UNIT-I

Definition of PPC:

It is the processes of effectively organising, directing, planning, coordinating and controlling the production, that is the operations of that part of an enterprise, it means to say that PPC is responsible for the actual transformation of raw materials into finished products.

Objectives of Production Planning and Control:

Production planning and control consists of planning production in a manufacturing organization before production activities take place and exercising control actions to ensure that the planned production is realized in terms of quantity, quality, delivery schedule and cost of production.

The main objectives are:
1. To attain maximum utilization of resources.
2. To produce quality products.
3. To minimize manufacturing cycle time.
4. To maintain optimum inventory levels.
5. To maintain flexibility in operations.
6. To achieve coordination between labour, machines, and other supporting departments.
7. To remove bottle-necks at all levels of production.
8. To achieve cost-reduction and cost control.
9. To prepare and maintain the production schedules.
10. To achieve the goals at minimum cost.

Limitations of Production Planning and Control:

In spite of several benefits of production planning and control, it has certain limitations. These are as follows
i)Production planning and control is based upon certain assumptions or forecasts about level of demand, availability of materials, technological progress, govt. policies etc. If these assumptions go wrong the production planning and control function may turn out ineffective.
ii) It is costly and time-consuming exercise.
iii) It becomes a difficult exercise especially when external environmental factors changes very rapidly.
iv) The employees may resist changes when planning involves several changes.

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Functions of production planning and control:

Functions of production planning and controlling is classified into:

1. Pre-planning function
2. Planning function
3. Control function

1. PRE-PLANNING FUNCTION

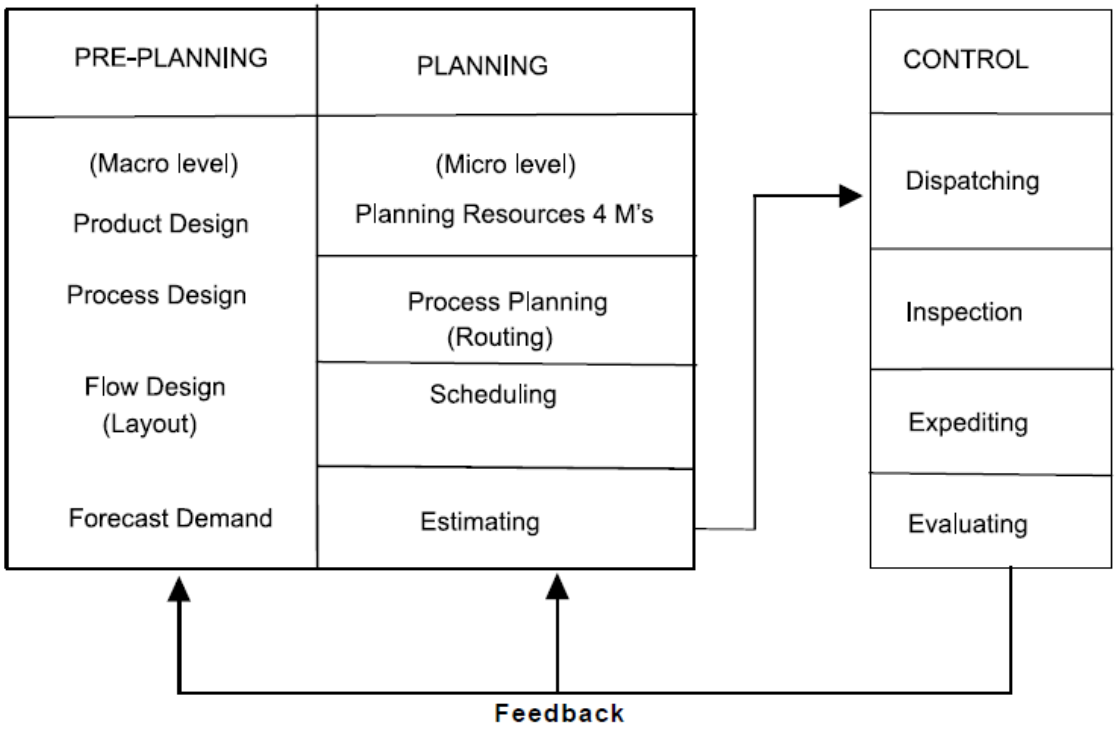
Pre-planning is a macro level planning and deals with analysis of data and is an outline of the planning policy based upon the forecasted demand, market analysis and product design and development. This stage is concerned with process design (new processes and developments, equipment policy and replacement and work flow (Plant layout). The pre-planning function of PPC is concerned with decision-making with respect to methods, machines and work flow with respect to availability, scope and capacity.

