

Once the broadest strategic decisions concerning a manufacturing company, viz.,

- (a) what business it is in, and
- (b) what territory it will serve,

are made the operations managers use the forecasts of expected demand to select the most appropriate type of factory (production facility). The choice may be one of the following, viz.,

- (a) Job shop (process focused factory)
- (b) Flow shop or assembly line system
- (c) Continuous production system or product focused factory
- (d) Project organization for manufacturing or service.

Shop floor planning and control include the principles and techniques that are necessary to plan, schedule, control and evaluate the effectiveness of production operations. Shop floor activity control integrates the activities of the factors of production of a manufacturing facility such as workers, machines, materials and material handling systems. Shop floor activity control helps in efficient implementation of master production schedule; control of priorities in processing and ensuring minimum work-in-progress and finished goods inventories. Ultimately it minimises the manufacturing cycle time and helps in improving customer service by meeting the promised delivery dates.

I THE PRODUCTION ENVIRONMENT

Management of shop floor planning and control activities differs widely in make-to-order and make-to-stock manufacturing firms. In make-to-order situations, due dates (or promised delivery schedules) are important and sequencing of customer order at various work centres becomes an important function. Make-to-stock products are generally high volume consumer products. Manufacture of standardized high volume products involves flow shop or continuous production systems requiring a shop floor control system known as flow control.

Moving from Plans to Reality

The company's operation's strategy is carried out by a series of scheduling decisions and activities at various levels in a manufacturing facility whatever may be the type of production shops, viz., job, batch or continuous production. The company's operations strategy and long range capacity plan lead to the selection of the type and amount of fixed capacity needed to meet the market demand.

The aggregate capacity plan provides the adjustable capacity to ensure effective and efficient operation to meet the demand within the intermediate time horizon. Effective scheduling and control of the available capacity in the short-term determines how effectively the capacity is utilized.

For every type of product produced, each customer order must be broken down into its component parts and the sequence of operations must be recorded in the route sheet and the jobs must be routed through various work centres as per the sequence of operations recorded in the route sheets.

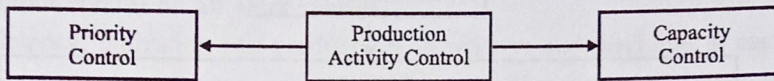
I PRODUCTION ACTIVITY CONTROL OR SHOP FLOOR ACTIVITY CONTROL

The MRP system specifies what products or components are needed in what quantities and when they are required. The production activity control (PAC) or shop floor activity

Shop floor planning and control: Principles and techniques required to plan, schedule, control and evaluate the effectiveness of production operations.

control (SFAC) directs how, when and where the products/components should be made in order to ensure the delivery of goods as per schedules or due dates. *Exhibit 15.1* shows the major concerns of production activity control.

Exhibit 15.1 : Concerns of Production Activity Control



Priority control ensures that the production or shop floor activities are carried out as per a predetermined priority plan. This involves of control orders to vendors/sub contractors and in-house production shops.

Capacity control ensures that the amount of equipment and labour hours necessary at various work centres to carry out the scheduled work are provided.

The concept of priority control and capacity control can be applied both in production systems and service systems even though the problems associated vary in nature and difficulty.

Production activity control is concerned with:

- Priority Control
- Capacity Control.

Objectives of Production Activity Control

1. To know the current status of the job (*i.e.*, what jobs are being processed, at which work centre or on which machine?).
2. To determine what should be the next job to be processed and in which work centre.
3. To ensure that the correct quantities of materials are in the right place (machine or work centre) at the right time and the required capacity and tooling are provided.
4. To maximize operational efficiency *i.e.*, efficiency of labour and machine utilization.
5. To minimize work-in-progress inventory.
6. To minimize set-up costs.
7. To maintain control of operations by monitoring job status and lead times, measuring progress and indicate corrective action when necessary.

The above objectives of a production activity control system help integrate and coordinate the human and machine resources of a production system.

