Operation Management

MME - 1216

Four modules.

Dr. B. B. Pami

(3) Make the value flow without interruption.
(4) Let the customer pull value from the producer.
(5) Pursue perfection.

Components of Lean Manufacturing.

The following are the components of lean manufacturing.

1. Standardized production.
2. Continuous improvement in production.
3. Adoption of JIT in production.
4. Design for manufacturing.
5. Poka yoke adoption.
6. Cellular manufacturing.
7. Single minute Exchange Die.
8. Flexible Workforce.

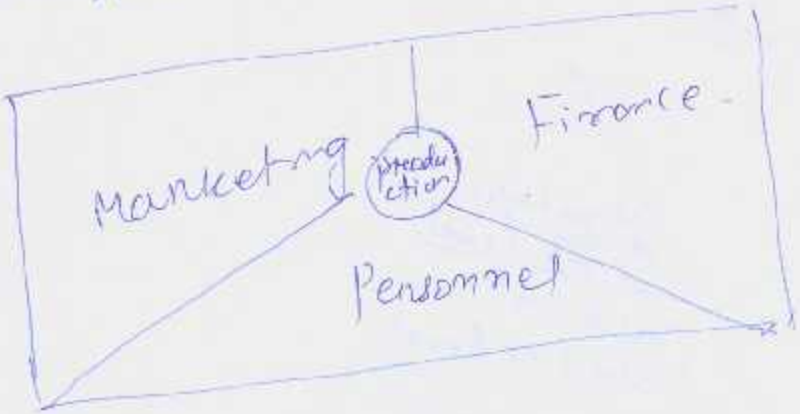
X ——— X

Operation Management

Module I

§. Functional subsystem of an Organization -

An organization consists of four subsystems. viz - Marketing, Production, Finance and personnel.



§. Operation Management -

Production/Operation management is the process which combines and transforms various resources used in the production/operation subsystem of the organization into value added products/services in a controlled manner as per the policies of the organization.

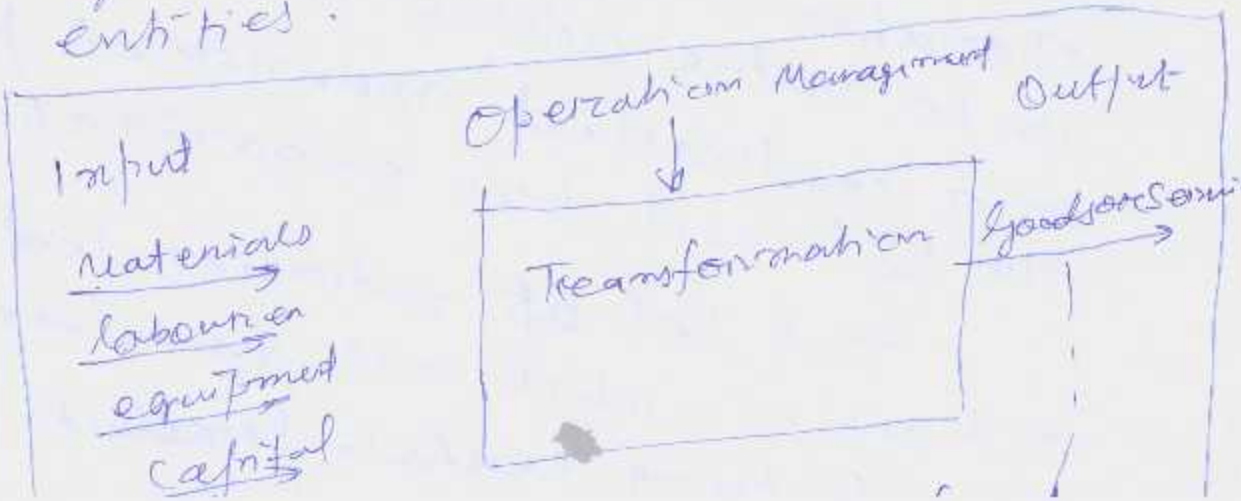
The set of interrelated activities which are involved in creating certain products is

If the same concept is extended to service management, then the corresponding set of management activities is called as Operations management.

The management decisions are classified into strategic decisions, tactical decisions and operational decisions.

