CHAPTER | ELEVEN

Production/Operations Planning and Control

Learning Objectives

After reading this chapter, you should be able to:

- Define the term "Production\Operations planning and control."
- Discuss the factors determining production planning procedures.
- Describe the production planning system.
- Describe the production control system and factors determining production control procedures.
- State the objectives of production planning and control (PPC)
- Discuss the role of PPC in operations management.
- Discuss the scope and functions of production planning and control.
- Describe the PPC functions in different production systems
- Describe make-or-buy analysis and routing, scheduling and dispatching functions.

Production/ Operations Planning and Control: Planning, direction and co-ordination of the firm's facilities to achieve the predetermined production objectives in the most economical manner.

Production consists of a sequence of operations that transform materials from a given form to a desired form (products). The highest efficiency in production is obtained by manufacturing the required **quantity** of products, of the required **quality,** at the required **time**, by the **best** and **cheapest method.** To achieve this objective, production management employs production planning and control function which is a management tool that coordinates all manufacturing activities.

The four factors *viz., quantity, quality, time* and *cost* encompass the production system of which production planning and control (in short referred to as PPC) is the nerve centre or brain. There are three stages in PPC.

They are :

(i) **Planning :** The choice from several alternatives of the best means of utilising the resources available to achieve the desired objectives in the most efficient and economic manner.

(ii) **Operations :** Performance in accordance with the details set out in the production plan.

(iii) **Control :** The monitoring of performance through a feed back by comparing the results achieved with the planned targets so that performance can be improved through proper corrective action. This control mechanism is also responsible for subsequent adjusting, modifying and redefining plans and targets in order to ensure the attainment of goals.

Hence, production planning and control may be defined as the *planning, direction and coordination of the firm's material and physical facilities towards the attainment of predetermined production objectives in the most economical manner.*

Production planning and control is also referred to as *operations planning and control* because the production planning and control techniques used in production systems manufacturing tangible goods can also be employed in operations or service systems providing services.

Production/operation planning and control involves the organisation and control of an overall manufacturing (or service) system to produce a product (or a service).

I CLASSIFICATION OF PRODUCTION PLANNING AND CONTROL FUNCTIONS

The functions of PPC can be classified under the following :

(i) **Materials :** Raw materials, spare parts and components which must be available in the correct quantities and specifications at the right time.

(ii) **Methods :** Choosing the best method from several alternatives. It involves deciding the best sequence of operations for manufacturing the parts, building up subassemblies and major assemblies which in turn will make up the finished product, within the limitations of existing layout and workflow.

(iii) **Machines and Equipments :** Production processes or methods have a relationship to the production facilities (machines and equipments) available. PPC is concerned with selection of machines and equipments and also with maintenance policy, procedures and schedules, replacement policy and tooling. (Design and manufacture of tools).

(iv) **Routing :** Routing prescribes the flow of work in the plant and is related to considerations of layout, of temporary storage locations for raw materials, components and semi processed parts, and of material handling systems. Routing is a basic PPC function.

(v) **Estimating :** The processing times (both set up time and operation time per piece) required for the parts to be manufactured in-house are estimated and the standard time (both machine time and labour time) are established as performance standards.

(vi) **Loading and Scheduling :** Machines have to be loaded according to their capacity and capability. Machine loading is carried out in conjunction with routing (as indicated in process layouts or operations analysis and routing sheets) to ensure smooth workflow and the prescribed feeds, speeds of machines are adhered to as well as the estimated time (standard time which is the allowed time to do a job).

Scheduling : Determines the utilisation of equipment and manpower and hence the efficiency of the plant. Scheduling determines the starting time and completion time for each and every operation for each and every part to be manufactured and sub-unit to be assembled so that the finish product is ready to be shipped to the customer as per the predetermined delivery schedules.

(vii) **Dispatching :** This is concerned with the execution of planning functions. Production orders and instructions are released according to the schedule, sequences indicated in route sheets, and machine loading schedules are adhered to and authorisation is given for release of materials and tools to the operators to carryout the work.

(viii) **Expediting or Progressing :** This means follow-up or keeping track of the progress made in completing the production as per schedules. This follows dispatching function logically. Dispatching initiates action on the shop floors whereas expediting ensures that the schedules are adhered to. It keeps a close liaison with the manufacturing work centres to provide a feed back to the PPC manager for prompt review of targets and schedules.

(ix) **Inspection :** This function relates to checking the quality in production and of evaluating the efficiency of the processes, methods and workers so that improvements can be made to achieve the desired level of quality.

(x) **Evaluating or Controlling :** The objective of evaluation or controlling is to improve performance. Methods and facilities are evaluated to improve their performance.

To sum up, we can state that PPC is a management tool, employed for the direction of the manufacturing operations and their coordination with other activities of the firm. In the production system, which is primarily defined by the dimensions of quantity, quality, time and price, the functions of PPC comprise.

(i) **Materials :** Procurement, storage, inventory control and issue.

(ii) **Methods :** Processes, operations and their sequences.

(iii) **Machines :** Allocation (loading) of jobs and utilisation.

(iv) **Manpower :** Availability of workers with appropriate skills.

(v) **Routing :** Flow of work.

(vi) **Estimating :** Operations times.

(vii) **Scheduling :** Time table of production, priority sequencing and machine loading.

(viii) **Dispatching :** Authorising the start of operations.

(ix) **Expediting :** Follow up and keeping record of progress made.

(x) **Evaluating :** Assessing the performance effectiveness.

The advantage of production planning is that efficiency and economy are maximised. The 4 Ms – resources of **men, machinery, materials** and **money** are analysed to select the most appropriate materials, methods, and facilities for accomplishing the work. This is followed by functions such as routing, estimating and scheduling. The more detailed, realistic and precise the production planning is, the greater the conformity to schedules achieved during production and subsequently the greater the efficiency of the plant.

Prominent planning functions are those dealing with standardisation and simplification of products, materials and methods. Also, the PPC function is closely interwoven with industrial engineering (or workstudy) functions, mainly related to plant layout, equipment policies, time and motion studies, work simplification and standardisation.

The production planning and control functions are examined under two separate functions namely: *(i)* Production planning and *(ii)* Production control, in the beginning of the following section and under "Production Planning and Control" function later in this chapter.

I PRODUCTION PLANNING/OPERATIONS PLANNING

Production / Operations Planning: Organisation of an over-all manufacturing/ operating system to produce a product.

Production planning/Operations planning involves the organization of an overall manufacturing/operating system to produce a product.

The various activities involved in production/operation planning are designing the product, determining the equipment and capacity requirements, designing the layout of physical facilities and materials handling system, determining the sequence of operations and the nature of the operations to be performed along with time requirements (standard times) and specifying certain production quantity and quality levels.

Objective of production planning is to provide a physical system together with a set of operating guidelines for efficient conversion of raw materials, human skills and other inputs into finished products.

I FACTORS DETERMINING PRODUCTION PLANNING PROCEDURES

The production planning procedures used, varies from company to company. Production planning may begin with a product idea and a plan for the design of the product and the entire production/operating system to manufacture the product. It also includes the task of planning for the manufacturing of a modified version of an existing product using the existing facilities. The wide difference between planning procedures in one company and another is primarily due to the differences in the economic and technological conditions under which the firms operate. The three major factors determining production planning procedures are:

(i) Volume of Production

The amount and intensity of production planning is determined by the volume and character of the operations and the nature of the manufacturing processes. Production planning is expected to reduce manufacturing costs. The planning of production in case of custom order job shop is limited to planning for purchase of raw materials and components and determination of work centres which have the capacity of manufacturing the product. In high volume operations, extensive production planning is necessary in planning for the design of both the product and the production processes in order to achieve substantial cost reduction when large no of products are produced.

(ii) Nature of Production Processes

In job shop, the production planning may be informal and the development of work methods is left to the individual workman who is highly skilled. In high volume production, many product designers, equipment designers, process engineers, and methods engineers are involved and they put enormous amount of effort in designing the product and the manufacturing processes.

