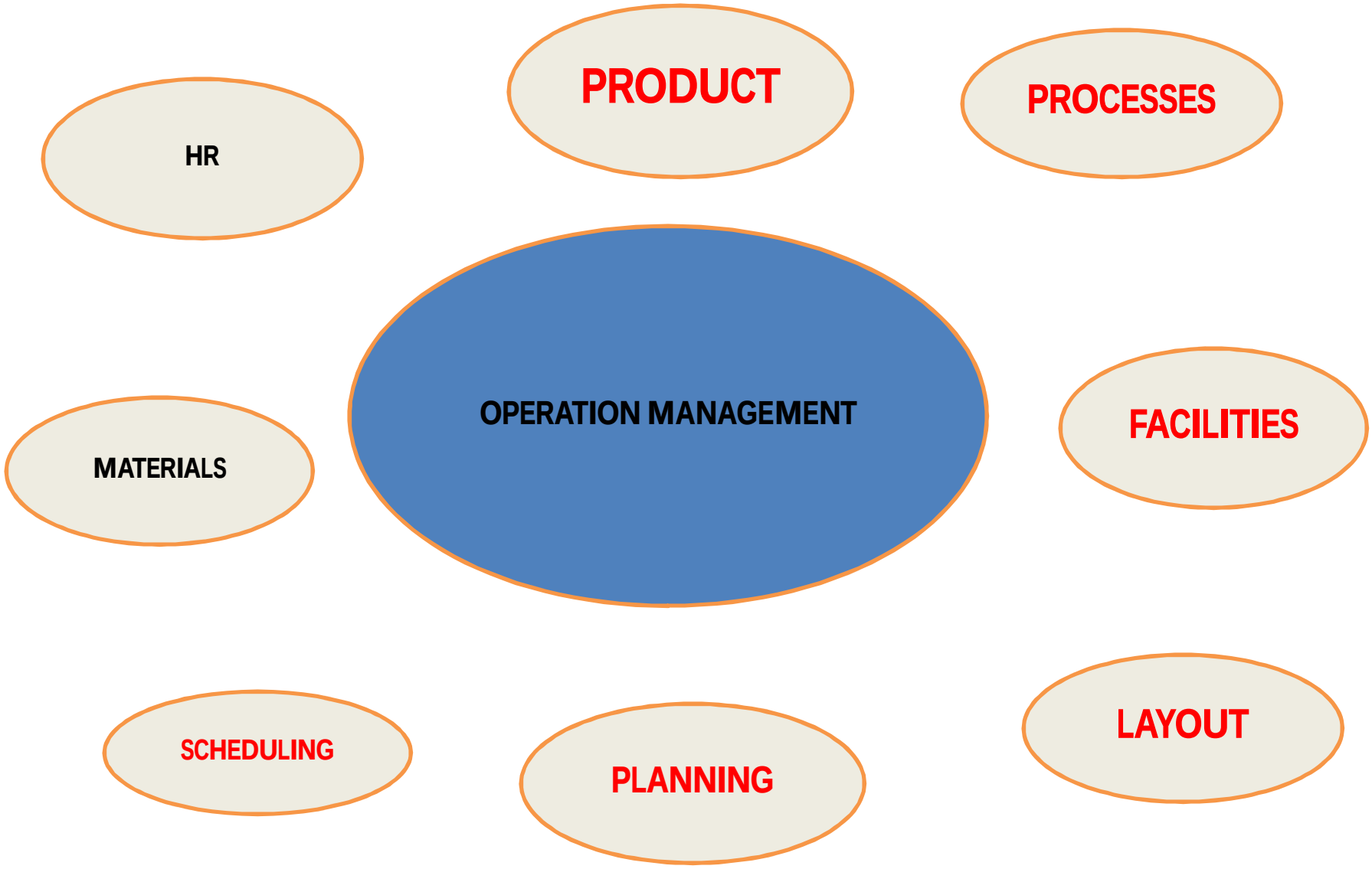
PRODUCTION MANAGEMENT


PRODUCT
PROCESSES
HR
OPERATION MANAGEMENT
FACILITIES
MATERIALS
LAYOUT
SCHEDULING
PLANNING

Product -Definition

Product:

The end **result** of the manufacturing **process** to be offered to the **market place** to satisfy a need or a **want.**

Inventory Control

- Importance of materials availability at various stages of production.
- Inventory Control & Stores Management
- Complex Function
  - No over stocking
    - Finance
    - Obsolescence
    - Space etc

Inventory Control

- No stock Outs
  - Loss of production,
  - Loss of business
  - Imbalances adding costs

Inventory Management

- What is meant by Inventory?
- Why inventory is necessary?
- What are the various forms of the inventory?
- What are the costs involved in inventories?
- What are the risks associated with the inventories?

