Production management

Unit - I

Production function – an Introduction – Definitions and types of production systems. Strategic Management – corporate strategies, production strategies, World class manufacturing, demand forecasting for Operations.

PRODUCTION:

Production is the process by which goods and service produced.

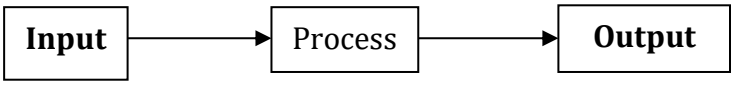
Production management:

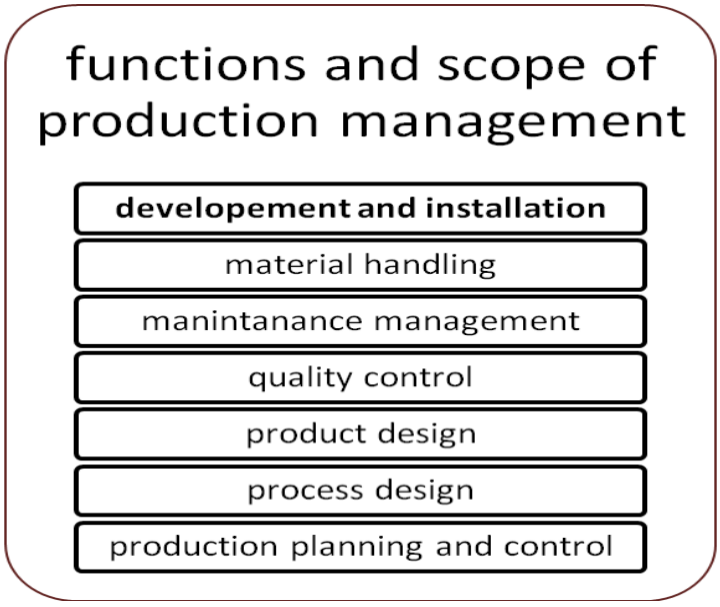
Production management means the application organizing directing and controlling (transform input and output) of production activities.

Production is a process used to transform raw material into finished goods.

Definition:

According H.A.Harding "Production management is concern with those processes which convert input into output".





Importance/significance/purpose of production management:

- ✓ It helps to introduce new products
- ✓ Expansion of the new firm
- ✓ Minimize the price of production
- ✓ Maintain reputation, good will, and image
- ✓ Helps to face the competition
- ✓ Support different useful functional areas
- ✓ Optimum utilization of resources

Strategy:

- ✓ The word strategy is derived from the Greek word strategies
- ✓ In management strategy means a plan of Action. Design to achieve long term or overall aim
- ✓ The management the word strategy has how replaced the more "traditional term long term planning"
- ✓ The strategy is deals with long term development rather than routine operation.

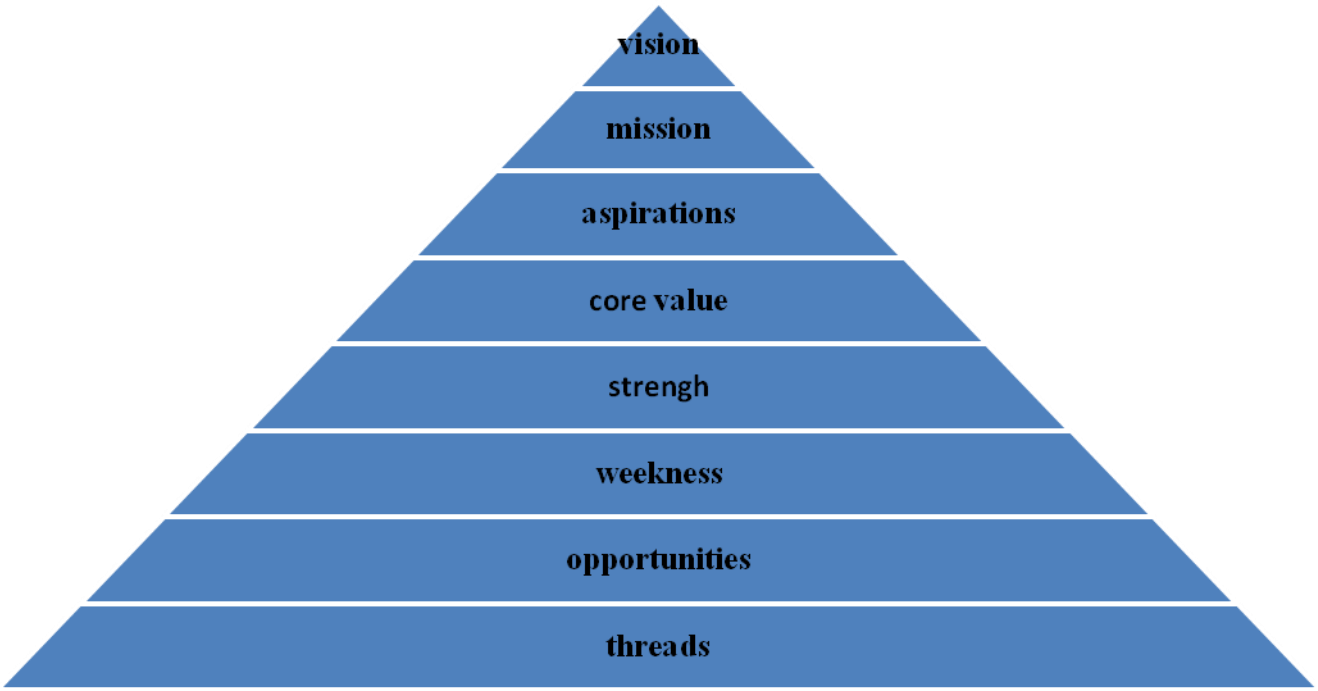
Strategic management

The strategic management is a continuous process, for formulation, evaluation, and control the business and individual and industries, which an organization is involved.