(iii) Nature of Operations

Detailed production planning is required for repetitive operations, *for example,* in case of continuous production of a single standardized product.

The variants in manufacturing approach are :

(a) Manufacturing to order which may or may not be repeated at regular intervals.

(b) Manufacturing for stock and sell (under repetitive batch or mass production). Example: Manufacture of automobiles, watches, typewriters etc.

(c) Manufacturing for stock and sell, (under continuous process manufacturing). Example: Chemical and food products, soap, synthetic yarn etc.

The degree to which production planning is carried varies with the nature of the process.

I PRODUCTION PLANNING SYSTEM

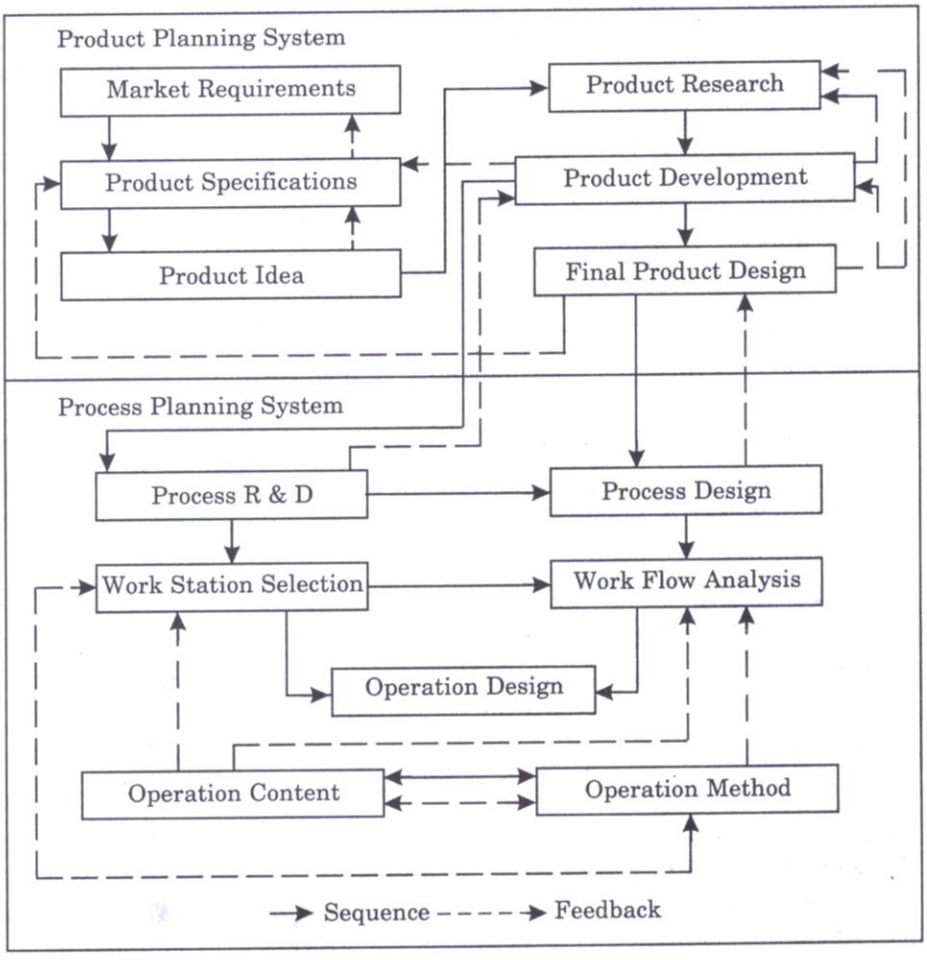
Production Planning System consists of two inter related subsystems: (i) Product planning system (ii) Process planning system.

There are two inter-related subsystems in the production planning system namely:

1. Product planning system
2. Process planning system.

The inter relationship between these two subsystems is shown in *Exhibit 10.1.*

Exhibit 10.1 : Production Planning System



I PRODUCTION CONTROL

Importance of Control Function

The function of production control is to :

(i) Provide for the production of parts, assemblies and products of required quality and quantity at the required time.

(ii) Co-ordinate, monitor and feedback to manufacturing management, the results of the production activities, analyzing and interpreting their significance and taking corrective action if necessary.

(iii) Provide for optimum utilisation of all resources.

(iv) Achieve the broad objectives of low cost production and reliable customer service.

Benefits of Production Control

1. Improvement in profits through –
   - *(a)* Maintenance of a balanced inventory of materials, parts. Work-in-process and finished goods.
   - *(b)* Balanced and stabilized production.
   - *(c)* Maximum utilization of equipment, tooling, labour (manpower) and manufacturing and storage space.
   - *(d)* Minimum investment in inventory.
   - *(e)* Reduction in indirect costs.
   - *(f)* Reduction in set up costs.
   - *(g)* Reduction in scrap and rework costs.
   - *(h)* Reduction in inventory costs.
2. Competitive advantage –
   - *(a)* Reliable delivery to customers.
   - *(b)* Shortened delivery schedules to customers.
   - *(c)* Lower production costs and greater pricing flexibility.
   - *(d)* Orderly planning and marketing of new or improved products.

Elements of Production Control

1. ***Control of Planning :*** Assure receipt of latest forecast data from sales and production planning, bill of material data from product engineering and routing information from process engineering.
2. ***Control of Materials :*** Control of inventory and providing for issue of materials to the shop and movement of materials within the shop.
3. ***Control of Tooling :*** Check on the availability of tooling and provide for issue of tools to shop departments from tool cribs.
4. ***Control of Manufacturing Capacity :*** Determine the availability of equipment and labour capacities and issue realistic production schedules and provide a means of recording completed production.
5. ***Control of Activities :*** Release order and information at assigned times.
6. ***Control of Quantity :*** Follow up of progress of production in order to ensure that the required quantities are processed at each production step and to ensure that corrective action is initiated where work fails to pass each stage of inspection.

7. ***Control of Material Handling :*** Release orders for movement of work to ensure availability of material as required at each stage of the operation.
8. ***Control of Due Dates :*** Check on the relation of actual and planned schedules and determine the cause of delays or stoppages that interfere with weekly schedules of work assigned to each machine or work centre.
9. ***Control of Information :*** Distribute timely information and reports showing deviations from plan so that corrective action can be taken and provide data on production performance measurement for future planning.

PRODUCTION CONTROL SYSTEM

The production control system consists of a group of procedural elements that operates as a whole to fulfil the four functions listed under importance of control function

The elements of production control system are :

1. Means of setting the system in motion such as production orders.
2. Methods to determine lead time for production.
3. Methods to control and monitor production operations including means to
   (a) Determine what and where work is to be done
   (b) Determine when work is to be done
   (c) Issue orders to production shops and ensure that work is completed.
4. Techniques for measuring and recording data on machine utilization, scrap and indirect labour that can serve as a basis for manufacturing action leading to optimum utilization of facilities and low cost operation.
5. An information system for display, recording and retrieval as well as processing and flow of data.

FACTORS DETERMINING PRODUCTION CONTROL PROCEDURES

Factors determining production control procedures are; (i) Nature of production, (ii) Complexity of production, and (iii) Magnitude of operations.

1. Nature of Production : The manufacturing firms are classified as intermittent, continuous or composite production firms, depending on the length of processing time without set up changes.

Production control procedure is comparatively simpler in continuous flow process operation than in intermittent, multi-operation production.

In case of continuous flow process operation, for example, found in petrochemical, soap and synthetic fibre industries, routing is standardised, quality control is highly developed and planning for raw materials, finished goods inventory levels and markets is extremely important. The production control function in such industries is generally embodied in the process equipment itself. In case of intermittent, multi operation production, found in case of manufacture of hand tools, toys, automobile spares etc., a great variety of material is used in many ways and for many purposes. The products consist of a large number of parts and sub assemblies. The production control procedures become complex and sophisticated in order to ensure proper sequence of operation and performing these operations at the right time and place.