5. System concept of production.

System is a collection of interrelated entities.



The techniques and procedures used in the preduction/operation Sabsystem are as follows.

1. Forecasting.
2. Location and layout techniques.
3. Preadut design and analysis.
4. Preaduction control techniques.
   (a) Aggregate planning.
   (b) Master preaduction schedule.
   (c) Material requirement planning
   (d) capacity planning.
   (e) scheduling and control.
      - Line loading
      - Line of balance
      - Single m/c scheduling
      - Flow shop scheduling.
      - Jobshop scheduling.
5. Maintenance Management.
6. Feedback and control techniques.
   (a) Quality control.
   (b) Inventory control.

§ Types of Preaduction System.

undergoes the same sequence of operation using specialised equipments usually positioned along a production line.
Example: Auto assembly, assembly of TV sets etc.

Flow shop can be classified into continuous flow shop and intermittent flow shop.

2. Job Shop - This is a conventional process in which units of different types of products follow different sequences through different shops. This type of subsystem has more flexibility. But this system results into more set-up time, more in process inventory complex scheduling, varying quality etc.

3. Batch Manufacturing

They produced some intermediate varieties of products with intermediate volumes. The volume of any single product may not be sufficient to justify the use of a dedicated set of equipments for its production. The range of possible operations is much narrow than in a job shop.

4. The Project

with a set of well defined tasks in terms of resources required and time phasing.

Example: Dam Construction, Starting new industries etc.

8. Strategic Management —

The process of making decisions about their future in this complex and changing environment is called Strategic Mgt.

This mgt has two phases.

(1) Formulation of Strategy.

(11) Implementation of Strategy.

Strategy formulation is concerned with.

- Defining the organisations mission.
- Establishing long and short range objectives to achieve the organisations mission.
- Selecting the Strategy to be used in achieving the organisations objective.

Strategy implementation consists of
- Organisation Structure,
- System and processes with Chosen Strategy.

9. Corporate Strategies.

(1) Stable growth strategy.

- Concentric diversification.
- Vertical diversification
- horizontal diversification.
- Conglomerate diversification.

3. Emelgamie Strategies :-

4. Retrenchment Strategies.

- Turnoround Strategy.
- Desinvestment strategy.
- Liquidation Strategy.

5. Combination Strategy.

- Simultaneous Strategy.
- Sequencial Strategy.

6. Generic competitive Strategies.

A list of generic competitive (business) strategies is as follows.

- Overal cost leadership Strategy.
- Differentiation Strategy.
- Focus Strategy.

7. Functional Strategies.

Under any these four Strategies are there.

1) Marketing Strategies.
2) Financial Strategies.
3) Personnel Strategies.

8. Gross Domestic Product (GDP)

GDP of a nation is the sum of values of goods and services produced in that nation in a year.

India has very low per capita GDP. After liberalization many multinational companies are coming to India to set up their business units hence to avail the raw material and cheap labour. This gives increased opportunities to India and hence the increase the GDP of India.

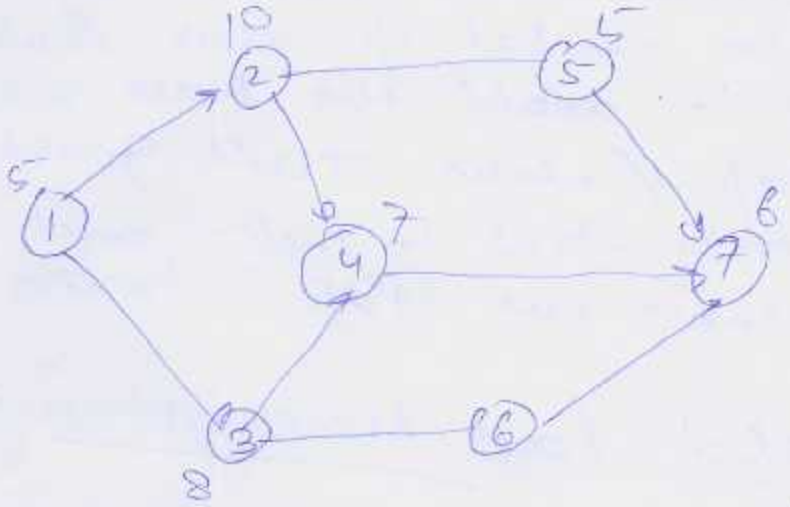
9. World Class Manufacturing.