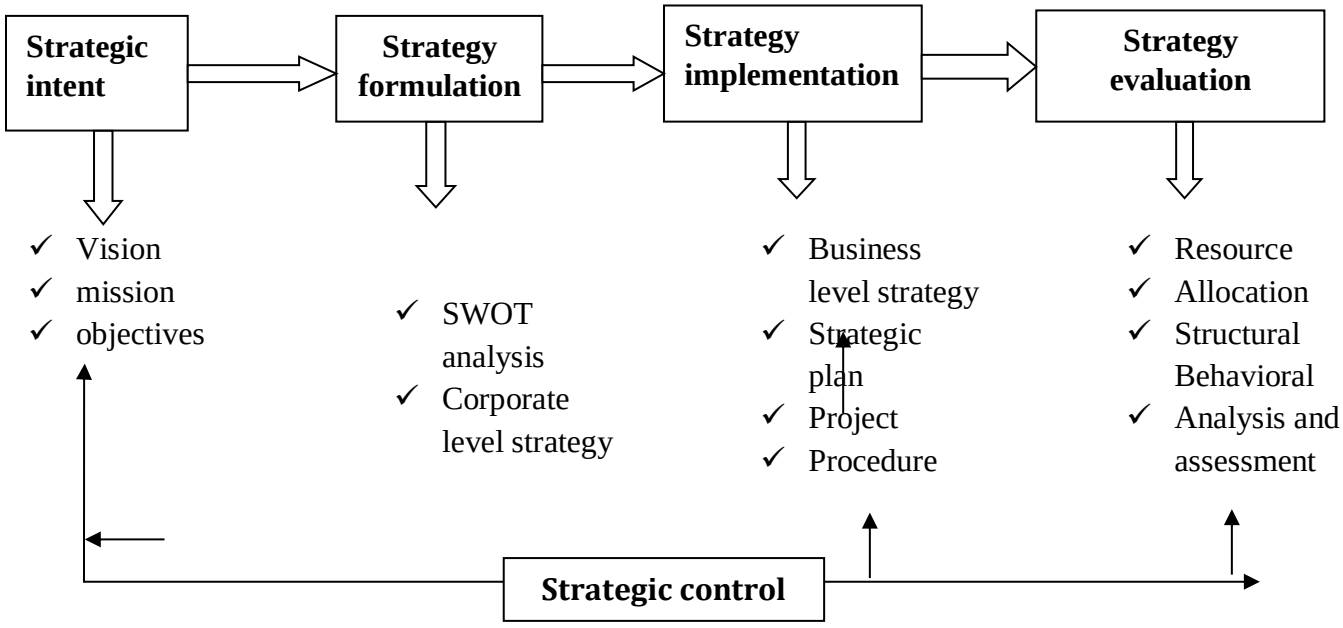
Features, importance, objectives, purpose of strategic management:

- ✓ It helps to deals with uncertainty or uncertainty event
- ✓ It is deals with long term development (new product, new methods, new market)
- ✓ It is helps to predict the behavior of competitors, and employee
- ✓ Strategy is well defined road map
- ✓ It is defined overall, mission, vision and direction of the organization.
- ✓ Bridge of the gap between where we are and where we want to be.

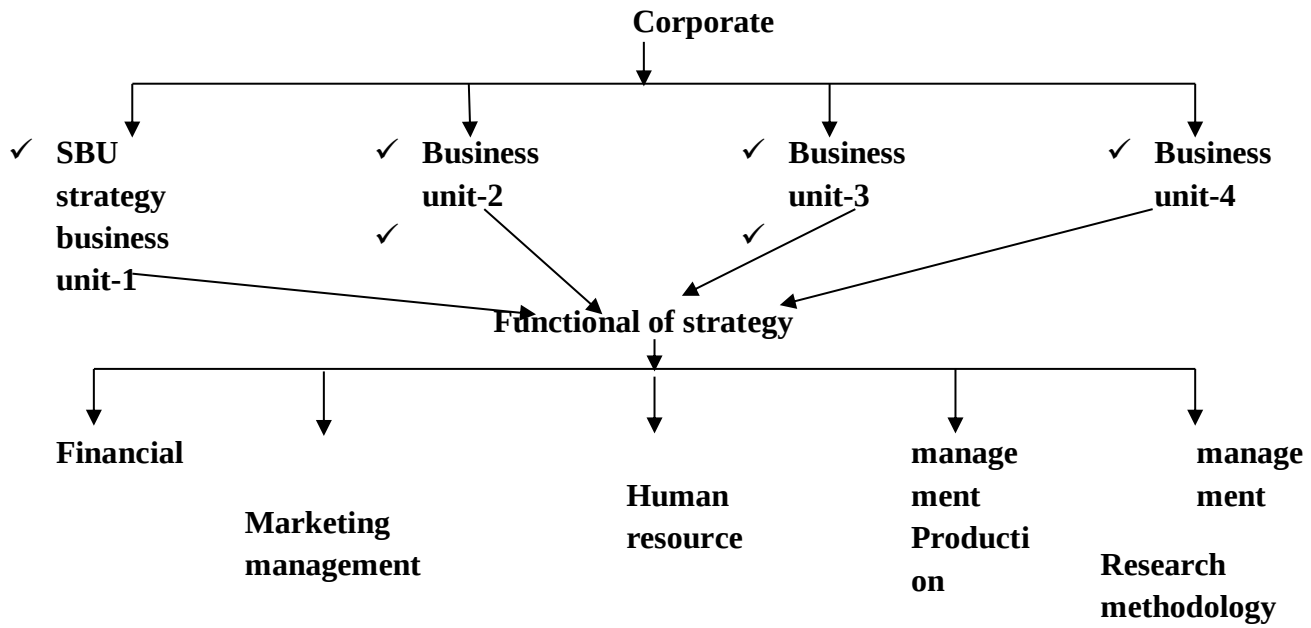
Components of strategic management



Strategic management process:



The Strategy Management Framework:

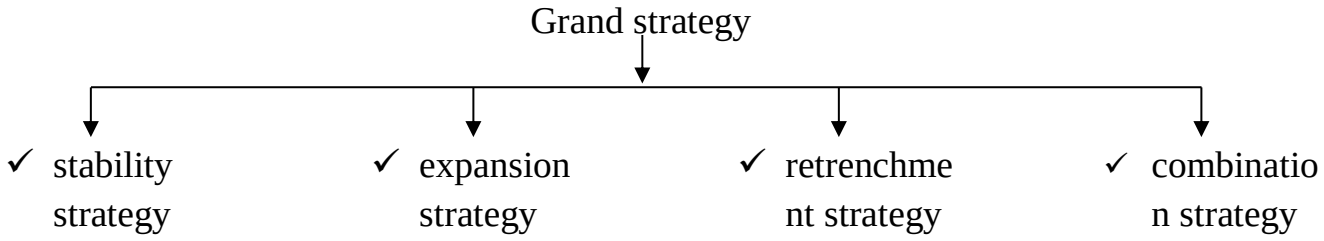


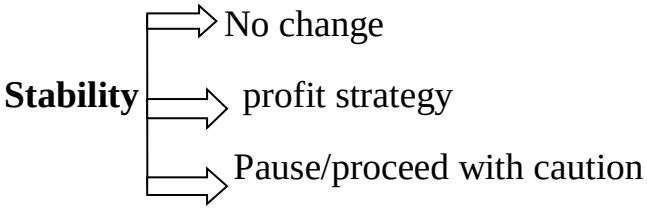
The grand strategies are the corporate level strategies the corporate level strategies designed to identify the firm choice with respect to direction it follows to accomplish it set objectives.

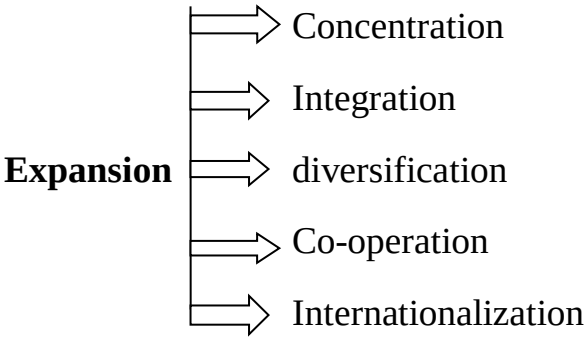
- ✓ Long term plan
- ✓ alternatives

The grand strategies are also called as master level strategy.