A large number of manufacturing plants include both intermittent and continuous processes and are classified as composite or combination operations. Such a plant may have sub assembly departments making parts in a continuous operation, while the final assembly department works on an intermittent basis. (as in the furniture and custom packaging industries)

2. *Complexity of Operations :* Generally the complexity of production planning and control function increases with the increase in the variety of operations. Factors affecting the complexity of production control procedures are:

(a) Number of ultimate parts in the end product.

(b) Number of different operations on each part.

(c) Extent to which processes are dependent on completion of previous operations.

(d) Variations in production rates of machines used in the process.

(e) Number of discrete parts and subassemblies.

(f) Degree to which customer's orders with specific delivery dates occur.

(g) Receipt of many small lot orders.

3. Magnitude of Operations : The size of operation (*i.e.,* time taken to complete an operation) and the distance travelled by the parts from operation to operation are important in establishing proper production control procedures. Generally the need is greater for centralized production control organization and for formal procedures as the size of the operation increases and the dependent operations are more physically separated.

I PRODUCTION PLANNING/OPERATIONS PLANNING AND CONTROL

Production planning and control function essentially consists of planning production in a manufacturing organization before actual production activities start and exercising control activities to ensure that the planned production is realised in terms of quantity, quality, delivery schedule and cost of production.

Objectives of Production Planning and Control

1. To deliver quality goods in required quantities to the customer in the required delivery schedule to achieve maximum customer satisfaction and minimum possible cost.
2. To ensure maximum utilization of all resources.
3. To ensure production of quality products.
4. To minimise the product through-put time or production/manufacturing cycle time.
5. To maintain optimum inventory levels.
6. To maintain flexibility in manufacturing operations.
7. To co-ordinate between labour and machines and various supporting departments.
8. To plan for plant capacities for future requirements.
9. To remove bottle-necks at all stages of production and to solve problems related to production.
10. To ensure effective cost reduction and cost control.
11. To prepare production schedules and ensure that promised delivery dates are met.
12. To produce effective results for least total cost.
13. To establish routes and schedules for work that will ensure optimum utilization of materials, labour and equipments and machines and to provide the means for ensuring the operation of the plant in accordance with these plans.
14. The ultimate objective is to contribute to profit of the enterprise.

3 stages in production planning and control functions are:

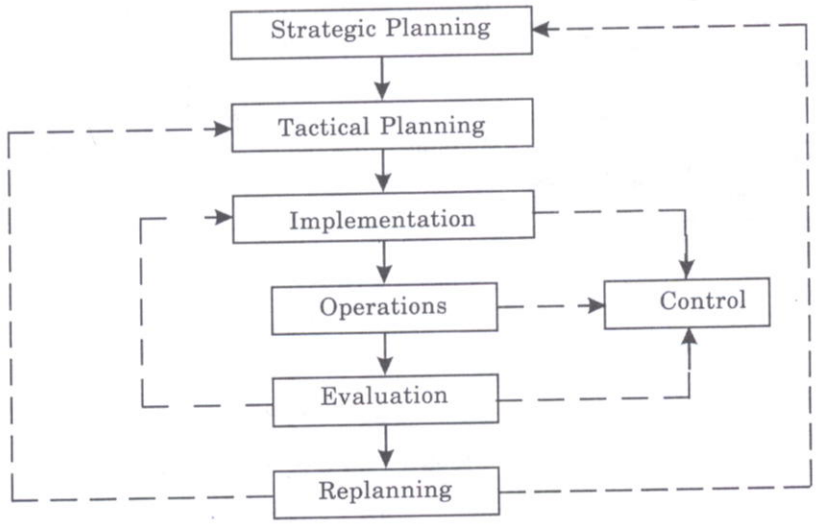
1. **Planning** → Choosing the best course of action among several alternatives.
2. **Operations** → Execution as per plan
3. **Control** → Maintaining the performance by comparing the actual results with performance standards set and taking appropriate corrective action if necessary to reduce variance.

3 stages of PPC functions are: (i) Planning, (ii) Operations, (iii) Control

I ROLE OF PRODUCTION PLANNING AND CONTROL IN OPERATIONS MANAGEMENT

Exhibit 10.2 shows the production/operations management cycle.

Exhibit 10.2 : The Production/Operations Management Cycle



Operations are at the centre of the diagram in *Exhibit* 10.2 because they are the dynamic 'doing' elements of the production process. As the *Exhibit* shows, planning and control never cease in the production area. There are a variety of productions/operations management responsibilities such as:

(i) Product design
(ii) Job design and process design
(iii) Equipment selection and replacement
(iv) Labour skills and training programs
(v) Input material selection including raw materials and sub-contracting
(vi) Plant location and layout
(vii) Scheduling steps of the plan
(viii) Implementing and controlling the schedule
(ix) Operating the production system.

The above are concerned with the design of the production process.

In addition, the control systems to be considered are:

(i) Inventory control policies
(ii) Quality control policies

(iii) Production schedule control policies
(iv) Productivity and cost control policies
(v) Constructing control systems
(vi) Implementing and operating control systems
(vii) Modifying policies and designs.

Exhibit 3.2 : Importance of Production Planning and Control Department

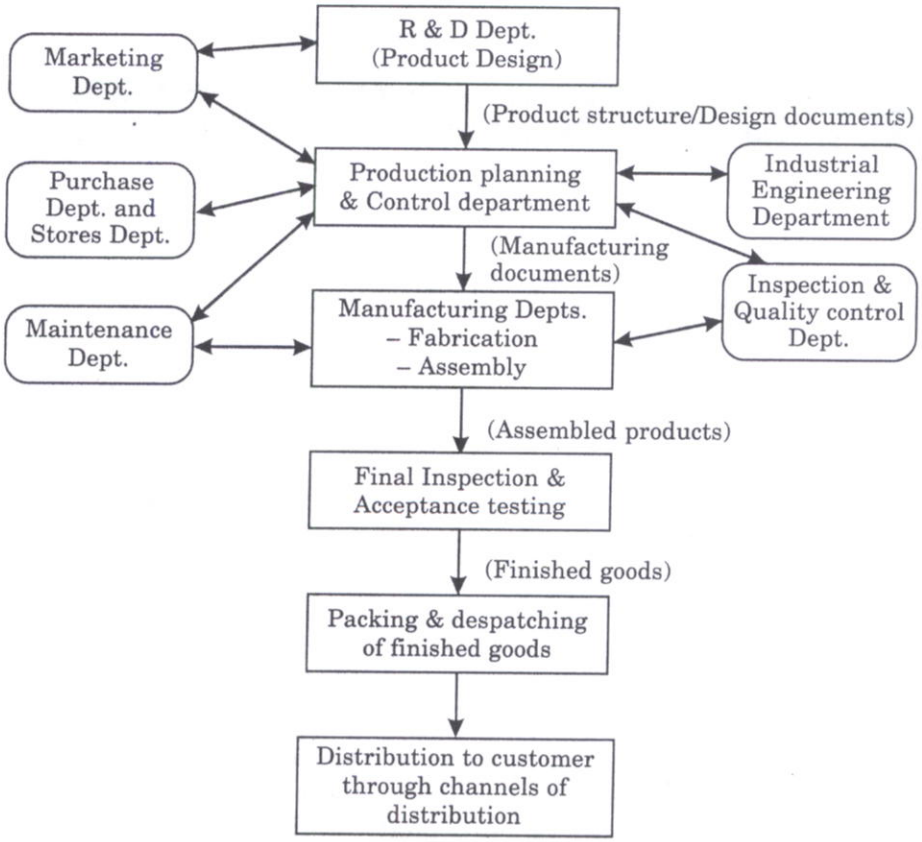


Exhibit 10.3 illustrates the importance of production planning department as the nerve centre of the entire productive system.

Production planning and control is a management tool employed for the direction of the manufacturing operations and their co-ordination with other activities of the firm.

I SCOPE OF PRODUCTION PLANNING AND CONTROL

Production planning and control encompasses the following areas:

1. ***Materials :*** Planning for procurement of raw materials, components and spare parts in the right quantities and specifications at the right time from the right source at the right price. Purchasing, storage, inventory control, standardisation, variety reduction, value analysis and inspection are the other activities associated with materials.
2. ***Methods :*** Choosing the best method of processing from several alternatives. It also includes determining the best sequence of operations (process plans) and planning for tooling, jigs and fixtures etc.