Materials Management

Importance :

- Materials form major part of the Product cost – 60% or so
- With contribution at say 15%, every % saved in materials is equal to approx 4% increase in Sales.
- Has direct bearing on the profitability
- Timely and right quality of materials availability decides the overall productivity of any organisation.
- Cannot afford too much or too little – both dangerous for survival and growth.

Materials Management

- Functions:
  - Material Planning and controlling
  - Purchasing/Vendor development
  - Stores and inventory control

Inventory Management

- Forms bulk of current assets.

Stock outs

- Loss of profit from the missed sales
- Loss of customer and good will
- Loss of production
- Reduced machine/men utilization

Excessive Inventory

- Inventory carrying costs
- Cost of storage
- Deterioration/obsolescence/pilferage

Just in Time Production System

Inventory forms one of the major cost of production

Inventory is a must to enable smooth and cost effective production and hence one looks for most optimum inventory planning balancing between the two objectives.

Just in time (JIT) as the name suggests is to work towards getting parts at a workstation just when they are required and move through the operations quickly.

Just in Time Production System

- JIT is an integrated set of activities designed to achieve high volume production using minimal inventories of raw materials, work in progress and finished goods.
- JIT works on a pull system-when an item is sold, the market pulls a replacement from the last work station, that is finished goods, the last workstation in turn pulls parts from the earlier station and so on.
- The process keeps getting repeated to meet market requirements

Just in Time Production System

- Essentials for JIT System to succeed:
  - High quality and strong vendor relationship
  - Vendor reliability
  - Plant reliability
  - Adequate Vendor and Captive plant capacities
  - Strong back ups
  - Fairly steady demand