2. PLANNING FUNCTION

The planning function starts once the task to be accomplished is specified, with the analysis of **four M's**, *i.e*., Machines, Methods, Materials and Manpower. This is followed by process planning (routing). Both short-term (near future) and long-term planning are considered. Standardisation, simplification of products and processes are given due consideration.

3. CONTROL FUNCTION

Control phase is effected by dispatching, inspection and expediting materials control, analysis of work-in-process. Finally, evaluation makes the PPC cycle complete and corrective actions are taken through a feedback from analysis. A good communication, and feedback system is essential to enhance and ensure effectiveness of PPC.



1. **Materials:** Raw materials, finished parts and bought out components should be made available in required quantities and at required time to ensure the correct start and end for each

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operation resulting in uninterrupted production. The function includes the specification of materials (quality and quantity) delivery dates, variety reduction (standardisation) procurement and make or buy decisions.

2. **Methods:** This function is concerned with the analysis of alternatives and selection of the best method with due consideration to constraints imposed. Developing specifications for processes is an important aspect of PPC and determination of sequence of operations.

3. **Machines and equipment:** This function is related with the detailed analysis of available production facilities, equipment down time, maintenance policy procedure and schedules. Concerned with economy of jigs and fixtures, equipment availability. Thus, the duties include the analysis of facilities and making their availability with minimum down time because of breakdowns.

4. **Routing:** It is concerned with selection of path or route which the raw material should follow to get transformed into finished product. The duties include:

(*a*) Fixation of path of travel giving due consideration to layout.

(*b*) Breaking down of operations to define each operation in detail.

(*c*) Deciding the set up time and process time for each operation.

5. **Estimating:** Once the overall method and sequence of operations is fixed and process sheet for each operation is available, then the operations times are estimated. This function is carried out using extensive analysis of operations along with methods and routing and a standard time for operation are established using work measurement techniques.

6. **Loading and scheduling:** Scheduling is concerned with preparation of machine loads and fixation of starting and completion dates for each of the operations. Machines have to be loaded according to their capability of performing the given task and according to their capacity.

Thus the duties include:

(*a*) Loading, the machines as per their capability and capacity.

(*b*) Determining the start and completion times for each operation.

(*c*) To coordinate with sales department regarding delivery schedules.

7. **Dispatching:** This is the execution phase of planning. It is the process of setting production activities in motion through release of orders and instructions. It authorises the start of production activities by releasing materials, components, tools, fixtures and instruction sheets to the operator.

The activities involved are:

(*a*) To assign definite work to definite machines, work centres and men.

(*b*) To issue required materials from stores.

(*c*) To issue jigs, fixtures and make them available at correct point of use.

(*d*) Release necessary work orders, time tickets, etc., to authorise timely start of operations.

(*e*) To record start and finish time of each job on each machine or by each man.

8. **Inspection:**

Physical identification of activities in the production floor. It is a major control tool. Though the aspects of quality control are the separate function, this is of very much important to PPC both for the execution of the current plans and its scope for future planning. This forms the basis for knowing the limitations with respects to methods, processes, etc., which is very much useful for evaluation phase.

9. **Expediting**: This is the control tool that keeps a close observation on the progress of the work. It is logical step after dispatching which is called ‘follow-up’. It coordinates extensively to execute the production plan. Progressing function can be divided into three parts, *i.e*., follow up of materials, follow up of work-in-process and follow up of assembly.

