

Meaning, Nature and Scope of Production and Operation Management

E.S.Buffa defines production management as follows: 'Production management deals with decision-making related to production processes so that the resulting goods or services are produced according to specifications, in the amount and by the schedule demanded and out of minimum cost'.

Joseph G .Monks defines Operations Management as the process whereby resources, flowing with in a defined system, are combined and transformed by a controlled manner to add value in accordance with policies communicated by management.

Production Management

Production Management refers to the application of management principles to the production function in a factory. In other words, production management involves application of planning, organizing, directing and controlling the production process.

The application of management to the field of production has been the result of at least three developments:

(i) First is the development of factory system of production. Until the emergence of the concept of manufacturing, there was no such thing as management as we know it. It is true that people operated business of one type or another, but for the most part, these people were owners of business and did not regard themselves as managers as well,

(ii) Essentially stems from the first, namely, the development of the large corporation with many owners and the necessity to hire people to operate the business,

(iii) Stems from the work of many of the pioneers of scientific management who were able to demonstrate the value, from a performance and profit point of view, of some of the techniques they were developing.

Production Management

It is observed that one cannot demarcate the beginning and end points of Production Management in an establishment. The reason is that it is interrelated with many other functional areas of business, viz., marketing, finance, industrial relation policies etc.

Alternately, Production Management is not independent of marketing, financial and personnel management due to which it is very difficult to formulate some single appropriate definition of Production Management.

Nature of Production/Operations Management

The nature of production or operations can be better understood by viewing the manufacturing function as:

(i) Production/operations as a system

(ii) Production/operations as an organizational function

(iii) Production/operations as a conversion or transformation process

(iv) Production/operations as a means of creating utility

These four distinct views are discussed in the following section.

(a) Production/Operations as a System

This view is also known as “systems concept of production”. A system is defined as the collection of interrelated entities. The systems approach views any organization or entity as an arrangement of interrelated parts that interact in ways that can be specified and to some extent predicted. Production is viewed as a system which converts a set of inputs into a set of desired outputs. A production system has the following elements or parts :

- Inputs
- Conversion process or transformation process
- Outputs
- Transportation subsystem
- Communication subsystem and
- Control or decision making subsystem

(b) Production/Operations as a Conversion/Transformation Process

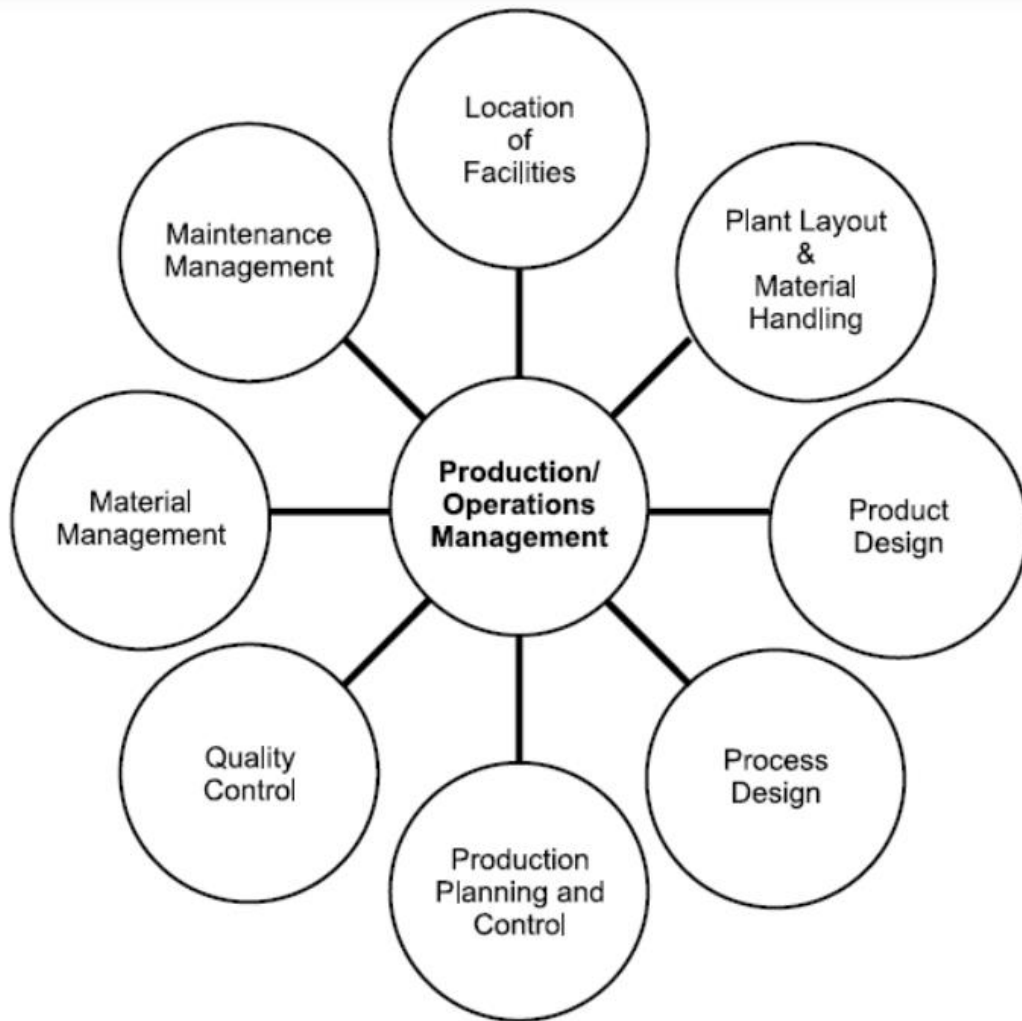
The conversion or transformation sub-system is the core of a production system because it consists of processes or activities wherein workers, materials, machines and equipment are used to convert inputs into outputs. The conversion process may include manufacturing processes such as cutting, drilling, machining, welding, painting, etc., and other processes such as packing, selling, etc. Any conversion process consists of several small activities referred to as “operations” which are some steps in the overall process of producing a product or service that leads to the final output.