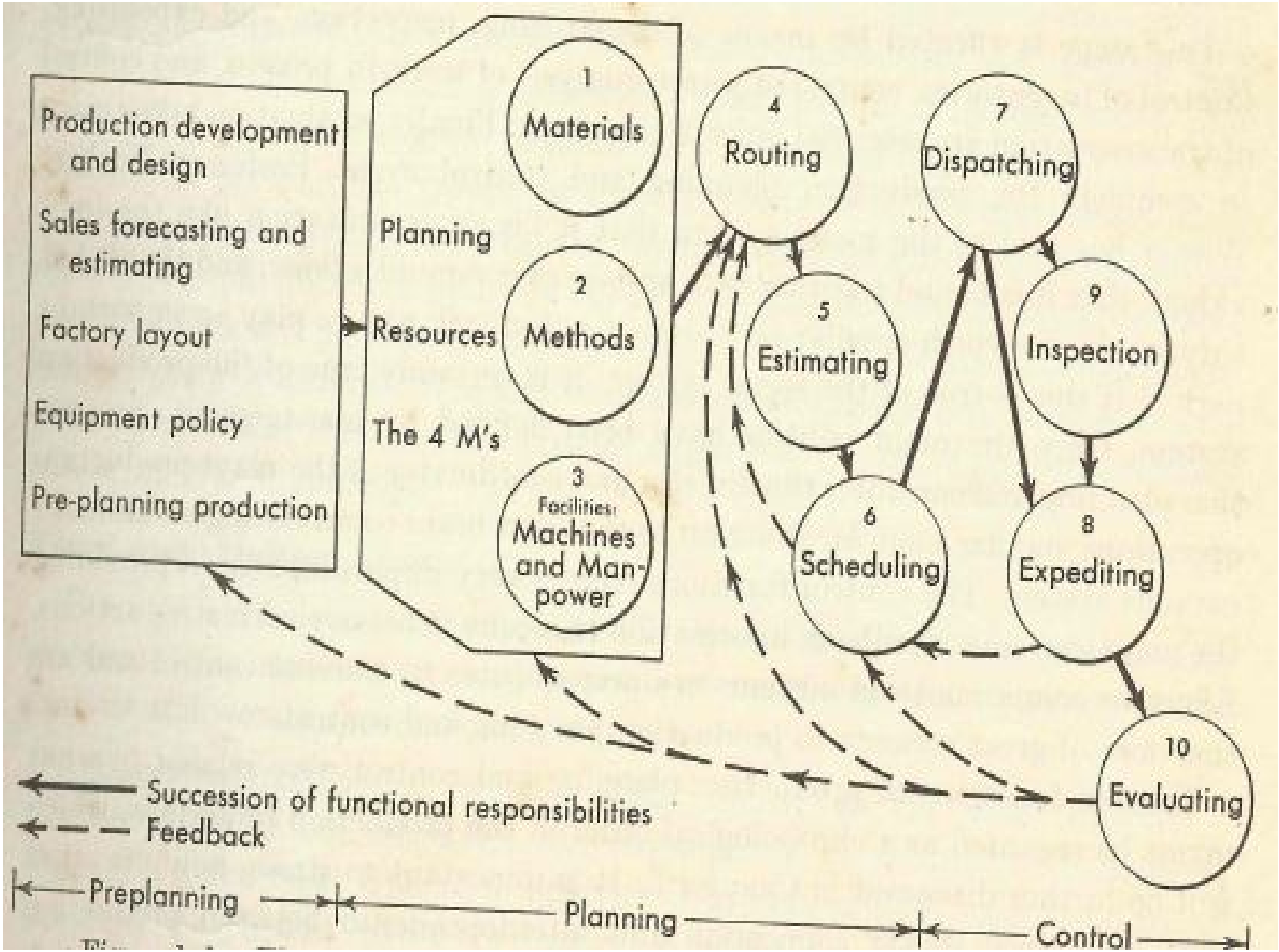
SCHEDULING

- Business plan transformed into a Master Production plan
- Master production plan –Derive resource requirements and check availability
    - Labour, skills/numbers
    - Plant & machinery
    - Finance
    - Utilities and services

and decide and/or agree on the plan

SCHEDULING

- Scheduling is the final stage of PPC, where all the production activities are coordinated and projected on a time scale.
- It tells what resource should be doing what and when.
- Varies with the manufacturing process
- It involves a process with which we try to match the requirements set out in the production plan (quantities,delivery) with the available facilities, including vendors.


Production development and design
Sales forecasting and estimating
Factory layout
Equipment policy
Pre-planning production
Planning
Resources
The 4 M's
1
Materials
2
Methods
3
Facilities:
Machines and Man-power
4
Routing
5
Estimating
6
Scheduling
7
Dispatching
8
Expediting
9
Inspection
10
Evaluating
Succession of functional responsibilities
Feedback
Preplanning
Planning
Control

SCHEDULING

- Several ways to meet the requirements, different routings through machines or processes, sequence of products, priority scale, when and how to expand facilities incl. short term through overtime etc.
- The best method is decided – costs which meets the objectives

SCHEDULING

Objectives

- Meet due dates
- Minimise late completion of jobs or tardiness
- Minimise completion time
- Minimise response time
- Minimise idle time
- Minimise overall costs
- Minimise WIP and other inventories
- Maximise resource utilisation.

SCHEDULING

Forms of scheduling

- A production flow diagram:

  Number of items to be manufactured for the final assly line and items to be made concurrently, the master flow diagram takes into account the sequence of operations and indicates when work on each component must start. In order to meet required date of completion of the product.

SCHEDULING
Forms of scheduling

- A production master diagram for large projects:

  - Useful for static layouts where the tools, materials, machines and operators flow from one object to another and requires high level of scheduling skills to coordinate the activities of all the facilities by appropriate phasing to achieve the desired level of utilsation and effectiveness of resources.

SCHEDULING
Forms of scheduling

- A cumulative output progress chart:

  For new jobs likely to take several months or years, the initial rate of production and subsequent rate of production are considered with due weightages to improvements through learning ned to be applied.

SCHEDULING
Forms of scheduling

- An outline master programme:

  - This merely translates the general requirements specified by the sales as a basis on which final and detailed schedules can be worked out.

A schedule for order breakdowns:

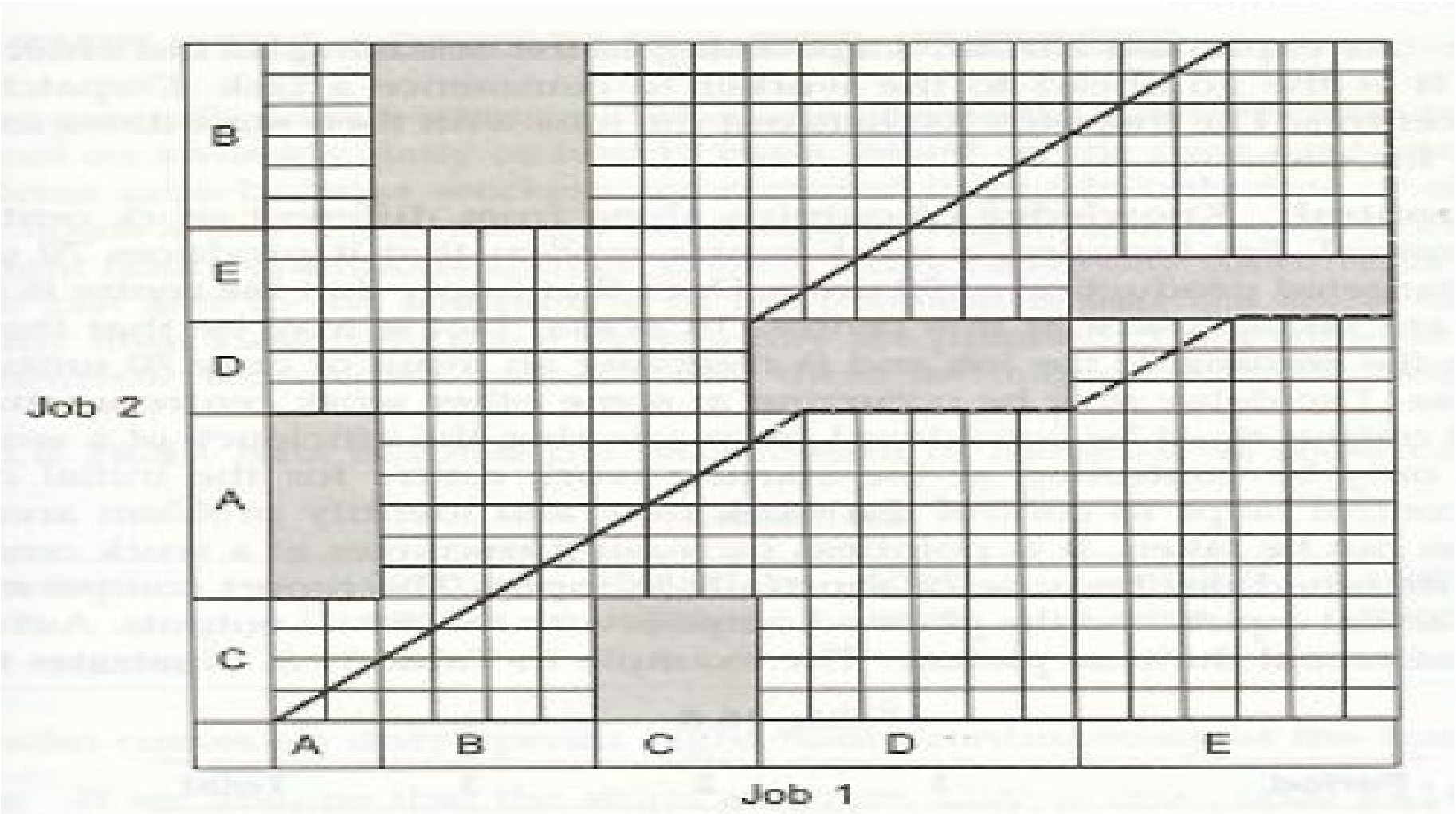
- This is a form of expressing the rate at which the work should progress, particularly useful for decentalised scheduling as it only indicates the quantities and dates for completion.

SCHEDULING

Basic scheduling problems

- Flow production scheduling for fluctuating demands
  - – Smoothening problems
- Batch production scheduling, when products are manufactured consecutively
  - – Assignment problems
- Scheduling orders with random arrivals
  - - Product sequencing

SCHEDULING



SCHEDULING

Basic scheduling problems

- Flow production scheduling for fluctuating demands

  - When sales of some products are subject to seasonal fluctuations, it can be met in one of the following ways;

    1. Have a static production programme, coupled with sufficient inventory to satisfy the fluctuating demands. Inventory levels will vary with fluctuating demands but replenishment at constant flow.

    2. Have a fluctuating production programme, to cater to changing demand and keep constant inventories with safety cushion between production and marketing.

    3. A combination of the two systems, with total costs at minimum, through proper balance between the amount of fluctuations and stock levels.

SCHEDULING

Basic scheduling problems

- Batch production scheduling, when products are manufactured consecutively

  When the rate of production is higher than the rate of consumption, the plant resorts to batch production. To fully utilise the available time, plant undertakes production of several products in succession.

  The scheduling has to consider the plant to produce n products one at a time and the manufacturing cycle is concluded when all products have been produced. The cycle length is determined by the total time for all the products in the cycle. The quantities of each products produced must be sufficient to cover the requirements of the cycle time, to avoid overstocking or stock outs. The quantities are governed by the batch production principles.