The duties include:

(*a*) Identification of bottlenecks and delays and interruptions because of which the production

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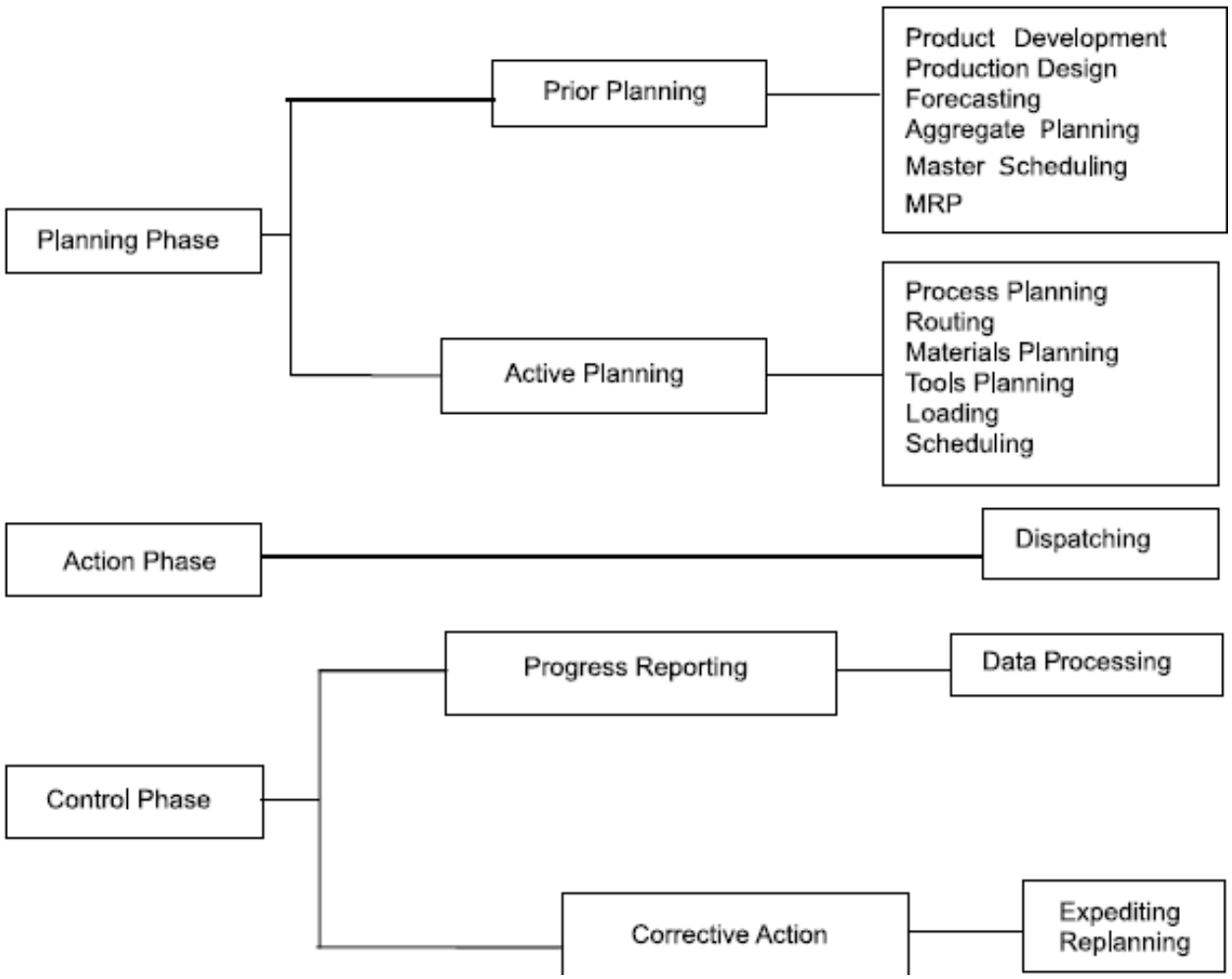
schedule may be disrupted.
(*b*) To devise action plans (remedies) for correcting the errors.
(*c*) To see that production rate is in line with schedule.