(c) Production/Operations as a Means of Creating Utility

Production is defined as the process of adding to the value of outputs or the process of creating utility in outputs. “Utility” is the power of satisfying human needs. During the process of converting the raw materials into finished goods, various types of utilities are created while adding value to the outputs. These

Types of utilities are:

- **Form utility:** This is created by changing the size, shape, form, weight, colour, smell of inputs in order to make the outputs more useful to the customers. For example, iron ore is changed to steel, wood is changed to furniture, etc.
- **Place utility:** This is created by changing the places of inputs or transporting the inputs from the source of their availability to the place of their use to be converted into outputs. For example the iron ore and coal are transported from the mines to the steel plant to be used in the conversion process.
- **Time utility:** This is created by storage or preservation of raw materials or finished goods which are in abundance sometime, so that the same can be used at a later time when they become scarce due to higher demand exceeding the quantity available.
- **Possession utility:** This is created by transferring the possession or ownership of an item from one person to another person. For example, when a firm purchases materials from a supplier, the possession utility of the materials will increase when they are delivered to the buying firm.
- **Service utility:** Which is the utility created by rendering some service to the customer. For example, a doctor or a lawyer or an engineer creates service utility to a client/customer by rendering service directly to the client/customer.
- **Knowledge utility:** This is created by imparting knowledge to a person. For example, a sales presentation or an advertisement about some product communicates some information about the product to the customer, thereby imparting knowledge.



Scope of Production and Operation Management

Production and operations management concern with the conversion of inputs into outputs, using physical resources, so as to provide the desired utilities to the customer while meeting the other organizational objectives of effectiveness, efficiency and adaptability. It distinguishes itself from other functions such as personnel, marketing, finance, etc., by its primary concern for 'conversion by using physical resources.' Following are the activities which are listed under production and operations management functions:

Location of facilities

Plant layouts and material handling

Product design

Process design

Production and planning control

Quality control

Materials management

Maintenance management

1. Location of facilities

Location of facilities for operations is a long-term capacity decision which involves a long term commitment about the geographically static factors that affect a business organization. It is an important strategic level decision-making for an organization. It deals with the questions such as 'where our main operations should be based?'

2. Plant layouts and material handling

Plant layout refers to the physical arrangement of facilities. It is the configuration of departments, work centers and equipment in the conversion process. The overall objective of the plant layout is to design a physical arrangement that meets the required output quality and quantity most economically.

According to James Moore, "Plant layout is a plan of an optimum arrangement of facilities including personnel, operating equipment, storage space, material handling equipment's and all other supporting services along with the design of best structure to contain all these facilities".