PPC encompasses
- Materials
- Methods
- Machines and Equipments
- Manpower
- Routing
- Estimating
- Loading and Scheduling
- Dispatching
- Expediting
- Inspection
- Evaluating
- Cost control

3. ***Machines and Equipments :*** Manufacturing methods are related to production facilities available in the production system. It involves facilities planning, capacity planning, allocation and utilization of plant and equipments, machines etc.

   It also involves equipments replacement policy, maintenance policy and maintenance schedules, tools manufacture and maintenance of tools etc.

4. ***Manpower :*** Planning for man power (labour, supervisory and managerial levels) having appropriate skills and expertise.

5. ***Routing :*** Determining the flow of work material handling in the plant, and sequence of operations or processing steps. This is related to considerations of appropriate shop layout and plant layout, temporary storage locations for raw materials, components and semi finished goods, and of materials handling systems.

6. ***Estimating :*** Establishing operation times leading to fixation of performance standards both for workers and machines.

7. ***Loading and Scheduling :*** Machine loading is allocation of jobs to machines in conjunction with routing and with due consideration for capacity of machines and priority for jobs in order to utilize the machines to the maximum possible extent.

   Scheduling ensures that parts, sub assemblies and finished products are completed as per required delivery dates. It provides a time table of manufacturing activities. It ensures balanced load on all work centres and ensures even flow of work through the manufacturing facilities.

8. ***Dispatching :*** This is concerned with the execution of the planning functions. It gives necessary authority to start a particular work which has already been planned under routing and scheduling functions. Dispatching is release of orders and instructions for the starting of production in accordance with the route sheets and schedule charts.

9. ***Expediting :*** Means chasing, follow up or progressing which is done after dispatching function. It keeps a close liason with scheduling in order to provide an efficient feed back and prompt review of targets and schedules.

10. ***Inspection :*** This function is related to maintenance of quality in production and of evaluating the efficiency of the processes, methods and labour so that improvements can be made to achieve the quality standards set by product design.

11. ***Evaluating :*** The objective of evaluation is to improve performance. Performance of machines, processes and labour is evaluated to improve the same.

12. ***Cost Control :*** Manufacturing cost is controlled by wastage reduction, value analysis, inventory control and efficient utilization of all resources.

In short, production planning and control function is concerned with decision-making regarding.

(a) What to produce → Product planning and development including product design.

(b) How to produce → Process planning, material planning, tool planning etc.

(c) Where to produce → Facilities planning, capacity planning and sub-contracting planning.

(d) When to produce → Production scheduling and machine loading

(e) Who will produce → Man power planning

(f) How much to produce → Planning for quantity, Economic batch size etc.

Principles of Production Planning and Control (PPC)

1. Type of production determines the kind of production planning the and control system needed.
2. Number of parts involved in the product affects expenses of operating PPC department.
3. Complexity of PPC function varies with the number of assemblies involved.
4. Time is a common denominator for all scheduling activities.
5. Size of the plant has relatively little to do with the type of the PPC system needed.
6. PPC permits 'management by exception'.
7. Cost control should be a by-product of PPC function.
8. 'The highest efficiency in production is obtained by manufacturing the required quantity of a product, of the required quality, at the required time by the best and cheapest method'' — PPC is a tool to coordinate all manufacturing activities in a production/ operating system.

Phases in Production Planning and Control Function

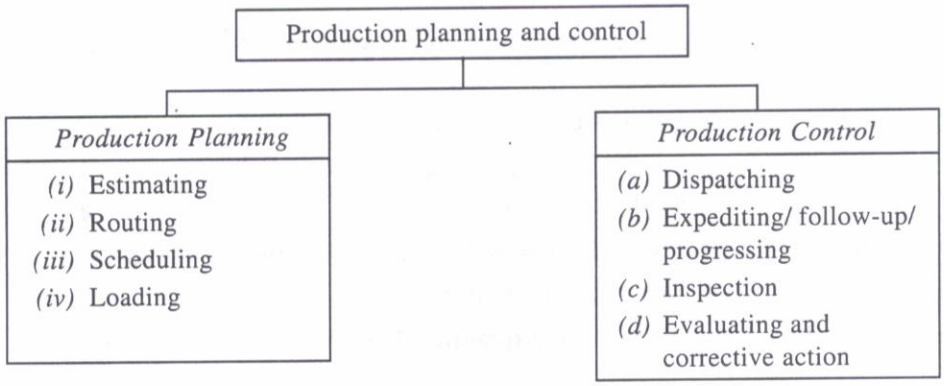
3 Phases in PPC function are:
(i) Planning phase
(ii) Action phase
(ii) Control phase

1. ***Planning Phase :*** *(a)* Preplanning ; *(b)* Active planning
   (a) Pre-planning activity involves product planning and development, demand fore casting, resources planning, facilities planning, plant planning, plant location and plant layout.
   (b) Active planning involves planning for quantity, determination of product - mix, routing, scheduling, material planning, process planning, capacity planning and tool planning.
2. ***Action Phase :*** Execution or implementation phase includes dispatching and progressing function.
3. ***Control Phase :*** Includes status reporting, material control, tool control, inventory control, quality control, labour output control and cost control.

I MAIN FUNCTIONS OF PRODUCTION PLANNING AND CONTROL DEPARTMENT

Exhibit 10.4 shows the various functions or elements of production planning and control.

Exhibit 10.4



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I LEVELS OF PRODUCTION PLANNING

Production planning occurs at several levels in the organization and covers different time horizons.

Planning can be classified as *strategic* planning, *tactical* planning and *operational* planning according to the heiarchical levels in which it is done in the organization. Another classification based on time span of planning is long-range, intermediate range and short-range planning.

Strategic Planning: A process of thinking through the organisation's current mission and environment and setting forth a guide for future decisions and results (strategic planning is done by top management to develop long term plans).

Strategic Planning : Strategic planning is a process of thinking though the organizations current mission and environment and then setting forth a guide for future decisions and results.

Example : Technology forecasting and choice of appropriate technology for the long-range time horizon.

Strategic plans are usually long-range plans done at top management level. *For example,* the vice-president operations, together with the top executives of the firm develops long-range capacity and facility plans.

The long-range plans focus on product lines, divisions, factories, markets and other business units, span several years and reflect the operations strategy of the business. Long-range plans focus on the utilization of production facilities in the long-run to achieve business objectives. They involve commitment in terms of capital investment, manufacturing process technology, product life and the like. The factors to be taken into consideration in long-range planning are investment capacity of the firm, product life cycle, technology level, market requirements and the like. These plans set in motion activities required to develop facilities and equipment, production processes and major subcontractors. Long-range plans become constraints on how many products can be produced in the intermediate and short-range plans.

Objectives laid down by long-range planning are:

(a) Production levels (Number of units produced), *(b)* Operating capacities, *(c)* Inventory policies, *(d)* Levels of manufacturing costs.

Tactical planning: Planning over a medium range time horizon by middle level management.

Tactical Planning : *Tactical planning* is done over an intermediate term or medium range time horizon, by the middle level managment (Operations managers at departmental level). These plans focus on aggregate products rather than individual specific products. These aggregate plans have a time span of 6 to 18 months. They specify the employment plans, machinery and utility plans, subcontractor and materials supply plans and facility modification/expansion plans.

Operation Planning done over a short-time span by the junior level management, mainly concerned with the utilisation of facilities.

Operational Planning : Operational *planning* is done over a short-range time span developed by the junior level management. It is concerned with the utilization of existing facilities rather than creation of new facilities. It involves proper utilization of key resources such as raw materials, machine capacity, energy etc.

Short term planning takes into account current customer orders, priorities, material availability, absenteeism rate, cash flows etc and it is designed to respond quickly to changes in production levels and market conditions.

Short-range planning establishes short-range schedules which specify the quantity of specific products to be produced in each week of the planning horizon which varies from a week to a few months.