10. **Evaluation:** This stage though neglected is a crucial to the improvement of productive efficiency. A thorough analysis of all the factors influencing the production planning and control helps to identify the weak spots and the corrective action with respect to pre-planning and planning will be effected by a feedback. The success of this step depends on the communication, data and information gathering and analysis.

PHASES OF PRODUCTION PLANNING AND CONTROL

Production planning and control has three phases namely:

1. Planning Phase
2. Action Phase
3. Control Phase



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Planning Phase

Planning is an exercise of intelligent anticipation in order to establish how an objective can be achieved or a need fulfilled in circumstances, which are invariably restrictive. Production planning determines the optimal schedule and sequence of operations economic batch quantity, machine assignment and dispatching priorities for sequencing. It has two categories of planning namely

1. Prior planning
2. Active planning.

PRIOR PLANNING Prior planning means pre-production planning. This includes all the planning efforts, which are taking place prior to the active planning. Modules of pre-planning The modules of prior planning are as follows:

1. Product development and design is the process of developing a new product with all the features, which are essential for effective use in the field, and designing it accordingly. At the design stage, one has to take several aspects of design like, design for selling, design for manufacturing and design for usage.

2. Forecasting is an estimate of demand, which will happen in future. Since, it is only an estimate based on the past demand, proper care must be taken while estimating it. Given the sales forecast, the factory capacity, the aggregate inventory levels and size of the work force, the manager must decide at what rate of production to operate the plant over an intermediate planning horizon.

3. Aggregate planning aims to find out a product wise planning over the intermediate planning horizon.

4. Material requirement planning is a technique for determining the quantity and timing for the acquisition of dependent items needed to satisfy the master production schedule.

Action Phase:

Action phase has the major step of dispatching. Dispatching is the transition from planning phase to action phase. In this phase, the worker is ordered to start manufacturing the product.

The tasks which are included in dispatching are job order, store issue order, tool order, time ticket, inspection order, move order etc.

The job order number is the key item which is to be mentioned in all other reports/orders. Job order is the official authorization to the shop floor to start manufacturing the product.

Stores issue order gives instruction to stores to issue materials for manufacturing the product as per product specifications.

Tool order, instruct the tool room to issue necessary tools for manufacturing the product

Time ticket is nothing but a card which is designed to note down the actual time taken at various processes.

This information is used for deciding the costs for future jobs of similar nature and also for performing variance analysis, which helps to exercise control.

Inspection order for timely testing and inspection so that the amount of rework is minimized.

Move order. instruction is given to the materials handling facilities for major movements of materials/subassemblies.

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CONTROL PHASE

The control phase has the following two major modules:

1. Progress reporting, and
2. Corrective action.

1. PROGRESS REPORTING In progress reporting, the data regarding what is happening with the job is collected. Also, it helps to make comparison with the present level of performance. The various data pertaining to materials rejection, process variations, equipment failures, operator efficiency, operator absenteeism, tool life, etc., are collected and analyzed for the purpose of progress reporting. These data are used for performing variance analysis, which would help us to identify critical areas that deserve immediate attention for corrective actions.

2. CORRECTIVE ACTION The tasks under corrective action primarily make provisions for an unexpected event. Some examples of corrective actions are creating schedule flexibility, schedule modifications, capacity modifications, make or buy decisions, expediting the work, pre-planning, and so on. Due to unforeseen reasons such as, machine breakdown, labour absenteeism, too much rejection due to poor material quality etc., it may not be possible to realize the schedule as per the plan. Under such condition, it is better to reschedule the whole product mix so that we get a clear picture of the situation to progress further. Under such situation, it is to be re-examined for selecting appropriate course of action. Expediting means taking action if the progress reporting indicates deviations from the originally set targets. Pre-planning of the whole affair becomes essential in case the expediting fails to bring the deviated plan to its right path.

Classification of Production System

Production systems can be classified as Job Shop, Batch, Mass and Continuous Production systems.