3. Product design

Product design deals with conversion of ideas into reality. Every business organization have to design, develop and introduce new products as a survival and growth strategy. Developing the new products and launching them in the market is the biggest challenge faced by the organizations.

6. Quality control

Quality Control (QC) may be defined as 'a system that is used to maintain a desired level of quality in a product or service'. It is a systematic control of various factors that affect the quality of the product. Quality control aims at prevention of defects at the source, relies on effective feed back system and corrective action procedure. Quality control can also be defined as 'that industrial management technique by means of which product of uniform acceptable quality is manufactured'. It is the entire collection of activities which ensures that the operation will produce the optimum quality products at minimum cost.

The main objectives of quality control are: To improve the companies income by making the production more acceptable to the customers i.e., by providing long life, greater usefulness, maintainability, etc. To reduce companies cost through reduction of losses due to defects. To achieve interchange ability of manufacture in large scale production. To produce optimal quality at reduced price. To ensure satisfaction of customers with productions or services or high quality level, to build customer goodwill, confidence and reputation of manufacturer. To make inspection prompt to ensure quality control. To check the variation during manufacturing.

4. Product design

Process design is a macroscopic decision-making of an overall process route for converting the raw material into finished goods. These decisions encompass the selection of a process, choice of technology, process flow analysis and layout of the facilities.

5. Production planning and control

Production planning and control can be defined as the process of planning the production in advance, setting the exact route of each item, fixing the starting and finishing dates for each item, to give production orders to shops and to follow up the progress of products according to orders. Planning is deciding in advance what to do, how to do it, when to do it and who is to do it. Planning bridges the gap from where we are, to where we want to go. Routing may be defined as the selection of path which each part of the product will follow, which being transformed from raw material to finished products. Scheduling determines the programmer for the operations. Scheduling may be defined as 'the fixation of time and date for each operation' as well as it determines the sequence of operations to be followed.

Dispatching is concerned with the starting the processes. It gives necessary authority so as to start a particular work, which has already been planned under 'Routing' and 'Scheduling'.

7. Materials management

Materials management is that aspect of management function which is primarily concerned with the acquisition, control and use of materials needed and flow of goods and services connected with the production process having some predetermined objectives in view.

8. Maintenance management

Maintenance management is the process of maintaining a company's assets and resources. The purpose is to ensure that production proceeds efficiently and that resources are used effectively.

Maintenance management involves keeping track of assets and parts. The purpose is to ensure that production proceeds efficiently and the minimum amount of resources are wasted. This is generally accomplished by a tailored combination of software, practices, and personnel that focus on achieving these goals.

Maintenance management is one of those aspects of managing a company that is usually not explored in depth. People outside of the maintenance industry may not realize how much time and effort go into making the flow of products through supply chains to the general world.

Objectives of Operations Management

Operations Management can be understood as an area of management which is concerned with the government of system, processes and functions that manufacture goods and renders services to the end user, to provide desired utilities to them while adhering to other objectives of the concern, i.e. efficiency, effectiveness, and productivity.

An operation may be defined as the process of changing inputs into outputs thereby adding value to some entity. Right quality, right quantity, right time and right price are the four basic requirements of the customers and as such they determine the extent of customer satisfaction. And if these can be provided at a minimum cost, then the value of goods produced or services rendered increases.

Operations management is concerned with managing the resources that directly produce the organization service and products. The resources are generally consist of people, material, technology and information but may go wider than this. These resources are brought together by a series of processes so that they are utilized to deliver the primary service or product of the organization. Thus operation management is concerned with managing inputs (resources) through transformation processes to deliver outputs (service or products). The objectives of production management are “to produce goods and services of the right quality, in the right quantities, according to the time schedule and a minimum cost”.

Objectives of production management may be amplified as under:

- Customer Service: The primary objective of operations management, is to utilize the resources of the organization, to create such products or services that satisfy the needs of the consumers, by providing “right thing at the right price, place and time”.
- Resource Utilization: To make the best possible use of the organisation’s resources to satisfy the wants of the consumers, is another important objective of the operations management.
- Producing the right kind of goods and services that satisfy customers’ needs (effectiveness objective).
- Maximizing output of goods and services with minimum resource inputs (efficiency objective).
- Ensuring that goods and services produced conform to pre-set quality specifications (quality objective).
- Minimizing throughput-time – the time that elapses in the conversion process- by reducing delays, waiting time and idle time (lead time objective).
- Maximizing utilization of manpower, machines, etc. (Capacity utilization objective).
- Minimizing cost of producing goods or rendering a service (Cost objective).