Master strategy/corporate level strategy:



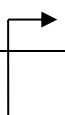


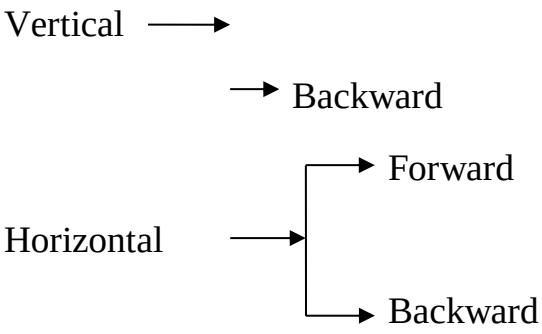


1. **Concentration**

- ✓ existing product, existing market
- ✓ existing product, new market
- ✓ new product, existing market

2. **Integration**





3. **Diversification**

- ✓ concentric diversification
- ✓ conglomerate diversification

4. **Co-operation:**

- ✓ merger
- ✓ takeover
- ✓ joint venture
- ✓ strategic alliance

5. **Internationalization**

- ✓ global strategy
- ✓ trans national strategy
- ✓ international strategy
- ✓ multi domestic strategy

Retrenchment strategy

- ✓ turn around
- ✓ divestment
- ✓ liquidisation

Combination strategy

- ✓ simultaneous
- ✓ sequential
- ✓ simultaneous and sequential

Production strategy

The primary mission of production strategy planning the production schedule, within the budget limitations and time constraints.

The major components of production strategy are inventory management and control.

Inventory management and control

Corporate, business, functional strategy.

Corporate strategy

Companywide strategy (single owner + multi business)

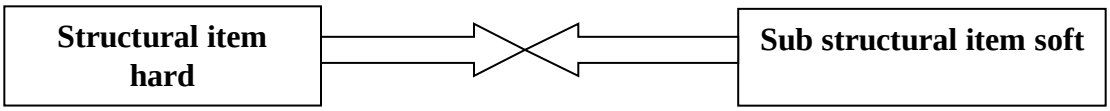
Business strategy

- ✓ Competition strategy
- ✓ Comparative, updating about the competitors

Financial strategy

(Financial, marketing, HRM, R&D, production) functional areas

Constituent of production strategy:



- ✓ Production capacity factory

  network/design technology etc.

- ✓ Investment plan control quality

  improvement etc

Production strategy

1.Chase strategy

- ✓ Demand matching strategy
- ✓ Investment in enough

2.Level production:

- ✓ Equal & average demand

3.Make to stock:

- ✓ Before customer place, the order (local area SALES)(departmental stores)

4.Make to order:

- ✓ After receiving the order- ex:bakery.

5.Assemble to order

- ✓ Electrical & electronics goods.

WCM-world class manufacturing:

World class manufacturing is set of concept, policy, technique, principle for operation and managing a manufacturing company

Three principles of WCM:

- ✓ Just in time (JIT)
- ✓ Total quality management(TQM)
- ✓ Total preventive management (TPM)

1. **Just in time**

- ✓ Eliminate wastage
- ✓ Eliminate excess production
- ✓ Eliminate unnecessary moment of scrub
- ✓ Reduction of cost

2. **TQM:**

- ✓ Bill of material
- ✓ Stock records
- ✓ Total quality
- ✓ Manufacturing techniques
- ✓ Encouraging zero tolerance

3. **TPM**

- ✓ Reduced unplanstoppages ,due to equipment failure are minimized.
- ✓ Reduce over production waiting of raw material and human resources(man power)
- ✓ Transformation expenses
- ✓ Reduce excess production
- ✓ Reduce failure and fault

Characteristics of world class manufacturing:

- ✓ Acquiring new technology
- ✓ Research and development/new product
- ✓ Customer service
- ✓ Team based approach
- ✓ Best practices(study and use)
- ✓ Man power planning
- ✓ Acquisition /merge
- ✓ Innovation
- ✓ Business partnership an d alliance
- ✓ Quality/control

Pillars of WCM:

- ✓ Safety and healthy
- ✓ Cost control
- ✓ Focused improvement
- ✓ Autonomous activity
- ✓ Professional maintenance
- ✓ Quality control
- ✓ Legal activity/registration
- ✓ Early equipment management
- ✓ People development
- ✓ Environment/eco friendly

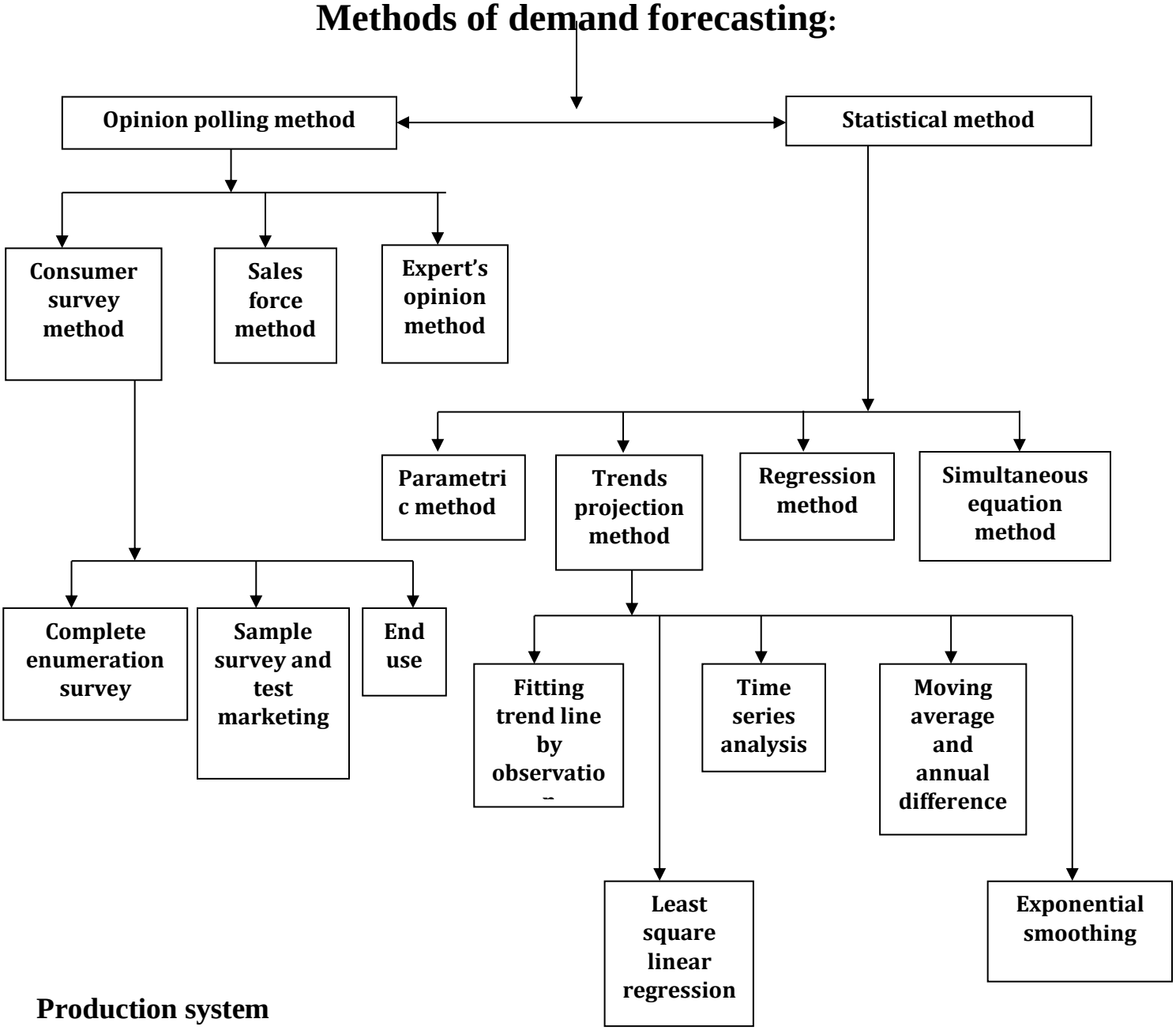
Lean production or lean manufacturing:

- ✓ Lean manufacturing is related to manufacturing companies
- ✓ It is fully related to learn
- ✓ Lean manufacturing is a system of systematic methods for avoid wastage or minimize wastage.
- ✓ This philosophy is management philosophy. It is derived from the Toyota production system.

Demand forecasting for operations:

- ✓ A forecasting is the estimate of an event which will happen in future.
- ✓ A good forecasting method focused on
  - ➢ Cost
  - ➢ Flexibility
  - ➢ Adequate skill
  - ➢ Sophistication

Methods of demand forecasting:



Production system

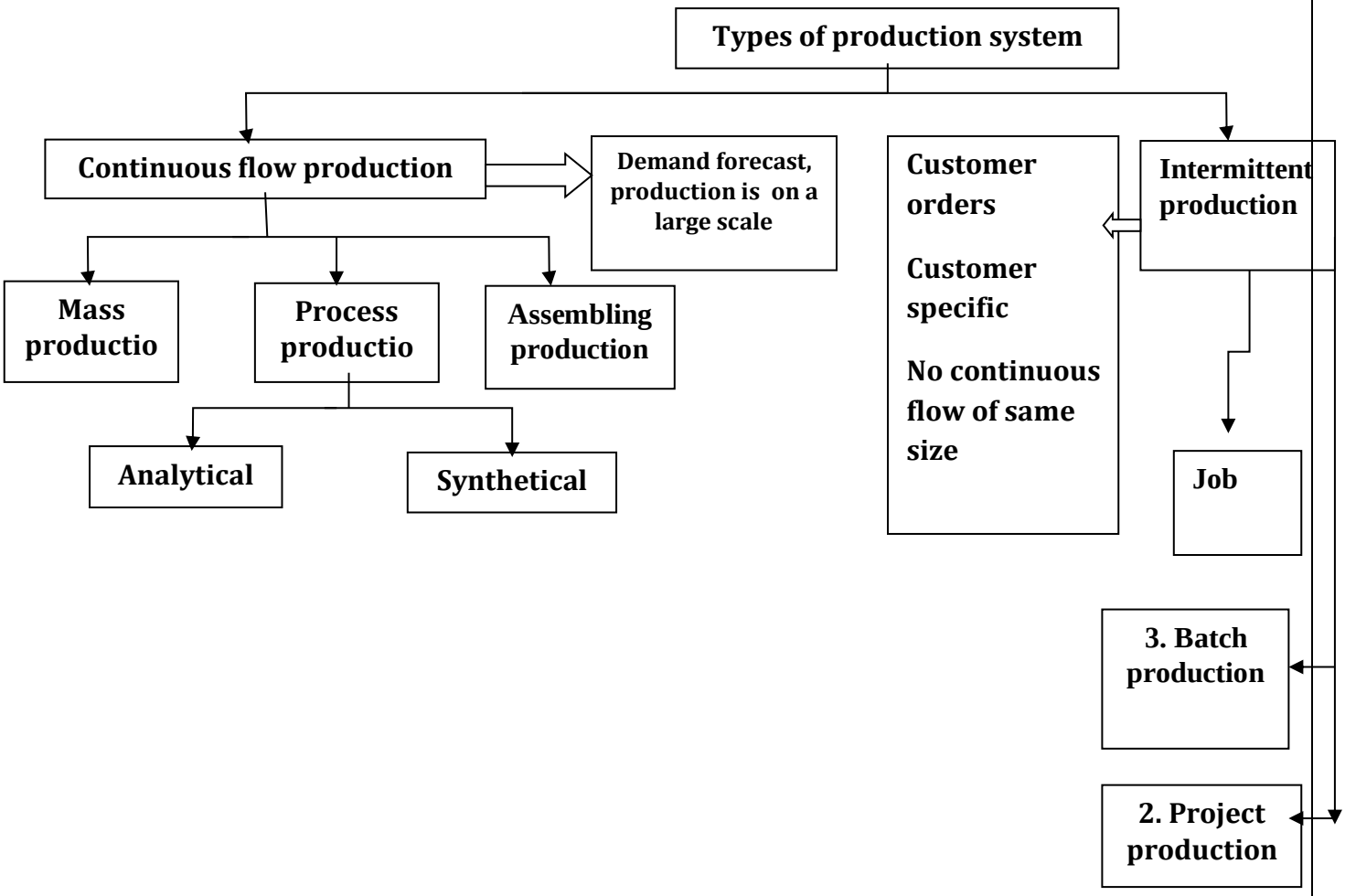
Production system means a set of procedures and resources used to convert raw material into products and delivering to the customers

Example: pizza

Definition:

Production system is defined as procedure and arrangement of all functions that require accumulating input, process and, output and delivering to the markets.

Types of production system:



➢ Continuous process:

A series of interconnected operators, where the material move from one stage to another stage without interpretation or disturbance .

- ✓ **Process production**

Process production means the single raw material can be transfer into different kinds of products at different stages.

- ✓ **Analytical production**

Analytical production is a broken into different products.

Example: paste, soap

- ✓ **Assembling production**

The two or more components are combined to manufacture finished products. Manufacture product are joined into sub assembles or final assembles.

Example: TV, mobile, automobiles.

➢ Intermittent production system:

The goods are manufactured specially to fulfill the orders placed by customer rather than the stock.

Example: catering service

- ✓ **Job Production:**

Job production means production of single, complete unit by one operator or a group of operators

Example: tailer, goldsmith, dam construction.

- ✓ **Batch production:**

The items are processed in lots or batch.

Example: chemical industry, printing.

- ✓ **Project production:**

Characterized by set of activity that must be performing in a particular order within the given period or within the estimated expenditure.