SCHEDULING

Basic scheduling problems

- Batch production scheduling, when products are manufactured consecutively

  The issues to be analysed include:

  - How to go about optimising the whole schedule
  - Criterion for optimisation
  - Optimum schedule and optimum batch quantities for individual products
  - To balance the two objectives

  More complex situation arise when products are manufactured on a batch basis, some consecutively and some concurrently, with overlapping production time. Requires combination of techniques including linear programming/assignment models etc.

SCHEDULING

Basic scheduling problems

- Batch production scheduling, when products are manufactured consecutively

The assignment problem:

- To assign the tasks to the machines or to the operators in such a manner as to minimise the processing cost and time.

- Distribution according to capacity: Effective utilisation of process capacity with the best mix. Assign the given tasks to the available machines and work out the cost of operating production facilities with alternatives, using linear programming model.

- Effects of Overtime or subcontracting, though may provide extra capacity, it is to be evaluated wrt the extra costs

SCHEDULING

Two objectives, which may not be compatible:

- Batch size optimisation for individual products
- Optimal solution for the whole production schedule

The batch sizes for optimal schedule may differ from the respective batches required for individual product optimization, and in order to reconcile the two, a compromise production schedule is constructed.

This requires production range which specifies the allowable deviations from the individual optimums and thereby provides a certain amount of flexibility in constructing the schedule.

The fluctuations in consumption are taken care of through appropriate Safety stocks. The changes in average consumption and trends in consumption may affect the batch size and the schedule.

This requires constant revaluation in the light of changing circumstances.

SCHEDULING

- Critical Path Scheduling:

  - Large & Complex projects, with interrelationship among these tasks, like design and manufacture of special purpose machine or development and introduction of a new product or construction of a building.

Techniques:

- The Critical Path Method (CPM)
- Project Evaluation and review Technique (PERT)

SCHEDULING

- Critical Path Method:
  - Begins with determination of each job that makes up the project
  - Relationship of jobs with each other (preceding/succeeding or independent)
  - Time for each job

Usually expressed in days/weeks

Job	Description	Imm. Predecessor	Time-days
G	Start		0
H	Procure matl for part 1	G	4
I	Procure matl for part 2	G	3
J	Machine part 1	H	6
K	2	I	5
L	Assemble 1 and 2	J & K	2
M	Inspect & Test	L	1
N	Finish	M	0

SCHEDULING

- Critical Path Method:

  To draw network, we need to find

  S – earliest start for the project

  ES – earliest start for each job

  t - time required to complete the job

  EF - ES+t

  F - earliest finish for the project

G---H-----J----L----M----N

G---I------K----L

SCHEDULING

- Critical Path Method:

  To draw network, we need to find

  T – target completion

  LF - latest finish without delay in T

  t - Time for the job

  LS – LF-t

Slack = LS-ES or LF-EF

SCHEDULING

- Critical Path Method:

Job	Possible start time		Possible finish time		Slack time
	ES	LS	EF	LF	
G	0	0	0	0	0
H	0	0	4	4	0
I	0	2	3	5	2
J	4	4	10	10	0
K	3	5	8	10	2
L	10	10	12	12	0
M	12	12	13	13	0
N	13	13	13	13	0

SCHEDULING

- Critical Path Method:

  Benefits :

  - Determines probable completion dates with alternate plans
  - Evaluation of progress
  - Corrective steps and effect on cost and completion
  - To evaluate ways to reduce completion ,if required through looking at activities on critical path, continuous review
  - To explore possible reduction in costs, utilising slacks

SCHEDULING

- PERT – A refined CPM

  - Analyse description of project in terms of activities and events
  - Activity is performance of a Task and is like a job in CPM
  - An event represents the start or completion of a task
  - Time estimates for each activity are made on the basis of;
    - optimistic time , a
    - most likely time , m
    - pessimistic time , b and

  Average is taken as (a+4m+b)/6

SCHEDULING

- PERT – A refined CPM

Example –

Event	
10	Start material procurement
20	Complete part 1 material procurement
30	Complete part 2 material procurement
40	Complete part 1 machining
50	Complete part 2 machining
60	Start assembly
70	Complete assembly
80	Complete inspection and testing

SCHEDULING

- PERT – A refined CPM

Event	TE	TL	Slack TL-TE	
10	0	0	0	
20	4.2	4.2	0	a=3, m=4,b=6
30	3.0	5.4	2.4	
40	10.2	10.2	0	
50	7.8	10.2	2.4	
60	10.2	10.2	0	
70	10.2	10.2	0	
80	13.3	13.3	0	

SCHEDULING

- PERT and CPM, limitations:

  - Requires clear understanding of interrelationships of activities.

  - Estimation of time, with resource and other factors

  - Cost comparisons of alternatives

  - Skilled job and also costly