Example of short-range plan is master-production schedule, together with materials requirement planning and capacity requirement planning.

Short-range production scheduling and shop floor planning involve the day-to-day issues and decisions related to operations planning.

Table 10.1 illustrates the heirarchy of plans in a production planning system.

Table 10.1 : Levels of Planning in a Production Planning System

Planning Horizon	Inputs	Plans/Schedule	Outputs
1. Long-range (strategic planning)	(a) Long-range demand forecast (b) Availability of funds and business analysis (c) Capacity data and analysis	Long-range capacity plan	(a) Production facility plans (plant location, layout, size, capacities, etc.) (b) Major subcontract plans (c) Major machinery and process plan
2. Intermediate range (tactical planning)	Intermediate range demand forecast	Aggregate capacity plan	(a) Employment plan (b) Machinery and utility plan (c) Subcontract and material supply contracts (d) Facility modification plans (e) Aggregate inventory plans
3. Short-range (operational planning)	(a) Short-range demand forecasts (b) On-hand customer order (c) Other orders (Intra-company) (d) Availability of material from suppliers	(a) Master production schedules (MPS) (b) Capacity requirement planning (CRP) (c) Material requirement planning (MRP)	(a) Short-range production schedules for end products (b) Short-range schedule for parts, components, sub-assemblies and final assemblies. (c) Short-range plan for purchasing materials (d) Short-range shop floor plans.

I PRODUCTION PLANNING FUNCTIONS

The main functions of production planning are:

1. Estimating

Estimating: Deciding the quantity of products to be produced and cost involved in it based on sales forecast.

Involves deciding the quantity of products to be produced and cost involved in it on the basis of sales forecast.

Estimating manpower, machine capacity and materials required (Bill of material is the basis) to meet the planned production targets are the key activities before budgeting for resources (e.g., production budget is the basis for materials budget, capital equipment budget and manpower, budget).

2. Routing

Routing: determining the sequence of operations to be performed in the production process.

This is the process of determining the sequence of operations to be performed in the production process. Routing determines what work must be done, where and how?

Routing information is provided by product or process engineering function and it is useful to prepare machine loading charts and schedules.

Route Sheet : A route sheet is a document providing information and instructions for converting the raw materials into finished parts or products. It defines each step of the

production operation and lays down the precise path or route through which the product will flow during the conversion process.

Route sheets contain the following information :

Route Sheet: A document providing information and instructions for converting the raw materials into finished products.

(a) The operations required and their desired sequence.
(b) Machine or equipment to be used for each operation.
(c) Estimated set up time and operation time per piece (standard time).
(d) Tools, jigs and fixtures required for the operation.
(e) Detailed drawings of parts, subassemblies and final assemblies.
(f) Specification, dimensions, tolerances, surface finishes and quality standards to be achieved.
(g) Specification of raw materials to be used.
(h) Cutting speed, feed, depth of cut etc to be used on machine tools for the operations to be carried on.
(i) Inspection procedure and metrology tools required for inspection.
(j) Packing and handling instructions during movement of parts and sub-assemblies through the operation stages.

3. Scheduling

Scheduling: Fixing priorities for each job and laying down a time table for production.

Involves fixing priorities for each job and determining the starting time and finishing time for each operation, the starting dates and finishing dates for each part, sub assembly and final assembly. Scheduling lays down a time table for production indicating the total time required for the manufacture of a product and also the time required for carrying out the operation for each part on each machine or equipment.

Objectives of scheduling are:

(a) To prevent unbalanced use of time among work centres and departments.
(b) To utilise labour such that the output is produced within established lead time or cycle time so as to deliver the products in time and complete production at minimum total cost.

4. Loading

Loading: Loading of facility or work centre as per a predetermined schedule.

Facility loading means loading of facility or work centre and deciding which jobs to be assigned to which work centre or machine. Loading is the process of converting operation schedules into practice. Machine loading is the process of assigning specific jobs to machines, men or work centres based on relative priorities and capacity utilization.

A machine loading chart (Gantt chart) is prepared showing the planned utilisation of men and machines by allocating the jobs to machines or workers as per priority sequencing established at the time of scheduling.

Loading ensures maximum possible utilisation of productive facilities and avoids bottlenecks in production. It is important to avoid either over loading or under loading the facilities, work centres or machines to ensure maximum utilization of resources.

I PRODUCTION CONTROL FUNCTIONS

The control functions are:

1. Dispatching

Dispatching: Setting production activities in motion after routing and scheduling functions are carried out.

Dispatching may be defined as setting production activities in motion through the release of orders (work order, shop order) and instructions in accordance with the previously planned time schedules and routings.

Dispatching also provides a means for comparing actual progress with planned production progress. Dispatching functions include

(a) Providing for movement of raw materials from stores to the first operation and from one operation to the next operation till all the operations are carried out.

(b) Collecting tools, jigs and fixtures from tool stores and issuing them to the user department or worker.

(c) Issuing job orders authorizing operations in accordance with dates and times as indicated in schedules or machine loading charts.

(d) Issue of drawings, specifications, route cards, material requisitions and tool requisitions to user department.

(e) Obtaining inspection schedules and issuing them to inspection section.

(f) Internal materials handling and movement of materials to inspection area after completing the operation, moving the materials to next operation centre after inspection, and movement of completed parts to holding stores.

(g) Returning jigs and fixtures and tools to stores after use.

2. Expediting/Followup/Progressing

Expediting/ Progressing: Ensuring that the work is carried out as per plan and delivery schedules are met.

Expediting or progressing ensures that the work is carried out as per plan and delivery schedules are met.

Progressing includes activities such as status reporting, attending to bottlenecks or hold-ups in production and removing the same, controlling variations or deviations from planned performance levels, following up and monitoring progress of work through all stages of production, co-ordinating with purchase, stores, tool room and maintenance deportments and modifying the production plans and replan if necessary

Need for expediting may arise due to the following reasons-

(a) Delay in supply of materials.

(b) Excessive absenteeism.

(c) Changes in design specifications.

(d) Changes in delivery schedules initiated by customers.

(e) Break down of machines or tools, jigs and fixtures.

(f) Errors in design drawings and process plans.

BENEFITS OF PRODUCTION PLANNING AND CONTROL FUNCTION

Production planning and control function is the nerve centre or heart of the production/ operations management function. It co-ordinates all phases of the production/operating system. An efficient production planning and control function results in higher quality, better utilization of resources, reduced inventories, reduced manufacturing cycle time, faster delivery, better customer service, lower production costs and lower capital investment and higher customer satisfaction. Efficient utilization of resources results in higher productivity and economy of production, timely delivery and right quality of goods/services at the right cost will improve customer satisfaction. Minimisation of breakdown of machines, plant and equipments minimises idle time of equipments and labour and ensures even flow of work through the plant facilities. This will improve employee discipline and morale.

An efficient production planning and control system enables the firm to improve its sales turnover, market share and profitability and provides a competitive advantage for the

firm due to balanced inventory levels and higher quality, flexibility and dependability and lower prices which are the performance factors for the firm.

Limitations of PPC

(a) Production planning and control function is based on certain assumptions or forecasts of customers' demand, plant capacity, availability of materials, power etc. If these assumptions go wrong, PPC becomes ineffective.

(b) Employees may resist changes is production levels set as per production plans if such plans are rigid.

(c) The production planning process is time consuming when it is necessary to carry out routing and scheduling functions for large and complex products consisting of a large no of parts going into the product.

(d) Production planning and control function becomes extremely difficult when the environmental factors change very rapidly such as technology, customers' taste regarding fashion or style of products needed, government policy and controls change frequently, stoppages of power supply by electricity boards due to power cuts, break in supply chain due to natural calamities such as floods, earthquakes, war etc.

Measuring Effectiveness of PPC Function

The task of PPC dept. is mainly to co-ordinate the activities of various depts which support production departments viz., purchase, stores, industrial engineering, quality control, design, maintenance etc. Hence the effectiveness of PPC department can be generally measured by the company's success in meeting the demand and its ability to produce quality products and deliver them in the delivery schedules desired by customers at a reasonable price that is acceptable to customers and thereby achieve maximum customer satisfaction.