Example: the home construction

UNIT -2

Product Design – New product development, process planning and design, value analysis, capacity planning

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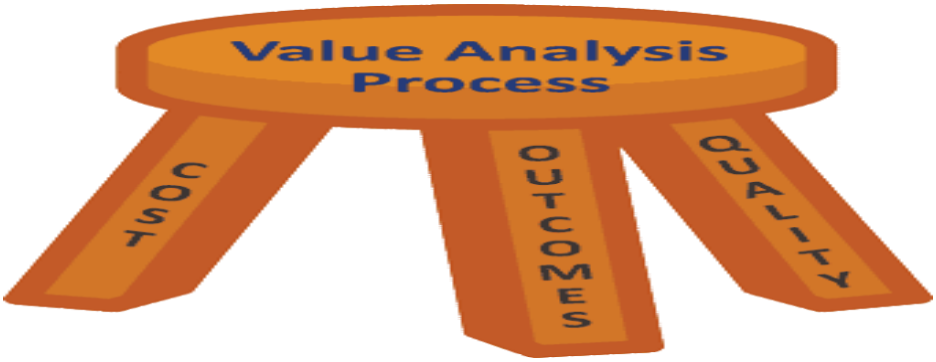
Product design

- Product design consists the process **of creating or improving a product** by learning what consumers **want and examining** similar products that are already available.
- Definitions for Product design is the process of **creating a new product** to be sold by a business to its customers A very broad concept.

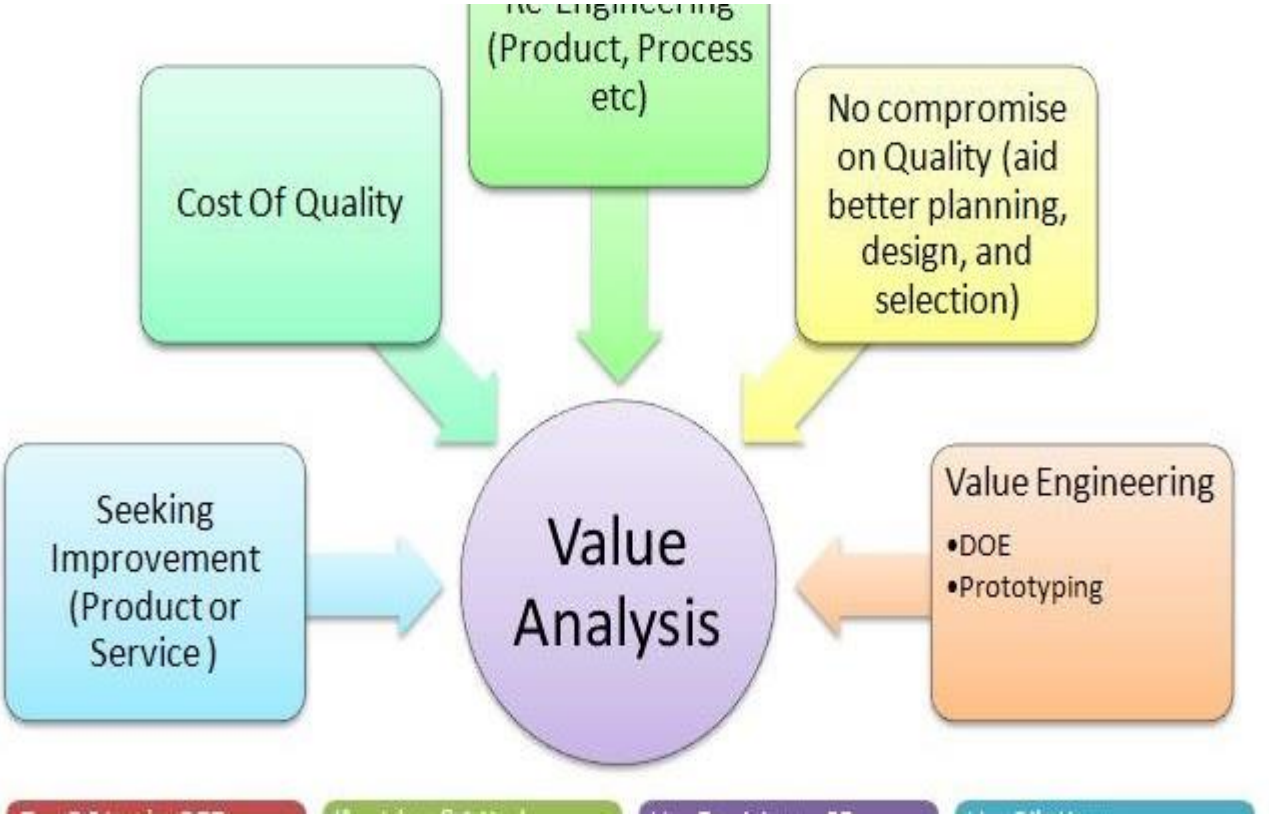
Value Analysis

Value Analysis meaning

- Value Analysis is one of the **major techniques** of **cost reduction and control**. It is a disciplined approach which ensures the necessary functions for **the minimum cost without diminishing quality, reliability, performance and appearance.**
- It is a creative approach to **eliminate the unnecessary costs**
- These are the days of providing the customer with really best quality products at least cost which is possible through value analysis which proves wrong rightly **"Best and Cheap" or "Best is never cheap" or "Cheap is not best one"**



RE ENGINEERING



Capacity Planning

The production system design planning considers **input requirements, conversion process and output**. After considering the forecast and long-term planning organization should undertake capacity planning.

Capacity is defined as the **ability to achieve, store or produce**. **For an organization, capacity would be the ability of a given system to produce output within the specific time period**. In operations, management capacity is referred as an amount of the input resources available to produce relative output over period of time.

In general, terms capacity is referred as **maximum production capacity**, which can be attained within a normal working schedule.

Capacity planning is essential to **be determining optimum utilization of resource and plays an important role decision-making process,** for example, extension of existing operations, modification to product lines, starting new products, etc.

Strategic Capacity Planning

A technique used to **identify and measure overall capacity of production** is referred to as strategic capacity planning. Strategic capacity planning is utilized for **capital intensive resource like plant, machinery, labor, etc.**

Strategic capacity planning is essential as it helps the organization in **meeting the future requirements** of the organization. Planning ensures that **operating cost is maintained at a minimum possible level without affecting the quality**. It ensures the organization remain competitive and can achieve the long-term growth plan.

Capacity Planning Classification

Capacity planning based on the timeline is **classified into three main categories long range, medium range and short range.**

Long Term Capacity: Long range capacity of an organization is dependent on various other capacities like design capacity, production capacity, sustainable capacity and effective capacity. Design capacity is the maximum output possible as indicated by equipment manufacturer under ideal working condition.

- ***Production capacity*** is the maximum output possible from equipment under normal working condition or day.
- ***Sustainable capacity*** is the maximum production level achievable in realistic work condition and considering normal machine breakdown, maintenance, etc.
- ***Effective capacity*** is the optimum production level under pre-defined job and work-schedules, normal machine breakdown, maintenance, etc.