Objectives of Production and Operations Management:

- **The main objectives may be one of more of the following:**
 - a. Efficiency:**
 - Increased output for a given input.
 - b. Productivity:**
 - Increased production using given resources.
 - c. Economy:**
 - Production is more economical (done at reduced cost).
 - d. Quality:**
 - Good quality products at reduced cost.
 - e. Reduced processing time:**
 - Increased production within a given amount of time.

In operations management, the formation of goods or services encompasses conversion of inputs into outputs, wherein different inputs such as capital, labour, material, machinery and information are combined and used to create output, by using the conversion process. For this purpose, the organization measures different points in the process and then compares the same with the set standards, to ascertain whether corrective action is required or not.

The role of operations management is to create some kind of value-added in form of goods and services by transforming a company's inputs into output as finished goods and services. The activities in operations can be divided as input, transformation process and output. The company's inputs include human resources such as workers and managers, information, technology IT and facilities and processes such as equipment's, buildings or lands and materials. Then the operations system will convert the transformed resources from inputs into outputs that are goods and services which produced by company and after that will get feedback information about the activities in the operation system.

Scope of Operations Management

1. Location of Facilities

The most important decision with respect to the operations management is the selection of location, a huge investment is made by the firm in acquiring the building, arranging and installing plant and machinery. And if the location is not suitable, then all of this investment will be called as a sheer wastage of money, time, and efforts.

So, while choosing the location for the operations, company's expansion plans, diversification plans, the supply of materials, weather conditions, transportation facility and everything else which is essential in this regard should be taken into consideration.

2. Product Design

Product design is all about an in-depth analysis of the customer's requirements and giving a proper shape to the idea, which thoroughly fulfils those requirements. It is a complete process of identification of needs of the consumers to the final creation of a product which involves designing and marketing, product development, and introduction of the product to the market.

3. Process Design

It is the planning and decision making of the entire workflow for transforming the raw material into finished goods, It involves decisions regarding the choice of technology, process flow analysis, process selection, and so forth.

4. Plant Layout

As the name signifies, plant layout is the grouping and arrangement of the personnel, machines, equipment, storage space, and other facilities, which are used in the production process, to economically produce the desired output, both qualitywise and quantitywise.

5. Material Handling

Material Handling is all about holding and treatment of material within and outside the organisation. It is concerned with the movement of material from one godown to another, from godown to machine and from one process to another, along with the packing and storing of the product.

6. Material Management

The part of management which deals with the procurement, use and control of the raw material, which is required during the process of production. Its aim is to acquire, transport and store the material in such a way to minimize the related cost. It tends to find out new sources of supply and develop a good relationship with the suppliers to ensure an ongoing supply of material.

7. Quality Control

Quality Control is the systematic process of keeping an intended level of quality in the goods and services, in which the organization deals. It attempts to prevent defects and make corrective actions (if they find any defects during the quality control process), to ensure that the desired quality is maintained, at reasonable prices.

8. Maintenance Management

Machinery, tools and equipment play a crucial role in the process of production. So, if they are not available at the time of need, due to any reason like downtime or breakage etc. then the entire process will suffer.

Hence, it is the responsibility of the operations manager to keep the plant in good condition, as well as keeping the machines and other equipment in the right state, so that the firm can use them in their optimal capacity.

Production Function

Meaning of Production Function

In simple words, production function refers to the functional relationship between the quantity of a good produced (output) and factors of production (inputs).

“The production function is purely a technical relation which connects factor inputs and output.” Prof. Koutsoyiannis

Defined production function as “the relation between a firm’s physical production (output) and the material factors of production (inputs).” Prof. Watson

In this way, production function reflects how much output we can expect if we have so much of labour and so much of capital as well as of labour etc. In other words, we can say that production function is an indicator of the physical relationship between the inputs and output of a firm.

The reason behind physical relationship is that money prices do not appear in it. However, here one thing that becomes most important to quote is that like demand function a production function is for a definite period.

It shows the flow of inputs resulting into a flow of output during some time. The production function of a firm depends on the state of technology. With every development in technology the production function of the firm undergoes a change.