Effectiveness of PPC function can be measured in four areas:
(i) Delivery
(ii) Inventory levels
(iii) Production/ Operations Management.

There are three specific areas in which effectiveness of PPC function can be measured. They are :

1. ***Delivery :*** This can be measured by finding out the number of deliveries effected on time and those got delayed over a period of time (usually one year).
2. ***Inventory Levels :*** The value of average inventory held annually value of obsolete inventory, value of non-moving and surplus inventories and the inventory turnover ratio are indicators of efficiency in inventory management
3. ***Production/Operations Management :*** Comparison of planned and actual production indicates the performance of PPC function. Number of overtime hours worked, machine utilization ratio etc are also indicators of effectiveness of PPC function. In addition, the expenditures incurred for carrying out the various functions of PPC dept *vis-a-vis* the production value and sales revenue realised, indicate the effectiveness of PPC function.

I PRODUCTION PLANNING AND CONTROL IN DIFFERENT PRODUCTION SYSTEMS

1. PPC in Job Production

Job production involves manufacture of products to meet specific customer requirements of special orders. The quantity involved is usually small. Examples of job production are manufacture of large turbo generators, boilers, steam engines, processing equipments, material handling equipments, ship building etc.

Under job production we may have three types according to the regularity of manufacture namely,

(a) A small number of products produced only once.

(b) A small number of products produced intermittently when the need arises.

(c) A small no of products produced periodically at known interval of time.

When the order is to be executed only once, there is either scope for improvement of production techniques by introducing intricate method studies, special tools or jigs and fixtures unless the technical requirement justify it. But if the order is to be repeated, jigs & fixtures, tools as well as specially designed inspection gauges should be carefully considered to reduce the manufacturing cycle time.

PPC function is relatively difficult in job production because of the following reasons:

(i) Every job order is of different nature and have different sequence of operations. There is no standardised routing for job orders.

(ii) Specific job orders are assigned to different work stations as per availability of capacity

(iii) Production schedules drawn depend on the relative priority assigned to various job orders.

(iv) Scheduling is dependent on assessment of production times and estimating is based on judgement.

2. PPC in Batch Production or Inermittent Production

Batch production is the manufacture of a number of identical articles either to meet a specific order or to satisfy continuous demand. The decisions regarding tooling and jigs and fixtures are dependent on the quantities involved in the production batch.

In batch production too there can be three types namely:

(a) A batch produced only once.

(b) A batch produced repeatedly at irregular intervals, when the need arises.

(c) A batch produced periodically at known intervals, to satisfy continuous demand.

Here again planning and control become more simplified as quantities increase and as manufacture becomes more regular. Two problems that may arise in batch production are due to size of the batch and due to scheduling of production.

The solution to these problems depends on whether the production is governed by

(a) External customer orders only.

(b) Whether the plant is producing for internal consumption *i.e.,* a subassembly used in the final product.

If it is the case of external customer orders, the customer order size usually determines the batch size. The timing will also depend on the delivery dates specified by the customers. If it is for internal consumption, both batch size and production scheduling problems are matters for internal management decisions.

The problem of optimal batch size has to take into account the set-up costs which are involved before each production run and the inventory carrying costs incurred when the finished product is held in stock. The batch size determines the length of the production run and affects both the production schedule and batch size considerations of other products.

Characteristics of PPC Function in Intermittent or Batch Production

(a) Before issuing manufacturing orders, need for new raw materials and tools, overloading and underloading of particular machines or work centres must be anticipated.

(b) As products are diversified and several orders are handled simultaneously in different work centres scheduling and follow up becomes a difficult task.

(c) Dispatching has to be done efficiently to avoid delays and bottlenecks in the production process.

3. P.P.C. in Continuous Production

Continuous production is normally associated with large quantities of production and with a high rate of demand. Continuous production is justified when the rate of production can be sustained by the market.

Two types of continuous production can be:

(a) Mass production (b) Flow production

In *mass production*, a large number of identical articles is produced, but inspite of advanced mechanization and tooling, the equipment need not be specially designed for the component to be manufactured.

In *flow production*, the plant and equipment and layout have been primarily designed to manufacture a particular product. A decision to switch over to a different kind of product needs basic changes in the equipments and the layout, especially when special purpose machines and complex material handling systems are used.

PPC in *continuous production* is usually far simpler than in job or batch production. Extensive effort is required for detailed planning before production starts but both scheduling and control need not be elaborate usually. The output is either limited by available capacity or regulated within given limits to conform to production targets based on periodic sales forecasts.

4. Production Planning and Control in Process Industry

PPC in process industry is relatively simple. Routing is automatic and uniform. Standard processes and specialised equipments are used. As the products are standardised and goods are produced to stock and sell, scheduling is easy. Departmental schedules are derived from master production schedules. Dispatching involves issue of repetitive orders to ensure a steady flow of materials throughout the plant. The main task of PPC in process industry is to maintain a continuous and uniform flow of work at the predetermined rate in order to utilise the plant and equipments fully and to complete the production in time.

Requirements of Effective Production Planning and Control System

1. Sound organizational structure with mechanism for proper delegation of authority and fixation of responsibility at all levels.
2. Information feed back system should provide reliable and up-to-date information to all persons carrying out PPC functions.
3. Standardisation of materials, tools, equipments, labour, quality, workmanship etc.
4. Trained personnel for using the special tools, equipments and manufacturing processes.
5. Flexibility to accommodate changes and bottle necks such as shortage of materials, power failures, machine break downs and absenteeism of employees.
6. Appropriate management policies regarding production and inventory levels, product - mix and inventory turnover.
7. Accurate assessment of manufacturing lead times and procurement lead times.
8. Plant capacity should be adequate to meet the demand. The plant should be flexible in order to respond to the introduction of new products, changes in product-mix and production rate.

Earlier in this chapter we have discussed three phases in production planning and control function namely, planning phase, action phase and control phase. Pre-planning phase is the first stage in planning phase and it is the interface between product design and process design. One such activity in pre-planning phase is 'make or buy analysis' which is the basis for process planning, capacity planning, facilities planning and plant planning. We will discuss 'make or buy analysis' and plant planning in the following paragraphs.

I MAKE OR BUY ANALYSIS

Make or Buy decisions are basically questions of specialisation and vertical integration

The capacity of a firm to produce finished products depends on at what stage the firm begins the manufacturing process. If it starts with basic raw materials, the total output will be much less than if many of the parts and components are purchased from vendors. The firm is faced with a decision of whether to make or buy each part or sub-assembly.

Make or buy decisions are basically questions of specialization and vertical integration. The product design specifies the product structure which indicates the number of sub units and piece parts that comprise a product. Each and every sub assembly or part has a detailed design drawing specifying the materials and piece parts required to make the sub assembly or the raw material required to make the piece part. The process planning engineer has to make an important decision of ***"make or buy"*** after studying the detailed drawings of assemblies, parts and components.

Many components, sub assemblies and piece parts can be either bought, sub contracted or produced in-house.

Consideration in Make or Buy Decision

1. In the economic consideration based on cost of manufacture versus cost of buying the item, the least cost alternative is selected. Economic analysis of make or buy decisions is based on break-even-analysis or Economic Batch Quantity or Economic Order Quantity concepts.
2. Apart from economic consideration, there are some non economic considerations such as:
   (a) Availability of supply and alternative sources of supply for components and sub-units.
   (b) Desire to specialise in a particular field of manufacture.
   (c) Control of trade secrets and design secrets.
   (d) Quality and reliability considerations.
   (e) Research and development facilities available in-house.
   (f) Delivery schedules to be met.
   (g) Reliability of supply of outside suppliers.
   (h) Lead time required for procurement or in-house manufacture.
   (i) Availability of manufacturing capacity (in-house).
   (j) Employee preferences.