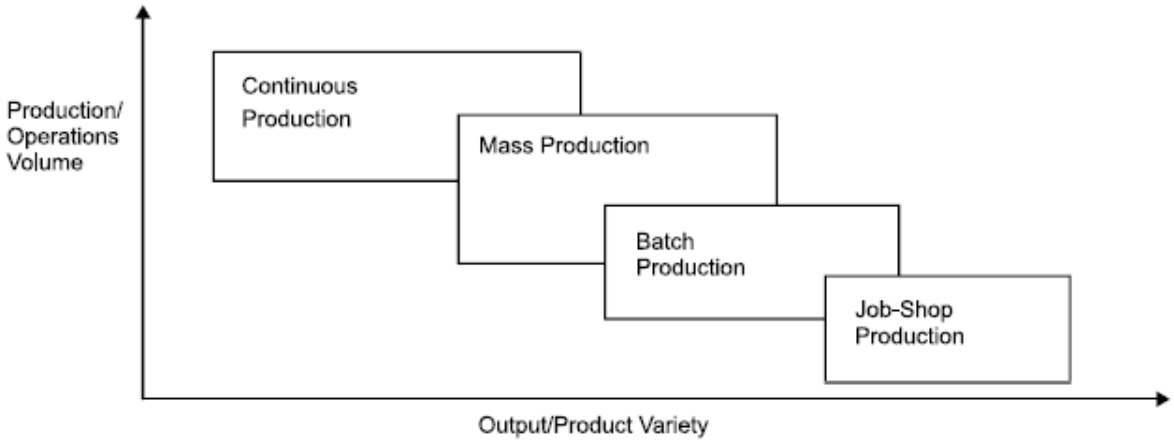

Fig. 1.2 *Classification of production systems*

JOB SHOP PRODUCTION

Job shop production are characterised by manufacturing of 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.

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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.

Characteristics

The Job-shop production system is followed when there is:

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

Advantages

Following are the advantages of job shop production:

1. Because of general purpose machines and facilities variety of products can be produced.
2. Operators will become more skilled and competent, as each job gives them learning opportunities.
3. Full potential of operators can be utilised.
4. Opportunity exists for creative methods and innovative ideas.

Limitations

Following are the limitations of job shop production:

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

BATCH PRODUCTION

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

Characteristics

Batch production system is used under the following circumstances:

1. When there is shorter production runs.
2. When plant and machinery are flexible.
3. When 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.
4. When manufacturing lead time and cost are lower as compared to job order production.

Advantages

Following are the advantages of batch production:

1. Better utilisation of plant and machinery.
2. Promotes functional specialisation.
3. Cost per unit is lower as compared to job order production.
4. Lower investment in plant and machinery.
5. Flexibility to accommodate and process number of products.
6. Job satisfaction exists for operators.

Limitations

Following are the limitations of batch production:

1. Material handling is complex because of irregular and longer flows.
2. Production planning and control is complex.

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3. Work in process inventory is higher compared to continuous production.
4. Higher set up costs due to frequent changes in set up.

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 standardisation exists and all outputs follow the same path.

Characteristics

Mass production is used under the following circumstances:
1. Standardisation of product and process sequence.
2. Dedicated special purpose machines having higher production capacities and output rates.
3. Large volume of products.
4. Shorter cycle time of production.
5. Lower in process inventory.
6. Perfectly balanced production lines.
7. Flow of materials, components and parts is continuous and without any back tracking.
8. Production planning and control is easy.
9. Material handling can be completely automatic.

Advantages

Following are the advantages of mass production:
1. Higher rate of production with reduced cycle time.
2. Higher capacity utilisation due to line balancing.
3. Less skilled operators are required.
4. Low process inventory.
5. Manufacturing cost per unit is low.

Limitations

Following are the limitations of mass production:
1. Breakdown of one machine will stop an entire production line.
2. Line layout needs major change with the changes in the product design.
3. High investment in production facilities.
4. The cycle time is determined by the slowest operation.

CONTINUOUS PRODUCTION

Production facilities are arranged as per the sequence of production operations from the first operations to the finished product. The items are made to flow through the sequence of operations through material handling devices such as conveyors, transfer devices, etc.