Medium Term Capacity: The strategic capacity planning undertaken by organization for 2 to 3 years of a time frame is referred to as medium term capacity planning.

Short Term Capacity: The strategic planning undertaken by organization for a daily weekly or quarterly time frame is referred to as short term capacity planning.

Goal of Capacity Planning

The ultimate goal of capacity planning is to meet the current and future level of the requirement at a minimal wastage. The three types of capacity planning based on goal are lead capacity planning, lag strategy planning and match strategy planning.

Factors Affecting Capacity Planning

Effective capacity planning is dependent upon factors like production facility (layout, design, and location), product line or matrix, production technology, human capital (job design, compensation), operational structure (scheduling, quality assurance) and external structure (policy, safety regulations)

Forecasting v/s Capacity Planning

There would be a scenario where capacity planning done on a basis of forecasting may not exactly match. For example, there could be a scenario where demand is more than production capacity; in this situation, a company needs to fulfill its requirement by buying from outside. If demand is equal to production capacity; company is in a position to use its production capacity to the fullest. If the demand is less than the production capacity, company can choose to reduce the production or share it output with other manufacturers.

Unit-3

Plant location – factors influencing plant location, Plant layout- classification of layout with advantages, layout design procedures, Production planning and control – aggregate planning nature, Strategies, methods, Master production Plan.

PLANT LOCATION / PLANT LAYOUT

PLANT LOCATION

- Plant location refers to the choice of region and the selection of a particular site for setting up a business or factory.
- The plant location refers to the choice of region where men, machinery, material, money and equipment or bought together for setting of the business/factory.
- The plant location is the function of determining where the plant should be located for maximum operating economy and effectiveness.

FACTORS INFLUENCING PLANT LOCATION

1. **Availability of raw material**
   - Ex: Pepsi, Tea factor, coffee factor
2. **Proximity to market**
   - Ex: Cement factory Dalmiya, Ramco
3. **Infrastructural facilities**
   - Ex: kudankulam, kalpakkam
4. **Government policy**
   - Ex: Goa, pondichery
5. **Availability of manpower**
   - Ex: Coimbatore, trichy
   - Gas, Fuel>Kathiramangalam>ONGC
6. **Local laws, Regulations, Taxation**
   - Ex: Dubai, Singapore, Malaysia
7. **Ecological and environment factors**
   - Ex:Trichy sugar factory
8. **Competition**
   - Ex: Choosen area for sale>Saree.

9. **Incentives, Land cost, Subsidies tax backward area**

10. **Climate conditions**

- Ex: Aravankaadu – Bullet
- Ex: Ooty – Film factory

11. **Political conditions**

- Ex: Delhi
- Nano car – Kolkata – Nandhigram – Kashmir – Terrorist – West Bengal – Terrorist

12. **Transport facilities**

- Ex: Near in transport facilities

13. **Disposal facilities for waste product**

- Ex: Hospital, Koodankulam

What is mean by plant layout?

- The plant layout means arrangement of machinery, equipment and other industrial facilities.
- The plant layout is arrangement of physical facilities and the manpower require to manufacturing a product at least cost or low cost.

Definition

According Riggs, overall objectives of plant layout is to design a physical arrangement that most economically meets that require output, quality and quantity.

Importance of plant layout

- It provides overall satisfaction to all.
- It reduces over material handling.
- Better supervising.
- Increasing productivity with better quality at low cost.
- Quick disposal of work.

Objectives of plant layout

- Reducing accident.
- Providing product flexibilities.
- Easy supervising and control.
- It provide for employee safety and health.
- Easy maintenance of machinery and plant.
- Highly utilize machine equipment and raw material.
- High productivity.
- Effectively utilize available flow space.

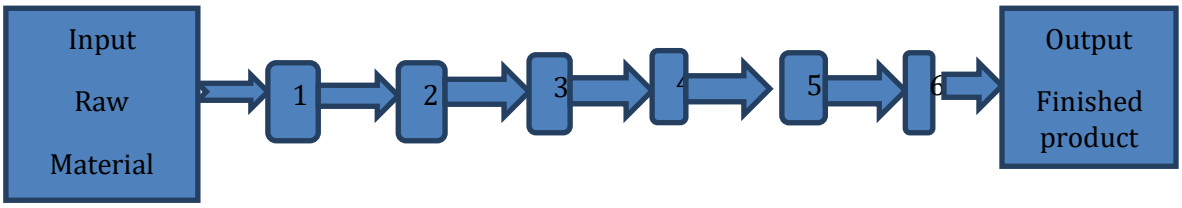
Types / classification of plant layout

- Product or line layout.
- Process or functional layout.
- Fixed or stationary material layout.
- Combined layout.
- Combination layout.
- Cellular layout.

Product (or) line layout

- It means all the processing equipment and machine are arranged according to the sequence of operation of a product.
- Only one type of product produced in large quantity.

  Ex: Input of sugar cane at one end output of sugar taken to other end.
  Ex: Raw material fed at one end and taken out as finished product at the other end.



1. Receiving
2. Conveyer
3. Fitter
4. Quality control
5. Baking
6. Pricing

Advantages

- Removal of obstacles in production.
- Economics in material handling.
- Lesser manufacturing time.
- Lesser working progress.
- Proper use of floor space.
- Clear inspection.
- Less manufacturing.
- Less labor cost.

Disadvantages

- Lesser flexibility.
- Large investment.
- High level of fixed overheads.
- Difficulty in expanding production.
- Lack of supervision.

Function or process layout

It means all equipment and machines are arranged used the function performed by a department by a department is established for each specialized operation.

Ex: Welding department will perform welding operation in one place like wise laths.

Stores	**Assembling**	**Painting**
Receiving	Plant office	Guiding
Shipping	Sub assembling	Welding

Advantages

1. Maximum utilization of machines.
2. Greater flexibilities.
3. Scope of expansion.
4. Specialization.
5. Effective utilization of workers.
6. More Effective supervision.
7. Less work stoppage.

Disadvantages

1. Coverage at floor area.
2. Higher cost of material handling.
3. Higher labor cost.
4. More production time.
5. Difficulties in production, planning and control.
6. Increased inspection cost.

FIXED LAYOUT

1. This type of layout is undertaken for the manufactured of large part and assembles.
2. A fixed position layout is appropriate for a product that is too large or heavy to move.

Ex: hospital operating room

Advantages

- Economics in transformation.
- Different jobs with same layout.
- Production in accordance with specification.
- Scope for flexibility.

Disadvantages

- Immobility of material.
- Large investment.
- Unsuitable for small product.

Production planning and control (PPC)

PPC is a pre determinant process which includes the use of human resource, raw material, machines etc...

1. Production planning and control addresses a fundamental problem of low productivity, inventory management and resource utilization.
2. Planning and control are essential ingredients for success of an operation unit.

Objectives of Production planning and control (PPC)

- To deliver the goods in required quantities to the customer.
- To ensure maximum utilization of all resource.
- To ensure product quality product.
- To minimize product production time.
- To maintain inventory.
- To maintain flexible operation.
- Co-ordination between labor and machines.