When to Make : Some of the reasons that may lead a firm to make a product or component in-house instead of purchasing it are

(a) Lower cost because the firm does not have to pay for the vendor's overhead or profit.
(b) Assurance of availability because the firm does not have to depend on vendors.
(c) Better control on quality.
(d) Availability of appropriate manufacturing equipments and expertise.
(e) Desire to preserve trade secrets, design secrets, etc.
(f) Savings on transportation costs.

When to Buy :

(a) When the parts can be bought from the vendors at lower cost, higher quality and faster delivery times than would be possible if the firm made them in-house.

(b) When the firm uses only a few numbers of a particular item and special equipments are needed to produce it in-house, then the firm will look for an outside vendor.

(c) When an outside vendor can sell an item at a lower cost than the purchasing firm would have to spend to produce it.

(d) When the vendors hold patents on the required item.

(e) When opportunity costs of producing are much higher than that of buying.

(f) When the vendors are able to meet the requirements of the purchasing firm in terms of quality, quantity, price and delivery period.

I ORGANISATION OF PPC DEPARTMENT

The major functions of PPC department are *(i)* Routing *(ii)* Scheduling *(iii)* Dispatching and *(iv)* Progressing.

Routing

The Routing Function : Routing defines what work has to be done and where it has to be performed and how it will be done. It is the process of determining the sequence of operations to be performed in the production process which in turn establish the **route** or path of flow of material from the raw material stage to the finished product stage through various production stages. The routing function specifies the operations to be performed, their sequence and the machine or equipment and tools to be used to carryout the operation, and the kind of worker needed to carryout the operation. The objective of routing is to select the best and the cheapest method to manufacture the product. The factors affecting routing function are – the nature of machines and equipments available in the plant, efficiency of workers, availability of physical facilities, accessories to machines, and the type of manufacturing process (*i.e.,* fabrication, assembly, chemical process, metallurgical process, etc.).

Routing: Defines what work has to be done, where and how it will be done.

Routing varies according to the type of production viz job production, batch production, mass production and continuous process production. In a job order shop, every lot must be separately routed because the production orders or job orders are not repetitive. In a batch production, the routing depends on the lot size (or batch size), In a continuous process production and mass production industry, route is standardised and fixed. Hence, the routing determined once will remain unchanged for the product under manufacture. Separate route sheets are prepared for each part to be fabricated, sub unit to be assembled and also for the finished product to be produced.

Routing Procedure : The following steps are involved in routing :

(i) Analysis of the product to determine the materials and parts required for manufacturing the product. The product structure documents such as *product structure tree, final assembly drawing, sub-assembly drawings, piece part drawings and the bill of materials* are analysed by the process planning or methods engineer, who prepares the route sheets.

(ii) Determination of the manufacturing operations required and their sequences.

(iii) Determination of lot size *i.e.,* the quantity of the parts to be manufactured in each batch or lot.

(iv) Deciding the inspection procedure for each operation.

(v) Determining the allowed time for each operation. The allowed time is the standard time comprising the machine set up time and operation time per piece of the part to be produced.

(vi) Preparing production orders (or work orders), job cards (or shop orders), labour cards, (or labour time tickets) inspection cards, tool requisitions and store requisitions for materials.

(vii) Analysis of the estimated cost of manufacturing the product in order to improve the method for cost reduction and reduction of operation time, set up time etc.

Route Sheets : Route sheet is a written specification or document which provides information and working data for conversion of raw materials into finished parts or products. Each step in the production operation is indicated in the route sheet.

The information and data required for preparation of route sheets are :

(i) Detail drawings of parts and assemblies.

(ii) Bill of materials.

(iii) Quality specifications.

(iv) Sequence of operations to be followed at each work centre.

(v) Equipment or machines to be used.

(vi) Tools, jigs and fixtures required.

(vii) Feeds and speeds of machines.

(viii) Machine set up and operation time standards.

(ix) Direct and indirect labour time standards.

A detailed route sheet contains the following information :

(i) Production order or work order identification.

(ii) Identification of the part and drawing reference number, including the data of last engineering revision (*i.e.,* issue number of the drawing).

(iii) Quantity of the part to be made.

(iv) Material to be used, its specification and size.

(v) Operation data including.

(a) Operation sequence number.

(b) Machine or equipment to be used.

(c) Tools to be used (cutting tools, jig and fixtures).

(d) Description of the operation.

(e) Feeds and speeds of the machine to be used.

(vi) Time for set-up; per piece operation time and the total time allowed to complete the operation for the lot size.

(vii) Inspection instructions, metrology gages to be used for inspection.

(viii) Handling and packing instructions.

Benefits of Routing

(i) Efficient use of available resources.

(ii) Reduction in manufacturing costs.

(iii) Improvement in quantity and quality of output.

(iv) Providing a basis for scheduling and loading.

Scheduling and Loading

Scheduling may be defined as the assignment of work to the facility with the specification of times (when to start and when to complete) and the sequence in which work has to be

carried out. It is a function that determines when each operation has to start and finish. It involves the preparation of a time table which would indicate the total time needed for the manufacture of a part, a subassembly and a finished product. It also indicates the time required for each operation required for manufacturing a part or assembling a sub-unit or a finished product.

Scheduling: Assigning work to the facility with the specification of time regarding when to start and when to complete the work.

Other definitions of scheduling are :

(i) Scheduling involves establishing the amount of work to be done and the time when each element of the work will start and finish.

(ii) Scheduling is the determination of time required to perform each operation and also all the operations from raw material stage to the finished part stage, as per the sequence of operations.

(iii) Scheduling function ensures that the **"right things"** are done at the **"right time"** with the **right machines** and **tools** and/or **right people** to create the product or service output through most efficient utilisation of resources.

Objectives of Scheduling

(i) Meeting customer and finished goods inventory delivery requirements.

(ii) To achieve the required rate of output with a minimum of delay and disruption in processing.

(iii) To have maximum utilisation of men, machines and materials by maintaining a smooth flow of materials along the production line.

(iv) To prevent unbalanced use of time among department and work centres with a view to eliminate idling of men and machines.

(v) To complete the production at minimum total cost and to reduce the manufacturing cycle time to the minimum.

(vi) To deliver products in time as per the delivery schedules committed to the customers.

(vii) To balance production loads in order to obtain maximum utilisation of available machines and labour.

(viii) Sequencing production in a manner that will produce minimum production and inventory carrying costs.

Facility Loading (or Machine Loading)

This means loading of facility or work centres or machines and deciding which jobs should be assigned to which machines or work centres, giving due consideration to the sequence of operations as per the route sheet and the priority sequencing and utlisation of machines or work centres.

Loading establishes the amount of work load (in terms of labour hours or machine hours) each machine or work centre must carry during the future planning period (usually expressed as weeks or months). It will ensure efficient utilisation of facilities or work centres and workers with minimum idle time.

Objectives of Loading

(i) reduce set up time

(ii) fix up delivery dates

(iii) evenly load the plant and balance work load with available machine and labour capacity

(iv) reduce waiting time for jobs to be loaded on the machines

(v) reduce idle time of men and machines

(vi) increase the efficiency of utilisation of the plant capacity.

Elements of Schedulings

Elements of scheduling are:
- Demand forecast
- Aggregate scheduling
- Production plan
- Master production schedule
- Priority planning
- Capacity planning
- Facility loading
- Evaluation of work load
- Sequencing

(i) **Demand Forecast :** This forms the basis for scheduling. It may be a long-range forecast or a short-range forecast.

(ii) **Aggregate Scheduling :** It is a tentative schedule based on quarterly or monthly demand. It enables employment of available resources in meeting the demand by adjusting the capacity.

(iii) **Production Plan :** It shows the output levels planned, resource requirements, capacity limitations and inventory levels.

(iv) **Master Production Schedule (MPS) :** It specifies in detail exactly what products are to be produced during the short-term planning horizon (*i.e.,* a quarter or year).

The master production schedule indicates the desired quantities of each type of product to be produced on a daily or weekly or monthly or quarterly basis to meet the customer's firm order or forecasted demand.