World Class manufacturing concept is a recent origin. The following attributes of World Class manufacturing are aimed to fulfil the customer demand.

1. Product with high quality.
2. Product with competitive price
3. Products with enhanced features
4. Products in wider variety.
5. Products delivered with shorter lead times.
6. Products delivered in time.
7. [illegible] in fulfilling promises

5. Line Balancing

The main objective of flow control in flowshop is to balance the assembly line. The assembly line is represented in the form of a precedence diagram. Sample of this is here.



The precedence diagram specifies the order or sequence in which the activities must be performed. Each circle is a node and the number inside each circle identifies particular operation. The number outside the circle represents the duration of the operation. Arrows indicates the direction of flow operation.

$$\text{cycle Time} = \frac{\text{Production Time}}{\text{Demand per period.}}$$

§ Objective of Assembly Line Balancing.

The objective of assembly line balancing is to subdivide the network into several subnetworks without violating the precedence relationships and allocating operations to each station without exceeding the cycle time.

This type of problem comes under combinatorial category. Here we have to use some heuristics for this purpose

1. Ranked positional weight (RPW) method
2. COMSOAL.

(1) Rank Positional weight Method

This method assigns those jobs first whose followers have the largest total time. The positional weight of a work element is its own processing time plus the processing times of all the following work element. In this the work element with the highest positional weight is selected and assigned to the current station. The generalized algorithm stated earlier can be used

using the maximum rank positional weight as the selection criterion.

Example: page 186. OPM, Panneerselvam.

§ THE COMSOAL ALGORITHM —

The computer operations for assembly line (COMSOAL) was developed by Arcus. Here simulation method is used. We can choose the solutions that satisfies our need the most.

The following conditions must be satisfied.

(i) All its immediate predecessors are already assigned.

(ii) Its preceding time is less than or equal to the unassigned cycle time.

Unlike RPW method, COMSOAL is an iterative method. This algorithm is demonstrated using the assembly network which is given in RPW method.

Example. ⊗. POM, Panneerselvam. p. 188.

§ Model For Assembly Line Balancing.

The objective assembly line balancing is to minimize the number of work stations & maximize the balancing efficiency.

5. Integer Programming Model to Minimize Number of Work stations.

Here an integer programming model to minimize the number of work stations is presented. The notations used here as follows.

A_i – a non negative integer variable which is the work station number in which task i is assigned (A_i indicates that the task i is not assigned any station).

C – cycle time.

N – Number of task to be assigned.

H – Highest station number (equal to N)

i – Task number ($1 \le i \le N$)

j – station number ($1 \le j \le N$).

T_i – Time required to perform task.

W_j – The set of all tasks which can be assigned to station j by virtue of task precedence constraints.

W_j' – The subject of tasks in W_j that are actually assigned to station j.

P_i – The set of task which must immediately precede task i.

Minimize $Z = A_N$.

Subject to $\sum_{i \in W_j'} T_i \le C, \quad j = 1, 2, 3 \cdots H$

In the above model

(i) The objective function minimize the number of workstation or equivalently, Xn, which is the station to which the unique terminal task N is assigned.

(ii) Constraints set(1) ensures that the sum of the task times assigned to each station is less than ~~or~~ equal to the cycle time (c).

(iii) Constraints set(2) ensures that all predecessors of a given task are assigned to same preceding station or the current station before ~~=~~ j is assigned.

5. Model to minimize balancing Delay.

Here a model is developed to minimize balancing delay. The ~~details~~ are discussed in POM. Paneerselvam P191.