Characteristics

Continuous production is used under the following circumstances:
1. Dedicated plant and equipment with zero flexibility.
2. Material handling is fully automated.
3. Process follows a predetermined sequence of operations.
4. Component materials cannot be readily identified with final product.
5. Planning and scheduling is a routine action.

Advantages

Following are the advantages of continuous production:
1. Standardisation of product and process sequence.
2. Higher rate of production with reduced cycle time.
3. Higher capacity utilisation due to line balancing.

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4. Manpower is not required for material handling as it is completely automatic.
5. Person with limited skills can be used on the production line.
6. Unit cost is lower due to high volume of production.

Limitations

Following are the limitations of continuous production:
1. Flexibility to accommodate and process number of products does not exist.
2. Very high investment for setting flow lines.
3. Product differentiation is limited.

Difference between continuous and intermittent systems

Continuous (flow /mass) production	Intermittent (batch/job) production
1.Specific machinery	1.Generalised machinery
2.Permanent machine setup	2.Frequent changes in machine setup
3.Duplication of machines	3.Less machines required
4.Unskilled as well as small team of specialised labour force	4.Highly skilled labour force
5.Mechanized material handling	5.Not feasible to employ mechanized handling
6.Material handling cost is less	6.Material handling cost is higher
7.Investment in inventory is higher	7.Need for inventory is minimised
8. Few standard products in large quantities	8. Wide range of products in small quantities
9. Output on the basis of anticipation of demand	9. Output according to order received
10.Absence of maintennce may interrupt whole process	10.No danger of stoppage of whole line
11.Controlling is simpler	11.Controlling is complex

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ORGANISATION CHART FOR P.P.C. DEPARTMENT

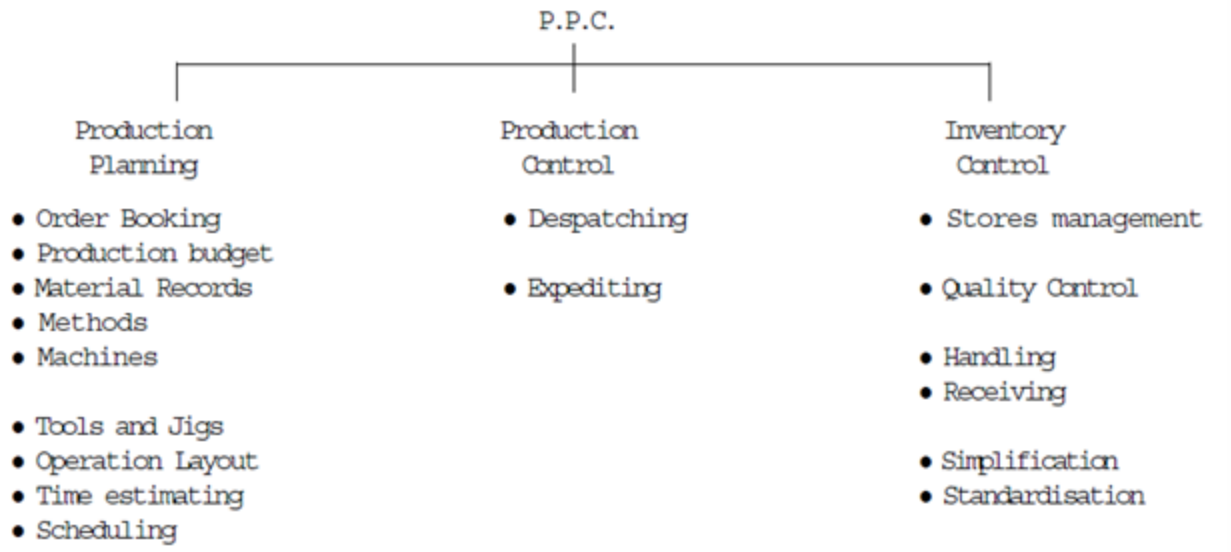

Figure : An organization chart for production management department.

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