The new production function brought about by developing technology displays same inputs and more output or the same output with lesser inputs. Sometimes a new production function of the firm may be adverse as it takes more inputs to produce the same output.

Mathematically, such a basic relationship between inputs and outputs may be expressed as:

$$Q = f(L, C, N)$$

Where Q = Quantity of output

L = Labour

C = Capital

N = Land.

Hence, the level of output (Q), depends on the quantities of different inputs (L, C, N) available to the firm. In the simplest case, where there are only two inputs, labour (L) and capital (C) and one output (Q), the production function becomes.

$$Q = f(L, C)$$

Definitions

“The production function is a technical or engineering relation between input and output. As long as the natural laws of technology remain unchanged, the production function remains unchanged.” Prof. L.R. Klein

“Production function is the relationship between inputs of productive services per unit of time and outputs of product per unit of time.” Prof. George J. Stigler

“The relationship between inputs and outputs is summarized in what is called the production function. This is a technological relation showing for a given state of technological knowledge how much can be produced with given amounts of inputs.” Prof. Richard J. Lipsey

Thus, from the above definitions, we can conclude that production function shows for a given state of technological knowledge, the relation between physical quantities of inputs and outputs achieved per period of time.

Features of Production Function

Following are the main features of production function:

1. Substitutability

The factors of production or inputs are substitutes of one another which make it possible to vary the total output by changing the quantity of one or a few inputs, while the quantities of all other inputs are held constant. It is the substitutability of the factors of production that gives rise to the laws of variable proportions.

2. Complementarity

The factors of production are also complementary to one another, that is, the two or more inputs are to be used together as nothing will be produced if the quantity of either of the inputs used in the production process is zero.

The principles of returns to scale is another manifestation of complementarity of inputs as it reveals that the quantity of all inputs are to be increased simultaneously in order to attain a higher scale of total output.

3. Specificity

It reveals that the inputs are specific to the production of a particular product. Machines and equipment's, specialized workers and raw materials are a few examples of the specificity of factors of production. The specificity may not be complete as factors may be used for production of other commodities too. This reveals that in the production process none of the factors can be ignored and in some cases ignorance to even slightest extent is not possible if the factors are perfectly specific.

Production involves time; hence, the way the inputs are combined is determined to a large extent by the time period under consideration. The greater the time period, the greater the freedom the producer has to vary the quantities of various inputs used in the production process.

In the production function, variation in total output by varying the quantities of all inputs is possible only in the long run whereas the variation in total output by varying the quantity of single input may be possible even in the short run.

SHORT RUN AND LONG RUN PRODUCTION FUNCTION

A short-run production function refers to that period of time, in which the installation of new plant and machinery to increase the production level is not possible. On the other hand, the Long-run production function is one in which the firm has got sufficient time to install new machinery or capital equipment, instead of increasing the labour units.

The production function can be described as the operational relationship between the inputs and outputs, in the sense that the maximum amount of finished goods that can be produced with the given factors of production, under a particular state of technical knowledge. There are two kinds of the production function, short run production function and long run production function.

Short Run Production Function

The short run production function is one in which at least is one factor of production is thought to be fixed in supply, i.e. it cannot be increased or decreased, and the rest of the factors are variable in nature.

In general, the firm's capital inputs are assumed as fixed, and the production level can be changed by changing the quantity of other inputs such as labour, raw material, capital and so on. Therefore, it is quite difficult for the firm to change the capital equipment, to increase the output produced, among all factors of production.

In such circumstances, the law of variable proportion or laws of returns to variable input operates, which states the consequences when extra units of a variable input are combined with a fixed input. In short run, increasing returns are due to the indivisibility of factors and specialisation, whereas diminishing returns is due to the perfect elasticity of substitution of factors.

Long Run Production Function

Long run production function refers to that time period in which all the inputs of the firm are variable. It can operate at various activity levels because the firm can change and adjust all the factors of production and level of output produced according to the business environment. So, the firm has the flexibility of switching between two scales.

In such a condition, the law of returns to scale operates which discusses, in what way, the output varies with the change in production level, i.e. the relationship between the activity level and the quantities of output. The increasing returns to scale is due to the economies of scale and decreasing returns to scale is due to the diseconomies of scale.