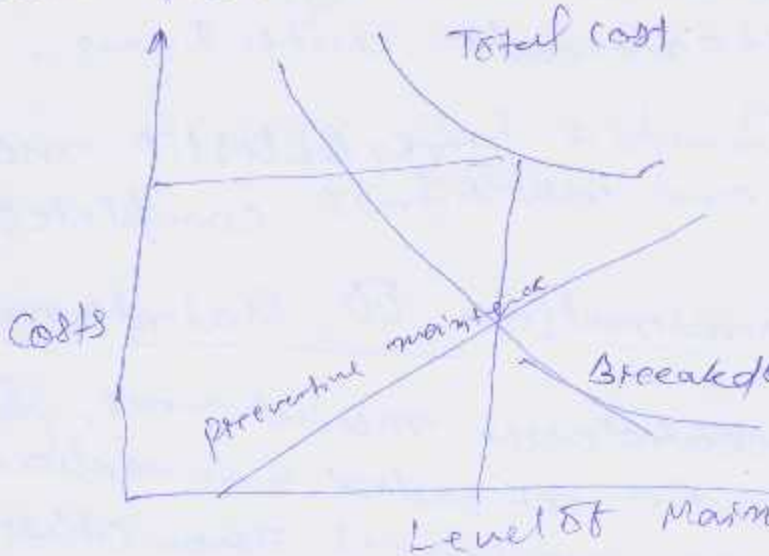
Module III

5. Maintenance Planning and Control.

Objective – If a firm wants to be in the business competitively, it has to take decision on whether to replace the equipment or to retain old equipment by taking the cost of maintenance & operation in to account.

5. Types of Maintenance.

Maintenance activities can be classified as (1) Preventive maintenance (PM) (2) Breakdown maintenance



5. Basic Reasons for replacement.

There are two reasons

(1) physical impairment

(2) Obsolescence.

physical impairment refers only to changes to physical condition of the machine itself.

Obsolescence is mainly due to improvement of the tools of production, mainly improvement in technology.

It is not economical to produce products with the same machine under any of the

So, machines are to be replaced periodically. The replacement study can be classified in to two categories.

(a) Deterministic type of items that deteriorate with time.

(b) Simple probabilistic model for items which fail completely.

5. Determination of Maintenance Crew Size

In breakdown maintenance, breakdown are to be attended immediately by maintance mechanics, otherwise it will lead to stoppage of production. So, determination of maintenance crew size is an important decision. The crew size can be achieved by using mathematical models or Simulations.

6. Crew Size Determination using Analytical Queuing Model.

In this case the determination of number of maintenance mechanics using analytical queuing model is demonstrated through an example

5. Total preoductive Maintenance (TPM)

TPM is a management system for optimizing the preoductivity of manufacturing equipment thirough systematic equipment maintenace involving employees at all levels. TPM is a maintenace preogreame equipmat maintenace involving employs at all levels. The goal of TPM is to maredly increase preoduction while at the same time, increasing employees moreal and job satisfaction.

5. Objectives of TPM.

1. Creating collective culture relating attainment of max. efficiency.
2. Using the system so as to prevent losses and to reach zero defect and zero breakdown in the manufacturing process.
3. Involving the entire workforce from bottom to top.
4. To obtain zero losses by integrating the activities of teams with the preoduction system.

§. Wastes Eliminated in TPM.

TPM eliminates 6 big losses which are as focused.

1) Breakdown, which can result in long expensive repair.
2. Setups and changeovers which can take much longer time than needed.
3. Idling and minor stoppages which are hard to quantify and add up to big losses.
4. Reduced equipment speed which results in gradual deterioration of equipment cycle times.
5. Start-up losses which can take much time to steady state after a change.

§. Equipment Maintenance Techniques

TPM uses four equipment maintenance techniques.

These are

(I) Preventive maintenance
(II) Corrective "
(III) Maintenance prevention

5. Benefits of TPM.

The following benefits can be achieved by TPM.

(1) Increased equipment productivity.
(2) Reduced equipment downtime.
(3) Increased plant capacity.
(4) Lower maintenance and production cost.
(5) Improved return on investment
(6) Rectified customer complaints
(7) Reduced accidents.
(8) Improved team work and a less adversarial approach between production and maintenance.
(9) General increased involvement of the work force etc.

6. Pillars of TPM.

TPM has 8 pillars which will enhance its success. These are.

(1) 5S.
(2) Jishu Hozen (Autonomous maintenance)
(3) Kaizen.
(4) Planned maintenance.
(5) Quality maintenance.

Module IV

8. Modern Production Management Tools

(1) Just In Time Manufacturing -

The primary objective of JIT to achieve zero inventory within an organization as well as throughout the entire supply chain.