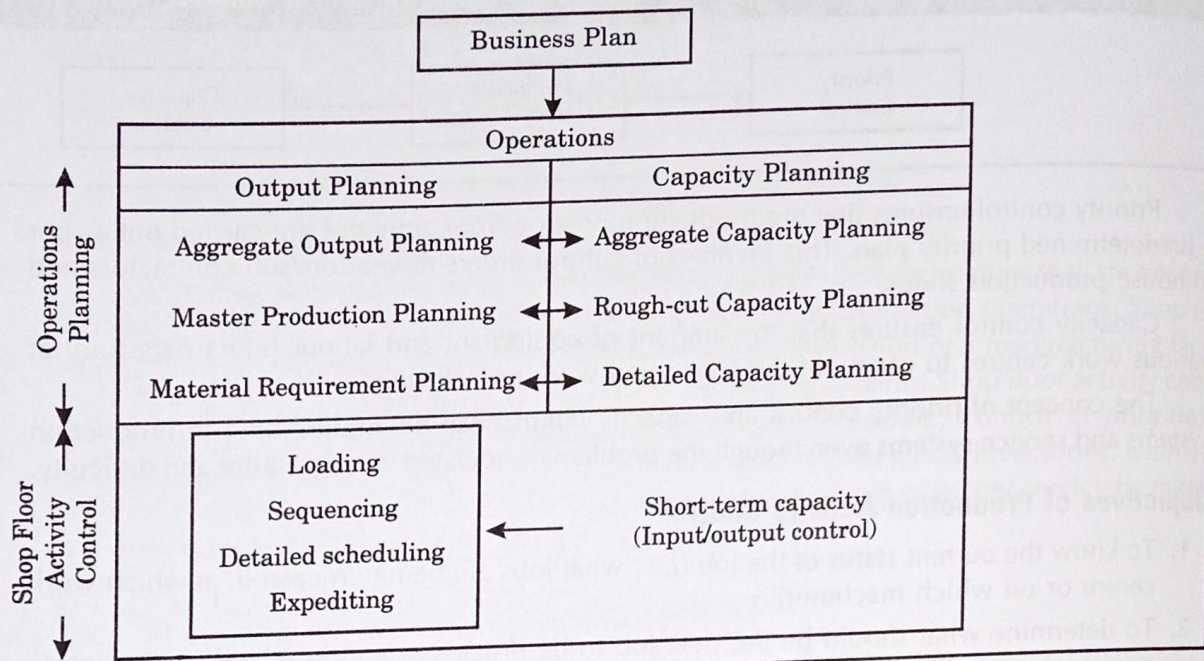
Operations Planning and Scheduling

Scheduling involves developing and assigning specific dates for the start and completion of the necessary tasks or operation in a production shop floor. The output plans indicated in master production schedules must be translated into detailed operational schedules to be implemented on the shop floor on day to day basis. This operations scheduling and control process includes activities such as priority sequencing, detailed scheduling, loading, expediting and input/output control.

Exhibit 15.2 shows the operations planning and scheduling system. The various terms used in operations planning and scheduling are described briefly.

1. **Loading** : Loading, sometimes known as shop loading or machine loading, is the assignment of jobs to various work centres or machines for future processing giving due consideration to the sequence of operations as per the route sheet and the priority sequencing and machine / work centre utilization. Loading establishes the amount of load (labour hours or machine hours) each work centre or machine must carry during the future planning period (weekly or monthly). This will result in load schedules which indicate comparison of labour and machine hours needed to produce the MPS with the

Loading:
Assignment of jobs to various work centres or machines for future processing.



Sequencing: The process of determining the sequence of processing of all jobs at each centre or machine.

Expediting: The special effort or action needed to keep the job moving through the production facility on time as per the detailed schedule.

Input-output control: Managing work flow and queues at work centres.

2. **Sequencing :** Sequencing is the process of determining the sequence of processing of all jobs at each work centre or machine. It establishes the priorities for processing the jobs which are waiting in the queue at each work centre or machine. The priority sequencing is done as per a priority sequencing rule which will be discussed later in this chapter.
3. **Detailed scheduling :** It is the process of determining the start and finish times (dates) at each work centre or machine for all jobs. Detailed scheduling is possible only after loading and sequencing. By knowing the duration of time each job takes to complete the operation at each work centre/machine and also by knowing the due dates, the detailed schedule indicating the start and finish dates can be established.
4. **Expediting :** It is the special effort or action needed to keep the job moving through the production facility on time as per the detailed schedule. Disruptions in production due to machine/equipment break downs, non-availability of materials when needed, last-minute priority changes due to special jobs having over-riding priorities, necessitate expediting action for some important jobs.
This requires operations managers to deviate from plans and schedules.
5. **Input-output control :** Output plans and schedules call for certain levels of capacity at a work centre or machine but actual utilization may differ from what was planned. Input-output control is a key activity that provides detailed information about actual utilization of a work centres or machine's capacity versus the planned capacity utilization. It gives a picture of flow of jobs between work centres. Problems such as insufficient capacity at work stations and problems at upstream work stations can be identified through input-output control.

Shop Floor Planning and Control

The various activities included in shop floor planning and control are –

1. Assigning a priority to each order which help in setting the sequence of processing orders at work centres.

2. Issuing dispatching lists to each work centre. These lists indicate which orders due to be produced at a work centre, their priorities and completion dates/times.
3. Updating the work-in-progress inventory. Informations such as number of good parts coming out of each processing step (operation), amount of scrap, amount of rework required and number of units short on each order.
4. Providing input-output control on all work centres.
5. Measuring the efficiency, utilization and productivity of workers and machines at each work centre.