The difference between short run and long run production function can be drawn clearly as follows:-

1. The short run production function can be understood as the time period over which the firm is not able to change the quantities of all inputs. Conversely, long run production function indicates the time period, over which the firm can change the quantities of all the inputs.
2. While in short run production function, the law of variable proportion operates, in the long-run production function, the law of returns to scale operates.
3. The activity level does not change in the short run production function, whereas the firm can expand or reduce the activity levels in the long run production function.
4. In short run production function the factor ratio changes because one input varies while the remaining are fixed in nature. As opposed, the factor proportion remains same in the long run production function, as all factor inputs vary in the same proportion.
5. In short run, there are barriers to the entry of firms, as well as the firms can shut down but cannot exit. On the contrary, firms are free to enter and exit in the long run.

To sum up, the production function is nothing but a mathematical presentation of technological input-output relationship.

For any production function, short run simply means a shorter time period than the long run. So, for different processes, the definition of the long run and short run varies, and so one cannot indicate the two time periods in days, months or years. These can only be understood by looking whether all the inputs are variable or not.

Systems Approach to Operations Management

An organized enterprise does not, of course, exist in a vacuum. Rather, it is dependent on its external environment; it is a part of larger systems such as the industry to which it belongs, the economic system, and society. Thus, the enterprise receives inputs, transforms them, and exports the outputs to the environment. However, this simple model needs to be expanded and developed into a model of operational management that indicates how the various inputs are transformed through the managerial functions of planning, organizing, staffing, leading, and controlling. Clearly, any business or other organization must be described by an open system model that includes interactions between the enterprise and its external environment.

1. Inputs and Claimants

The inputs from the external environment may include people, capital, and managerial skills, as well as technical knowledge and skills. In addition, various groups of people will make demands on the enterprise. For example, employees want higher pay, more benefits, and job security. On the other hand, consumers demand safe and reliable products at reasonable prices. Suppliers want assurance that their products will be bought. Stockholders want not only a high return on their investment but also security for their money. Federal, state, and local governments depend on taxes paid by the enterprise, but they also expect the enterprise to comply with their laws. Similarly, the community demands that enterprises become good citizens, and providing the maximum number of jobs with a minimum of pollution. Other claimants to the enterprise may include financial institutions and labor unions; even competitors have legitimate claim for fair play. It is clear that many of these claims are incongruent, and it is manager job to integrate the legitimate objectives of the claimants.

2. The Managerial transformation Process

It is the task of managers to transform the inputs, in an effective and efficient manner, into outputs. Of course, the transformation process can be viewed from different perspective. Thus, one can focus on such diverse enterprise functions as finance, production, personnel, and marketing. Writers on management look on the transformation process in terms of their particular approaches to management. Specially, writers belonging to the human behavior school focus on interpersonal relationships, social systems theorist analyze the transformation by concentrating on social interactions, and those advocating decision theory see the transformation as sets of decisions. Perhaps, however, the most comprehensive and useful approach for discussing the job of managers is to use the managerial functions of planning, organizing, staffing, leading, and controlling as a framework for organizing managerial knowledge.

3. The Communication System

Communication is essential to all phases of the managerial process for two reasons. First, it integrates the managerial functions. For example, the objectives set in planning are communicated so that the appropriate organization structure can be devised. Communication is essential in the selection, appraisal, and training of managers to fill the roles in this structure. Similarly, effective leadership and the creation of an environment conducive to motivation depend on communication. Moreover, it is through communication that one determines whether events and performance conform to plans. Thus, it is communication which makes managing possible.

The second purpose of the communication system is to link the enterprise with its external environment, where many of the claimants are. For example, one should never forget that the customer, who is the reason for the existence of virtually all businesses, is outside a company. It is through the communication system that the needs of customers are identified; this knowledge enables the firm to provide products and services at a profit. Similarly, it is through an effective communication system that the organization becomes aware of competition and other potential threats and constraining factors.

4. External Variables

Effective managers will regularly scan the external environment. While it is true that managers may have little or no power to change the external environment, they have no alternative but to respond to it.

5. Outputs

It is the task of managers to secure and utilize inputs to the enterprise, to transform them through the managerial functions with due consideration for external variables and to outputs.

Although the kinds of outputs will vary with the enterprise, they usually include many of the following: products, services, profits, satisfaction, and integration of the goals of various claimants to the enterprise. Most of these outputs require no elaboration, only the last two will be discussed.