What is production planning?

Production planning is one part of production planning and control dealing with basic concepts of what to produce when to produce, How much to produce etc…

Production control

Production control look to utilize different type of control techniques to achieve optimum performance out of the production system as to achieve overall production planning targets.

Production control control

Need/ Importance/ Advantages/ Scope/ Nature/ Function/ Significance of PPC

- Utilize resource effectively.
- Make flow of production standard.
- Estimate production resource
- Maintain necessary stock level.
- Co-ordinate departmental activities.
- Minimize wastage of resources.
- Improve labor efficiency.
- It helps to face competition.
- Provide better work environment.
- Facilitate quality improvement.
- Customer satisfaction.
- Reduce production cost.

Tools/ Elements of PPC

- Routing.
- Loading.
- Scheduling.
- Dispatching.
- Follow up.
- Inspection.

- Corrective.

1. Routing: It is about selection of path or route through which raw materials pass in order to make it into a finished product. The points to be noted while routing process are – full capacity of machines, economical and short route and availability of alternate routing. Setting up time for the process for each stage of route is to be fixed. Once overall sequence are fixed, then the standard time of operations are noted using work measurement technique.

2. **Loading and scheduling**: Loading and Scheduling are concerned with preparation of workloads and fixing of starting and completing date of each operation. On the basis of the performance of each machine, loading and scheduling tasks are completed.

3. **Dispatching**: Dispatching is the routine of setting productive activities in motion through the release of orders and instructions, in accordance with previously planned time and sequence, embodied in route sheet and schedule charts. It is here the orders are released.

4. **Expediting / Follow-up**: It is a control tool which brings an idea on breaking up, delay, rectifying error etc., during the progress of work.

5. **Inspection**: Inspection is to find out the quality of executed work process.

6. **Corrective**: At evaluation process, a thorough analysis is done and corrective measures are taken in the weaker spots.

Stages of PPC

1. Preplanning.
2. Planning.
3. Controlling.

Aggregate planning

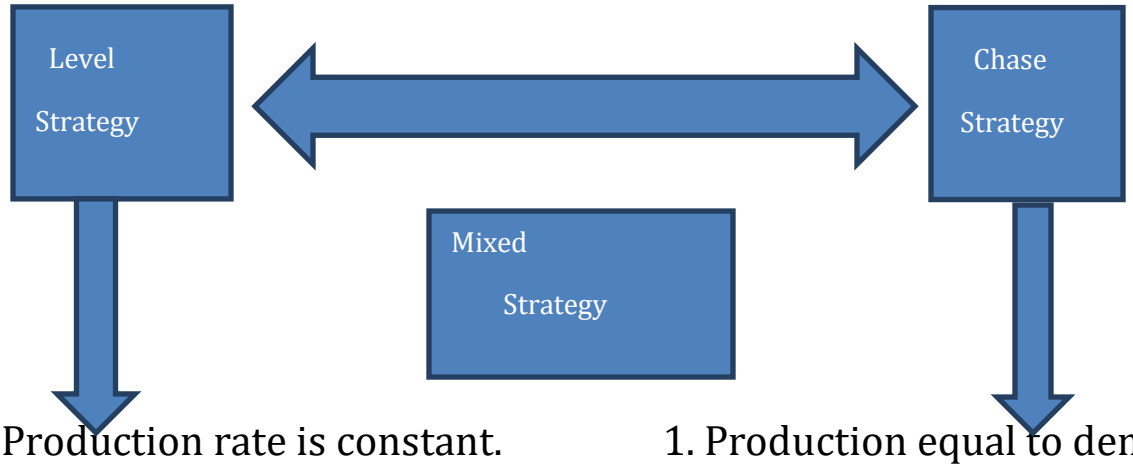
- Aggregate planning is marketing activities that do an aggregate plan for the production process. It advance of 6-18 month, to give an idea to the management (what, when, how, much produced)
    - It is concern with matching supply and demand of output over the medium time range (12 month) in the future.

Importance of aggregate planning

- Help to achieve long term objective.
- Achieving financial goal by reducing overall cost.
- Maximum utilization of the available production facility.
- Reduce investment in inventory stock.
- To create the happy and satisfy work force.

Types of aggregate plan strategy

- Active strategy/ Level approach.
- Passive strategy/ Reactive/ chase approach.
- Mixed strategy/ Combination strategy.



1. Production rate is constant.
2. Attempts to handle function In demand by focusing On demand manager.

1. Production equal to demand.
2. Attempts to handle fluctuation in demand by focusing on Supply and capacity management.

Level strategy	Chasing strategy	Combination Strategy
1. Keep a level work force throughout the planning period.	Adjust production capacity to match demand possibly by hiring or firing workers.	Some combination of the level and chase strategy.
2. May produce back order.	Avoid back order.	Reduce back order.
3. Avoid firing, hiring and training cost.	May incur firing, hiring cost. .	Reduce firing, hiring and cost.
Advantages Stable output rate and work force.	Investment in inventory is low but Labor utilization is high.	
Disadvantages Greater inventory cost.	The cost of work force heavy and damage to employee moral.	

Master production planning (MMP)

- MPP/MPS is a plan for individual commodities to be produced,in each time of period such as production, staffing, inventory etc….
- It is usually linked to manufacturing where the plan indicates when and how much of each product will be demanded.
- Using this MPS help to avoid shortage, costly expenditure, last minute schedule and inefficient allocation of resources.

Benefits of MPP

- Avoid shortage.
- Costly expenditure.
- Last minute schedule.

- Inefficient allocation of resources.
- Reduce in inventory.
- Quick response to change in demand.
- Reduce set up in change over cost.
- Better machinery utilization.
- Aid in developing master schedule.
- It can help to smooth the demand signal.
- Act as a signal/ Single communication tools to the business.
- It helps stabilize production.

UNIT-4

Quality control-Definition, need, Quality control techniques, control charts, acceptance sampling , six sigma , quality circles. TQM-scope, benefits. JIT.

WHAT IS QUALITY CONTROL TECHNIQUES

Quality control techniques for manufacturing will vary from plant to plant as processes, equipment and human skill will vary from plant to plant. Small variations in quality control methods are in some cases a "secret weapon" used by manufacturers to give them an edge over the competition. In general however there are some basic quality control techniques that most other strategies stem from. Here are some brief descriptions of these quality control techniques.