Scheduling

Scheduling pertains to establishing the time of the use of specific resources within an organisation. It relates to the use of equipment, machines, facilities and human activities. Scheduling is necessary in every organisation regardless of the nature of its activities. *For example*, in manufacturing organisations, production must be scheduled, which means developing schedules for workers, machines, equipments, maintenance etc. In service organisations such as hospitals, admission, surgery, nursing assignments and support services such as cleaning, maintenance, security, meal preparation etc., must be scheduled. In educational institutions, classrooms, instruction and students must be scheduled.

Scheduling, means organising a production line to produce products in *time* efficiently with least use of time and maximum utilisation of resources (especially men and machines).

Scheduling: Process of organising a production line to produce products in time efficiently with least use of time and maximum utilisation of resources.

Objectives of Scheduling

- (i) To prevent unbalanced use of time among departments and work centres or to evenly load all machines in the production line.
- (ii) To utilise machines and labour in such a way that the output is produced within the established lead time so as to (a) deliver the products/services in time and (b) complete production in the shortest cycle time possible at minimum total cost of production.
- (iii) To reduce idle time of labour and machines, which might be caused due to waiting for materials, waiting for movement, waiting for inspection and waiting for want of work.
- (iv) To fix up delivery dates for various manufacturing activities and for the finished products.
- (v) To increase the efficiency of production or productivity.

Managerial Considerations in Scheduling

Scheduling in production and operations management helps to allocate scarce resources. *For example*, machine time is a scarce resource that is allocated to different jobs, labour (or employee) time is allocated to different activities and facilities are scheduled for a given activity at a particular time period. In all these scheduling tasks, different criteria may be used in deciding which of several schedules is best. Those criteria may relate to the amount of time the machine or equipment might idle, the importance of a certain order or a certain customer, or the level at which the resource is utilised. In general there are **six criteria** that may be used in **evaluating different possible schedules**. They are:

- (i) Providing the product or service when the customer wants it.
- (ii) Minimising the length of time taken to produce that product or service (referred to as flow time)
- (iii) Minimising the level of work-in-progress (WIP) inventories
- (iv) Minimising the amount of idle time of equipment or machine.
- (v) Minimising the amount of idle time of employees and
- (vi) Minimising costs

Scheduling in production and operations helps to allocate scarce resources more effectively.

Elements of Scheduling

- (i) **Demand forecasts/customer's firm orders**—determine the delivery dates for finished products.
- (ii) **Aggregate scheduling** : Tentative schedule based on demand for quarterly or monthly requirements. Enables employment of available resources in meeting the demand by adjusting the capacity. Needs rough-cut capacity planning.
- (iii) **Production plan** : Showing output levels planned, resource requirements, and capacity limitations and inventory levels.
- (iv) **Master production schedule** : Dates committed and desired quantity to be produced on a daily, weekly, monthly or quarterly basis.
- (v) **Priority planning** : Master schedule is exploded into components and parts that are required to produce the product.
- (vi) **Capacity planning** : Regulates loading of specific jobs on specific work centres or machines for specific periods of time.
- (vii) **Facility loading or machine loading** : Loading work centres/Machines after deciding which job to be assigned to which work centre/machine i.e., actual assignment of jobs to machines taking into consideration priority sequencing and machine utilisation.
- (viii) **Evaluation of workload** : To balance the workload on various work centres /machines when resources are scarce or limited. Excess load in one work centre or machine has to be transferred to other work centre or machine having spare capacity.
- (ix) **Sequencing** : Priority sequencing of jobs is done to maximise workflow through work-centres or machines to minimise delay and cost of production.

Information Needed for Scheduling Process

Before starting scheduling process it is necessary to collect sufficient information about jobs, activities, employees, equipment, machines or facilities that are to be scheduled. Depending on the scheduling situation, various types of data must be collected. They are:

- (i) **Jobs** : (a) Due dates, (b) Routings with standard set up and processing times, (c) material requirements, (d) Flexibility of due dates, (e) Importance of completing the job by due date.
- (ii) **Activities** : (a) Expected duration, (b) Precedence relationships, (c) Desired time of completion.
- (iii) **Employees** : (a) Availability, (b) Job capabilities, (c) Efficiency at various jobs, (d) Wage rates.
- (iv) **Equipment/Machine** : (a) Machine or work centre capacities, (b) Machine or work centre capabilities, (c) Cost of operation, (d) Availability
- (v) **Facilities** : (a) Capacities, (b) Possible uses, (c) Cost of Use, (d) Availability.

Problems of Scheduling

- (i) Lack of correct and upto date information concerning lead time, operation or processing time, lot size and prevailing load on machines and work centres.
- (ii) Resource constraints capacity shortfall and delay in supply of materials.
- (iii) Absenteeism, lack of skill and experience in labour and inefficiency of labour
- (iv) Type of production viz., Job production, Batch production, Mass production and Continuous production.
- (v) Problems in machine loading and line balancing.