(v) **Priority Planning :** The master production schedule is exploded into components, parts and subunits that are required to be produced in order to complete production of finished products as per MPS. Material requirement planning (MRP) and time placed order point (TPOP) systems are two systems of priority planning.

(vi) **Capacity Planning :** This helps to verify whether there exists enough capacity in terms of machine hours and labour hours required to meet the requirement of MPS. It helps to regulate loading of specific jobs to specific machines or work centres for specific periods of time.

(vii) **Facility Loading or Machine Loading :** It involves loading machines or workcentres after deciding which job can be assigned to which machine or work centre. It involves actual assignment of jobs to machines taking into consideration priority sequencing and machine utilisation.

(viii) **Evaluation of Work Load :** To balance the work load on various machines or work centres when resources are limited. Excess work load on one work centre or machine may be transferred to other work centre or machine having spare capacity.

(ix) **Sequencing :** Priority sequencing of jobs done to maximise workflow through workcentres or machines will minimise delay or waiting and hence, the manufacturing cost.

Problems in Scheduling

(i) Lack of correct and up to date information concerning lead time, production time, lot size, prevailing load on the machines or workcentres.

(ii) **Resource constraints :** Capacity shortages, delay in supply of materials, machine break downs etc.

(iii) **Absenteeism,** Lack of skill and experience in labour and labour inefficiency resulting in actual time taken to complete a job exceeding the allowed time (*i.e.,* the standard time)

(iv) **Type of production** *viz.,* Job, Batch, process or continuous production.

(v) Problems of line balancing to balance the capacities of machines in the production line and also of workcentres in an assembly line.

(vi) Problems of machine loading due to changing the priorities in the loading sequence.

Types of Scheduling

Three types of scheduling are:
(i) Master production scheduling
(ii) Detailed scheduling
(iii) Machine loading

(i) Master production scheduling which results in an overall production schedule or master production schedule (MPS) over the intermediate planning horizon.

(ii) **Detailed scheduling** which results in a current schedule for the short-range planning horizon.

(iii) **Machine loading** and loading departments or work centres which indicate parts assigned to a machine in a particular priority sequencing, resulting in machine loading charts (referred to as Gantt machine loading charts) and load charts) and load charts (or Gantt load charts).

The master production schedule determines the overall production of end products for monthly or quarterly basis for one or two years. MPS assigns production capacity to individual products or customer orders.

Current or detailed production schedules establish the detailed time table indicating **"start"** and **"finish"** time (dates) for every part or sub-unit needed to build the end product. This will help in the estimation of work load for each work centre or machine for the next few works or months.

Machine loading charts show the allocation of jobs to machines on a weekly basis, taking into consideration the priority and utilisation of machine and labour. Machine loading charts are prepared for every work showing the jobs assigned to every machine or work centre by means of a horizontal bar indicating machine or work centre capacity in terms of standard hours.

Dispatching

Dispatching: An implementation function which is concerned with getting the work started on the shop floors. Two kinds of dispatching function are
(i) Centralised dispatching and
(ii) Decentralised dispatching.

Dispatching may be defined as setting production activities in motion through release of production orders (or work orders) shop orders and instructions to the manufacturing shops and assembly lines in accordance with previously planned time schedules and process routings. While *routing* and *scheduling* are production planning functions, *dispatching* is the implementation function which is concerned with getting the work started on the shop floors. It ensures that schedules and machine loading charts are properly implemented as planned. The following functions are carried out by dispatching section.

(i) Issuing shop orders or job cards to the production department authorising the production department to start the work as per schedule.

(ii) Collecting tools, jigs and fixtures from tool stores and raw materials from raw material stores and issuing the same to the user department or workcentre.

(iii) Issuing the drawings, specifications, route cards process plans and time tickets to the user department or workcentre.

(iv) Obtaining inspection schedule and issuing them to inspection department.

(v) Internal material handling and movement of materials to the inspection area after the completion of operations, moving the inspected items to the next operation centre and movement of completed items to holding stores.

(vi) Returning the tools, jigs and fixtures to the tool stores after use.

(vii) Recording the beginning time and completing time for the operation for each job.

(viii) Recording and reporting idle time of machine and labour.

The dispatching section is the representative of PPC department in the production shops. The dispatching sections keeps record of "start" and "finish" dates for each operation for every job and this will facilitate the progressing section to know the status of progress of any customer order on the shop floors.

Centralised and Decentralised Dispatching

In centralised dispatching a central dispatching section issues production or shop orders directly to the work centers. It maintains record of capacity of each machine or equipment and the work load against them orders or instructions are given to the supervisor or foreman of the work centres to load the machines with jobs as per the sequence shown in machine loading charts.

In a decentralised dispatching system, the respective shop supervisors perform the dispatching function. He loads the machine or equipment as per the schedule or machine loading chart and ensures that jobs are completed in the allowed time durations.

Advantages of centralised dispatching system are as below :

(i) Higher degree of overall control on shop floor activities.

(ii) Effective coordination between various centres is possible.

(iii) Greater flexibility.

(iv) Progress of the orders can be readily assessed at any time because of availability or information in a central place.

(v) Effective utilisation of machine capacity and labour capacity.

Advantages of decentralised dispatching system are as below :

(i) Shop supervisors have better knowledge of their shops and are in a better position to allot the right jobs to the right machines and workers

(ii) Accurate record keeping regarding progress of production is possible.

(iii) Better communication and coordination within workcentres and sections.

(iv) Day-to-day problems can be solved quickly.

Progressing (or Expediting or Follow-up)

Progressing: Ensuring that the work is carried out as per the plan.

Progressing is a production control function which ensures that the work is carried out as per the plan and the completion dates for each operation for each job are met and the delivery dates for the finished products can be realised. The objective of progressing function is to control variation or deviations from the plans for execution of the work. Some form of continuous recording of the status of progress in work and follow up procedure is created to monitor the progress of work to chase or expedite the work centres falling behind schedule.

Need for progressing or expenditing arises due to the following reasons :

(i) Delay in supply of raw materials to the production shops.

(ii) Excessive absenteeism of workers causing idling of machines and upsetting the production schedules.

(iii) Changes in design specifications and route cards or process plans.

(iv) Changes in delivery schedule demanded by customers.

(v) Break down of machine tools and equipments.

(vi) Break down of tools, jigs and fixtures.

(vii) Errors in design drawings and process plans.

The duties of progressing people or chasers or expeditors are as follows :

(i) To keep record of the status of completion of operations and to prepare progress reports.

(ii) To determine the causes of variations or deviations from the programme or planned performance levels and control the same.

(iii) Following up and monitoring the progress of work through all stages of production till the parts, subunits and finished products are completed.

(iv) To prepare lists of materials, components and parts which are in short supply for various stages of production (these lists are referred to as shortage lists).

(v) To attend to problems at bottleneck centres and to solve the problems which cause delay or hold up in production.

(vi) To coordinate with purchase, stores, tool room and maintenance departments and to solve problems which hinder progress of production as per schedules.

(vii) To modify the production plans or replan if necessary.

Documents Concerned with PPC Functions

1. Sales forecast (estimate of sales volume) or customers' firm orders
2. Production program - a long-range plan for new products
3. Production plan or production budget for specific products (a short-range plan)
4. Master production schedule (usually quarterly basis)
5. Production order or work order
6. Job order or shop order or job card
7. Route cards and process plans
8. Completion report
9. Inventory status record
10. Design drawings and specifications
11. Cost and time estimates
12. Job standards (or standard times)
13. Sale order
14. Stores requisition
15. Purchase requisition
16. Tool requisition
17. Receiving reports for purchased items
18. Inwards goods inspection report
19. In-process inspection report
20. Final inspection or testing report
21. Acceptance test report
22. Store credit notes
23. Shipping reports
24. Shortage lists
25. Engineering change notice (Design change instructions).

QUESTIONS

1. Explain the role of PPC in engineering industry.
2. 'Production control is the key to the success of a business organization'. Discuss this statement, listing the various functions carried out under production control and state their purpose in brief.
3. (a) How does PPC function change in the three types of production. Explain with reference to the differences in the three types of production.