It must contribute to the satisfaction not only of basic material needs (for example, employees as needs to earn money for food and shelter or to have job security) but also of needs for affiliation, acceptance, esteem, and perhaps even self-actualization so that one can use his or her potential at the work-place.

Manufacturing system: Mass, Batch, Job-Shop and Project

Manufacturing system

There is no single concept of a manufacturing system covering all industries in every detail. It is necessary to examine the fundamental properties and characteristics of a range of systems and to consider the way they are synthesized and operated before consolidating general conclusions. What is seen depends very much on the viewpoint and the narrowness of the focusing range. Nevertheless there is much to be gained from a fundamental study of all aspects of manufacturing systems and their interactions since there are opportunities for technology transfer between industries

Manufacturing systems must be designed by taking into account both steady state and dynamic performance, whilst ensuring there is an adequate number of controllable variables to compensate the effects of uncontrolled disturbances. The technological process part of the manufacturing system is synthesized from interacting unit-operation subsystems, and this itself is a subsystem of the overall business system. The business system has a complex multivariate nature and for its effective control it is important that information flows and plans or set points are well defined to allow people to be effective controllers of the system.

Types of Manufacturing Systems

1. Custom Manufacturing Systems

Custom manufacturing is by far the oldest and most popular type of manufacturing system in existence. It also happens to be associated with both the highest-quality products and the lowest-volume efficiency.

In the custom manufacturing system, each item is produced by a single craftsperson, who works solely by hand or with the help of a machine. When machines are used, they tend to be highly specialized to their task and cannot produce more than one item at a time.

This system will tend to have the highest unit cost for the product manufactured. As a result, custom-manufactured products are of the highest quality but are also the most expensive products in the market.

2. Intermittent Manufacturing Systems

The intermittent manufacturing system allows companies to make different types of goods using the same production line. Therefore, the manufacturing facility is designed to handle different product sizes and requirements. Generally, the goods are processed in lots to fulfill orders.

This system is commonly referred to as a "job shop" due to its popularity in countries with relatively cheap labor making products for multinationals based thousands of miles away. The goods made using this manufacturing method are produced in small quantities, so they may not be suitable for stock. Customization is typically done post-purchase.

This type of system is designed for production runs that happen intermittently, hence the name, or products that don't require high volumes. It uses general purpose machines and requires highly skilled labor.

3. Continuous Manufacturing Systems

Continuous manufacturing systems are designed to enable the mass production of a single product. The product goes through an assembly line with different stations where parts are added or worked on a little further. This method first arose during the Industrial Revolution and is most closely associated with the Ford Company, which employed the system to produce Model Ts in the 1920s.

This type of production system is ideal when a company has very high volume targets since it reduces the unit cost of the product. It does, however, require a massive capital injection at startup due to the investment in equipment and labor required.

4. Flexible Manufacturing Systems

Flexible manufacturing is a modern manufacturing system that has become very popular. It involves a significant investment in machinery, although it reduces labor costs by implementing robots eschewing human labor altogether. These machines can easily be reconfigured to manufacture different products in different quantities, and the whole process is automatic.

This method is called flexible manufacturing due to the flexibility in the variety of high-volume goods it can produce. Due to the automated process, quality control is a lot easier, and unit costs are low.

CLASSIFICATION OF PRODUCTION SYSTEMS

1. MASS PRODUCTION

Manufacture of discrete parts or assemblies using a continuous process are called Mass Production. This production system is justified by very large volume of production. The machines are arranged in a line or product layout. Product and process standardization exists and all outputs follow the same path.

Mass Production is characterized by

- Standardization of product and process sequence
- Dedicated special purpose machines having higher production capacities and output rates
- Large volume of products
- Shorter cycle time of production
- Lower in process inventory
- Perfectly balanced production lines
- Flow of materials, components and parts is continuous and without any back tracking
- Production planning and control is easy
- Material handling can be completely automatic

Advantages of Mass Production

Following are the advantages of Mass Production:-

- Higher rate of production with reduced cycle time.
- Higher capacity utilization due to line balancing
- Less skilled operators are required
- Low process inventory
- Manufacturing cost per unit is low

Limitations of Mass Production

Following are the limitations of Mass Production:-

- Breakdown of one machine will stop an entire production line
- Line layout needs major change with the changes in the product design
- High investment in production facilities
- The cycle time is determined by the slowest operation

2. BATCH PRODUCTION

American Production and Inventory Control Society (APICS) defines Batch Production as a form of manufacturing in which the job pass through the functional departments in lots or batches and each lot may have a different routing. It is characterized by the manufacture of limited number of products produced at regular intervals and stocked awaiting sales.