Basic Principles of JIT

The key theme of JIT is to work without buffer stock. To achieve this objective, identify every point in the organization where buffer stock normally occurs. Then critically examine the reasons for such stock.

The following reasons are there for maintaining high stocks.

1. Unpredictible deliveries
2. Poor quality from suppliers
3. Increased variety of materials
4. M/c breakdown
5. Labour absenteism
6. Frequent M/c Setting
7. Variations in operators capabilities
8. Schedule changes.
9. ...

To avoid high stock System - Cause - Remedy may be taken >m to consideration. Another way of achieving JIT the computer System may be adopted.

3. Computer Integreated Manufacturing

Integrating all the manufacturing activities using computer is called Computer integreated manufacturing.

There are two aspects of CIM

They are organized part and operational part.

(1) organized part:

- Corporate Services
- Finance
- Business planning.
- Marketing

(2) Operational part -

these consists of the following.

(1) Computer aided engineering (CAE)
- computer aided process planning (CAPP)
- computer aided planning (CAP).
- computer aided quality control (CAQC)
- computer aided design (CAD)
- Materials resource planning (MRP)

(11) Computer aided Manufacturing

- Flexible manufacturing assembly (FMA)
- Direct numerical control (DNC)
- Data acquisition System (DAS)
  - Production data acquisition
  - Machine data acquisition.
- Area computer (AC)
- Cell computer (CC)

Different types of computers which are used in CIM as follows.

(a) Mainframes.
(b) Mini computers
(c) Microcomputers.
(d) Personal computers
(e) PLCs.
(f) Robotic computers
(g) Workstations.

5. Total Quality Management.

The goal of any industry to provide a product or service at the most economical costs, ~~with~~ ensuring full costumer satisfaction. This can be achieved by TQM.

The Scope of TQM is applied

- Marketing
- Engineering
- purchasing
- Manufacturing
- Mechanical
- Shipping
- Installation and product Service.

Benefits of TQM

Costumer Satisfaction
Economic improvements.

Costumer Satisfaction Oriented Benefits.

- Improvement in product Quality.
- Improvement in product design.
- Improvement in product flow.
- Improvement in quality consciousness.
- Improvement in product Service.
- Improvement in market place acceptance.

Economic Improvement Oriented Benefits

- Reduction in operating costs.
- Reduction in operating loses.
- Reduction in field Service costs.
- Reduction in liability exposure.

- Environmental aspects affecting Quality.

1. Market.
2. Money
3. Management
4. Men
5. Motivation.
6. Materials.
7. Machines and mechanisms.
8. Modern information methods.
9. Meeting product requirements.

Quality control activities during production cycle.

They can be classified into
- New design control.
- Incoming materials control.
- Product control.

New design control

- Selling quality products.
- Engineering quality products
- Manufacturing quality parts.

Incoming materials control

- Buying quality materials.
- Receiving quality materials
- Manufacturing quality parts.

- Shipping quality products.
- Installing and servicing quality products.

Operating Quality costs.

These can be classified in to

- costs of control.
- costs of failure to control.

Costs of control

They can be classified in to

(1) cost of prevention.
(2) cost of appraisal

cost of prevention

The following activities involve cost of prevention

- Quality planning
- Process control.
- Design and development of quality information equipment.
- Quality training of workforce.
- Product design verification.
- System development

Cost of appraisal

The following are here -

- Test and inspection of purchased material
- Laboratory acceptance testing.
- Inspection.

- Quality audits
- Maintenance and calibration of quality information test.
- Product engineering reviews.
- Field tests.

Costs of failure to control.

This can be categories.

(1) Cost of internal failure
(2) Cost of external failure.

ISO 9000 Series.

ISO 9000 standards expects firms to have a quality manual that meet ISO guidelines, document etc.

They have five international standards.

1. ISO 9000
2. ISO 9001
3. ISO 9002
4. ISO 9003.
5. ISO 9004.

Standard	Objective Task.
ISO 9000	Selection and use of quality management and quality assurance standards.
ISO 9001	It has 20 elements covering design, development, production etc. Applicable for industries

ISO 9002 — It has 18 elements covering production and installation. It has same 9001 without the first two tasks.

