have been included in the process, it is often relatively easier for them to embrace the design.

The establishment of a written record of the job design can serve as a basis for referral, whenever there are clarifications to be made about it.

3.2 Approaches to the Study of Job Design

There are two basic schools of thought with respect to current practice in job design. One might be called the efficiency school, because it emphasises a systematic, logical approach to job design. The second one is called the behavioural school because it emphasises satisfaction of wants and needs.

We shall now examine each of these schools:

3.2.1 The Efficiency Approach

The efficiency approach, a refinement of Frederick Taylor's scientific management concepts, received considerable emphasis in the past. Taylor's approach is based on the philosophy that any operation can be improved by breaking it into components and studying the work content of each component in order to improve work methods. Taylor believed that managers should study jobs scientifically, using careful analysis, experimentation, and tools such as flow diagrams and process charts to find the most economic way to perform a task. Details of this will be covered under job specialisation in section 3.3.

3.2.2 The Behavioural Approach

The behavioural approach to job design emerged during the 1950s, and has continued to make impact on many aspects of job design. One of the major contributions of the behavioural approach is that it has reminded managers of the complexity of human beings, and that the efficiency approach may not be appropriate in ever instance. More of the behavioural approach will be treated under section 3.4.

3.3 Job Specialisation

A job with a high degree of specialisation involves a narrow range of tasks, a high degree of repetition, and presumably, great efficiency and high quality. Examples range from assembly lines to medical specialties. Some bakers specialise in wedding cakes; a heart specialist can diagnose and treat heart problems better than a general practitioner.

Generally, specialisation results in benefits such as:

- less training time needed per employee because the methods and procedures are limited,

- faster work pace, leading to more output in less time, and
- lower wages paid because education and skill requirements are lower.

However, the agreements against job specialisation suggest that narrowly defined jobs lead to:

- poor employee morale, high turnover, and lower quality because of the monotony and boredom of repetitive work;
- the need for more management attention because the total activity is broken into a larger number of jobs for a large number of employees, all of whom have to be coordinated to produce the entire product or service; and
- less flexibility to handle changes or employee absences.

3.4 Alternatives to Job Specialisation

From our previous discussions in unit 1, it should be clear to you now, that people work for a variety of reasons: economic needs (i.e. to earn a living), social needs (to be recognised and to belong to a group), and individual needs (to feel important and to feel in control). These factors influence how people perform their jobs.

In narrowly designed jobs (as in job specialisation), workers have few opportunities to control the pace of work, receive gratification for the work itself, advance to a better position, show initiative, and communicate with fellow workers. Suggestions have therefore been made on how to modify specialised jobs to provide for a broader range of needs satisfaction. These include job rotation, job enlargement, job enrichment, team production and empowerment. We will look at each of these in the sections that follow.

3.4.1 Job Rotation

Job rotation moves beyond specialisation, so that people who have the required skills can rotate from one job to another in order to get away from the job specialisation rut. For example, assembly line workers may work one week on engine mountings and then work on assembling dashboard components or tyre fixing, the following week. This process can help to reduce the monotonous aspects of the job.

Job rotation implies multi skills in personnel. It is not only advantageous and motivating for the employees, but it also gives the employer the flexibility to adjust to client needs. For instance, because workers learn many aspects of the job, job rotation increases the skills of the work force, thereby giving management to flexibility to replace absent workers, or to move more workers to different workstations as necessary. In addition, rotation of jobs can give a better appreciation for the production problems of others, and the value of passing only good quality to the next person.

3.4.2 Job Enlargement

Job enlargement is intended to avoid an employee being trapped in job specialisation by trying to improve the variety within a certain sphere of a person's ability and interest. It is done by adding additional similar tasks to workers' job. This is referred to as horizontal job

enlargement. Apart from reducing boredom, job enlargement has the potential to increase employee satisfaction because the worker feels a greater sense of responsibility, pride, and accomplishment.

3.4.3 Job enrichment

This is the most comprehensive approach to job design. It involves a vertical expansion of job duties. This means that workers have greater control and responsibility for an entire process, not just a specific skill or operation. For example, a purchasing secretary whose basic job is the correspondence for a group of purchasing people could have the job enriched by planning the work assignments of the group, being an intermediate in customer contact and maybe helping in the evaluation of some proposals. That is, the secretary's job is enriched from being a secretary to becoming an assistant. This is what obtains today, when many of the classic secretarial duties are less required as more and more people have their own personnel computers.

3.4.4 Team Production

This entails organising workers into work teams; selecting workers and training them to work as a team; assigning some responsibility for management of production to teams. However, building effective work teams means more than just grouping workers into work groups. More still needs to be done. For instance, team building requires training in team effectiveness, conflict resolution, team measurement, and motivation systems.

One strong feature of effective work teams is that they can focus on processes, instead of departments. For example, if a team is to design and develop a new product, the team can focus on the process of designing and developing the new product and not be constrained by departmental boundaries and responsibilities.

3.4.5 Empowerment

This is an extension of job enrichment by adding to it, complete employee trust and responsibilities not initially associated with the job. It is basically a process of conveying authority from management to workers.

Let us see how it works: imagine a manager tells his workers that they have authority to stop production lines whenever the notice that product quality is beginning to deteriorate. In this situation, workers tend to accept responsibility for product quality and shut down product whenever the need arises. They then come together in order to correct the cause of low product quality. Worker safety, maintenance problems, materials' shortages, and other occurrences are other factors that can cause the need for production to be stopped.

Giving workers the authority to stop production for these and other causes is perhaps the most visible conveyance of authority to workers. This process leads to what is now termed "internal ownership", where workers feel that the production line belongs to them and that they are responsible for everything that occurs in production.

4.0 Conclusion

In this unit, you have learned about the importance of job designs and how you can apply this to increase the efficiency as well as the productivity of your organisation. You should also be able to recommend between job specialisation and its alternatives in particular situations.

5.0 Summary

This unit has shown you that the importance of work system is underscored by the organisation's dependence on human efforts. It is therefore important for management to make design of work systems a key element of its operations strategy.

6.0 Self-Assessment Exercise

What are the major advantages and disadvantages of specialisation in business? Address these issues both from management and labour sides.

7.0 References/Further Reading

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