Batch Production is characterized by-

- Shorter production runs
- Plant and machinery are flexible
- Plant and machinery set up is used for the production of item in a batch and change of set up is required for processing the next batch
- Manufacturing lead-time and cost are lower as compared to job order production

Advantage of Batch Production

Following are the advantages of Batch Production:-

- Better utilization of plant and machinery
- Promotes functional specialization
- Cost per unit is lower as compared to job order production
- Lower investment in plant and machinery
- Flexibility to accommodate and process number of products
- Job satisfaction exists for operators

Limitation of Batch Production

Following are the limitations of Batch Production:-

- Material handling is complex because of irregular and longer flows
- Production planning and control is complex
- Work in process inventory is higher compared to continuous production
- Higher set up costs due to frequent changes in set up

3. JOB-SHOP PRODUCTION

Job-shop production are characterized by manufacturing one or few quantity of products designed and produced as per the specification of customers within prefixed time and cost. The distinguishing feature of this is low volume and high variety of products.

A job-shop comprises of general-purpose machines arranged into different departments. Each job demands unique technological requirements, demands processing on machines in a certain sequence.

Job-shop Production is characterized by:-

- High variety of products and low volume
- Use of general purpose machines and facilities
- Highly skilled operators who can take up each job as a challenge because of uniqueness
- Large inventory of materials, tools, parts
- Detailed planning is essential for sequencing the requirements of each product, capacities for each work centre and order priorities

Advantage of Job-shop Production

Following are the advantages of Job-shop Production:-

- Because of general purpose machines and facilities variety of products can be produced
- Operators will become more skilled and competent, as each job gives them learning opportunities
- Full potential of operators can be utilized
- Opportunity exists for Creative methods and innovative ideas

Limitation of Job-shop Production

Following are the limitations of Job-shop Production:-

- Higher cost due to frequent set up changes
- Higher level of inventory at all levels and hence higher inventory cost
- Production planning is complicated
- Larger space requirements

4. PROJECT PRODUCTION

Project production is characterized by complex sets of activities that must be performed in a particular order within the given period and within the estimated expenditure. Where output of a project is a product, such products are generally characterized by immobility during transformation. Operations of such products are carried out in “fixed position assembly type of layout” which can be observed in production of ships, locomotive and aircraft, construction of roads, buildings, etc.

Characteristics of Project Production

(i) Definite beginning and definite end

Each project has a definite beginning and a definite end.

(ii) “Fixed position” layout

Where the output of a project is a product, such products are generally characterized by immobility during transformation. Operations on such products are carried out in “fixed position assembly type of layout” which can be observed in production of ships, locomotive, aircraft, construction of roads/ buildings, etc.

(iii) High cost overruns

Often delays take place in the completion of the projects. Such delays are generally very expensive due to escalation in the cost of factors of production and incident of penalties.

(iv) Personnel problems

Project production has many personnel related problems namely:-

- When there is a fast build up, staff is either borrowed from other departments or hired for short duration. Therefore, personnel involved in the project have limited (or short lived) interest in the project.
- Since each project has a limited duration, the staff starts spending more time forgetting prepared for the next project.
- Site for the project may be in the underdeveloped region and it may change from project to project which causes dislocation of the normal life.

Importance of Project Production

(i) Non-uniform requirement of resources

Requirement of resources for project production is not uniform. At the end of the project, resources from the project are redeployed elsewhere in other projects. Even during the life of the project, requirement of resources is not uniform. Generally resource requirement (men, materials, money, etc.) in the beginning of the project is low which builds up fast with the progress of the project as more and more resources are absorbed, and then it levels off until there is gradual cutback as the project approaches completion.

(ii) Involvement of different agencies

A project generally involves many tasks, each having its own specialization to be performed by different agencies. The tasks generally have strict precedence (i.e. certain tasks must be completed before the next begins) and as such co-ordination between agencies is of utmost importance.

(iii) Scheduling and control

Because of large number of activities, involvement of different agencies and strict precedence requirements, scheduling and control assumes great importance. Some network planning techniques like PERT and CPM have been found to be very useful to overcome the problems mentioned above.