ISO 9003 It has 12 elements covering final inspection and testing for laboratories and warehouses.

ISO9004 This provides guidelines to the interpret the quality management and quality assurance.

Benefits of ISO 9000 Series.

1. This gives competitive advantage in global market.
2. Consistency in quality.
3. Documentation of quality procedure.
4. It ensures adequate and regular quality training for all members of the organization.
5. Helps the customers to have cost effective purchase procedure.
6. Help in increasing productivity.
7. Gives level of job satisfaction.

Steps in ISO 9000 registration.

1. the will

2. Preparation of quality manual to cover all the elements in the selected model.
3. Preparation of procedures and shop floor instructions which are used at the time of implementation.
4. Self auditing to check compliance of the selected model.
5. selection of a registration and making application to obtain the certificate.

8. Pokeyoke.

This means mistake proofing. The poke yoke devices are developed based on the answers to the following questions related to products.

- What is the defect?
- When is the defect discovered.
- What are the standard elements involved in making the part?
- What mistakes were made?
- Why are the mistakes made?

classification of poke yoke.

Steps of poka yoke

- Select a pilot process or a trouble some area of the facility of interest.
- Ask the coworkers to make a list of most common mistakes that result in the loss of materials.
- Workers should use pareto analysis to rank-order these errors.
- Workers should rank errors according to their importance and impact on the process and the environment
- Workers should develop poka yoke devices in consultation with engineers
- The implementation team should analyse the errors, frequency and other respective cost before applying any poka yoke method.

Benefits and Limitations of Pokayoke

Benefits -

- Reduction in waste and associated machining as nonconforming material is identified at each stage rather than an inspection stage between

Leads to reduction in inventory holding.
- Improvement in customer satisfaction.
- Improvement in employee's relationship as it encourages more involvement of operators and team members.

Limitations.
- It increases the time of inspection.

5. Kaizen:

Kaizen means continuous improvement.
Kai - change, Zen - good.
In any organization three things should happen simultaneously i.e Maintenance, Innovation and Kaizen.

Key elements of Kaizen

1. Elimination of waste and inefficiency.
2. The kaizen 5S framework of good housekeeping.
3. Standardization

Steps of Implementation of Kaizen

Blitz

(1) Defining the project goal and identifying the problem.
(2) Forming of a team.

Guidelines of Kaizen Team

- Get to Gemba (real life problem)
- Get hands on experience.
- Get the facts about Gemba.
- Abandon fixed ideas.
- Focus on process and not on person.
- Ask what can we do today?
- Ask why? five times, be classified with the answer available and take the root cause corrective action.
- Think 'can do' and how to make it work.
- Form multidisciplinary teams.
- Assign one full time Kaizen manager per 200 employees and one Kaizen workshop per 100 employees per month.

Benefits of Kaizen.

- Realization of immediate result
- Incorporation of usual action oriented talks
- It fosters communication amongst employees.
- Facilitate team concept within organization.

§ Business Process Engineering.

It is defined as the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality and speed of products/services delivered/provided by an organization.

Steps of BPR

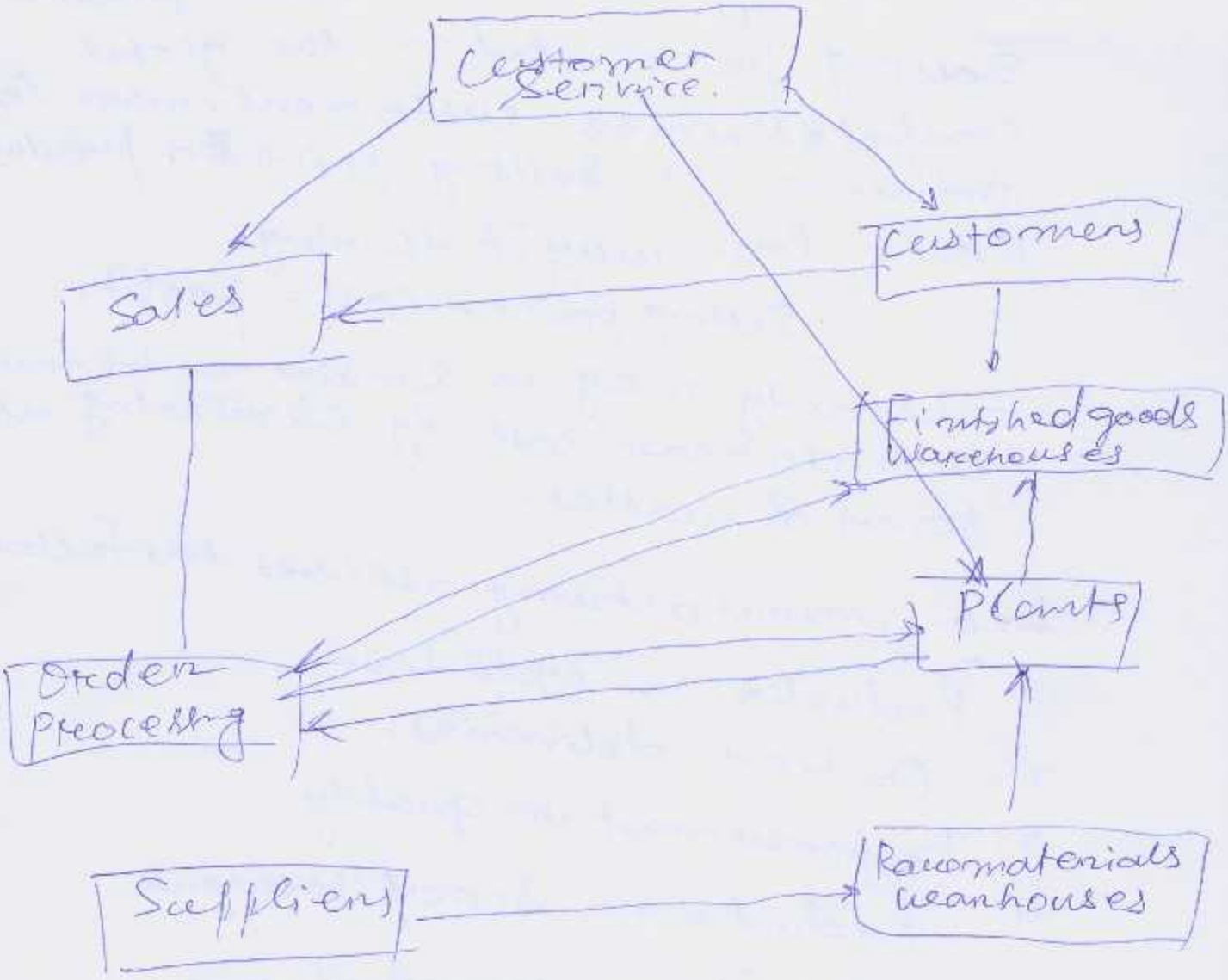
- Development of process vision and determination of process objectives.
- Definition of processes to reengineered.
- Measurement of existing processes.
- Identification of information technology application.
- Design of prototype and implementation

Application of BPR

It can be applied to all situations where dramatic improvement is required.

5. Supply Chain Management.

In the global competitiveness the customer can source his goods and services from anywhere in the world. This objective can be met through proper supply chain management. One can call the supply chain management as the integrated logistic system.



supply chain network.

§ Lean Manufacturing:

This is a systematic approach to identify and to eliminate wastes of all non-value added activities through continious improvement that is being adopted by world class, high performance firms to produce remarkable results. The traditional manufacturing way of thinking has been "Cost + profit = Selling price". But in the global competetiveness customers more less influence the selling price of a product. Hence lean way of thinking

Selling price − Cost = profit.

The only way to survive in the market is to decrease cost by eliminating all forms of wastes.

Lean manufacturing achieves the following

1. Reduction in cycle time.
2. On time deliveries.
3. Improvement in quality.
4. Reduction in scrap/rework.

Steps of Lean Manufacturing.

(3) Make the value flow without interruption.
(4) Let the customer pull value from the producer.
(5) Pursue perfection.

Components of Lean Manufacturing.

- The following are the components of lean manufacturing.

1. Standardized production.
2. Continuous improvement in production
3. Adoption of JIT. in production.
4. Design for manufacturing.
5. Poka yoke adoption.
6. Cellular manufacturing.
7. Single minute Exchange Die.
8. Flexible Workforce.

X ——— X