- **Failure testing**
- **Statistical control**
- **Company quality**
- **Total quality control**

Quality control Techniques

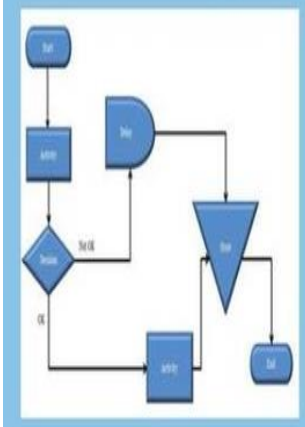
- JIT
- Quality at source
- Inspection
- SQC
- QC
- TQM

Quality Control – Tools & Techniques

- Cause and effect diagrams (Ishikawa)
- Control charts
- Pareto charts
- Flowcharts
- Histogram
- Run chart
- Scatter diagram
- Statistical sampling
- Inspection review
- Defect repair review

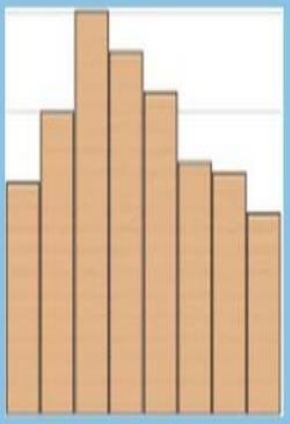
7 Q C Tools

Process Flow Diagram

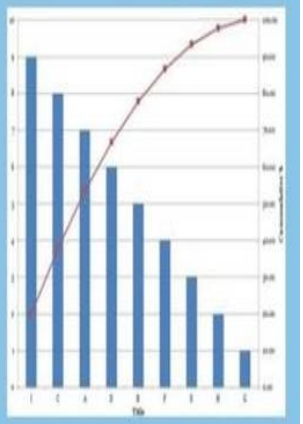


Check Sheet

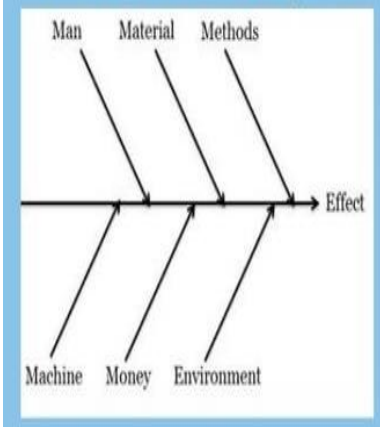
Histogram



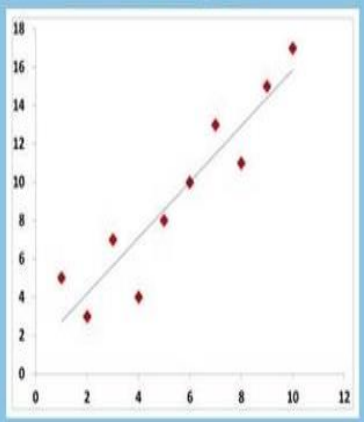
Pareto Diagram



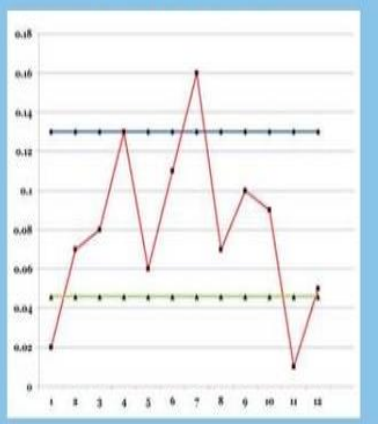
Cause and Effect Diagram



Scatter Diagram



Control Charts



Statistical Process
Quality Control Techniques

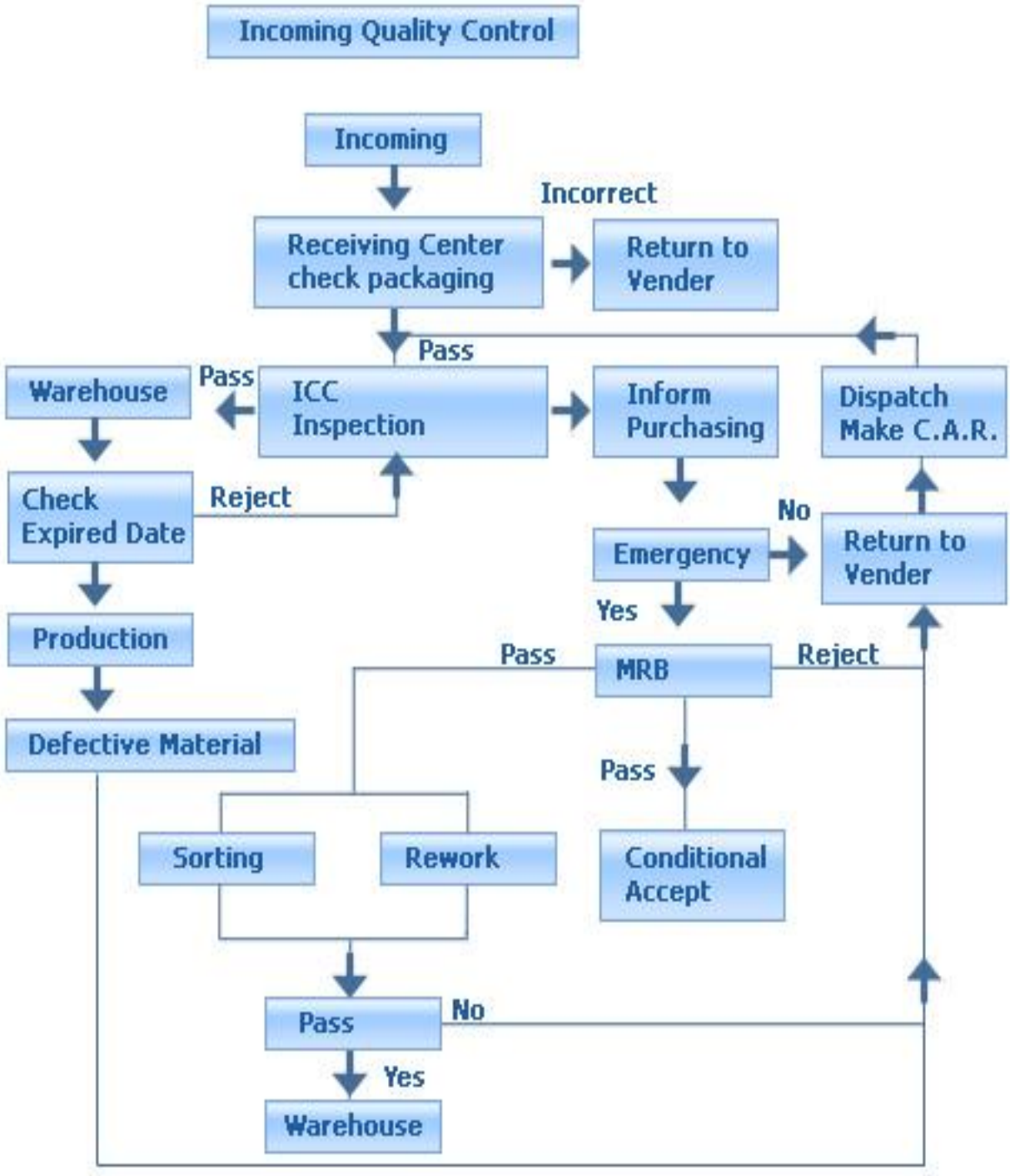
1. **Process-flow analysis**
2. **Cause-and-effect diagrams**
3. **Pareto chart**
4. **Control chart**
5. **Histogram**
6. **Scattergram**

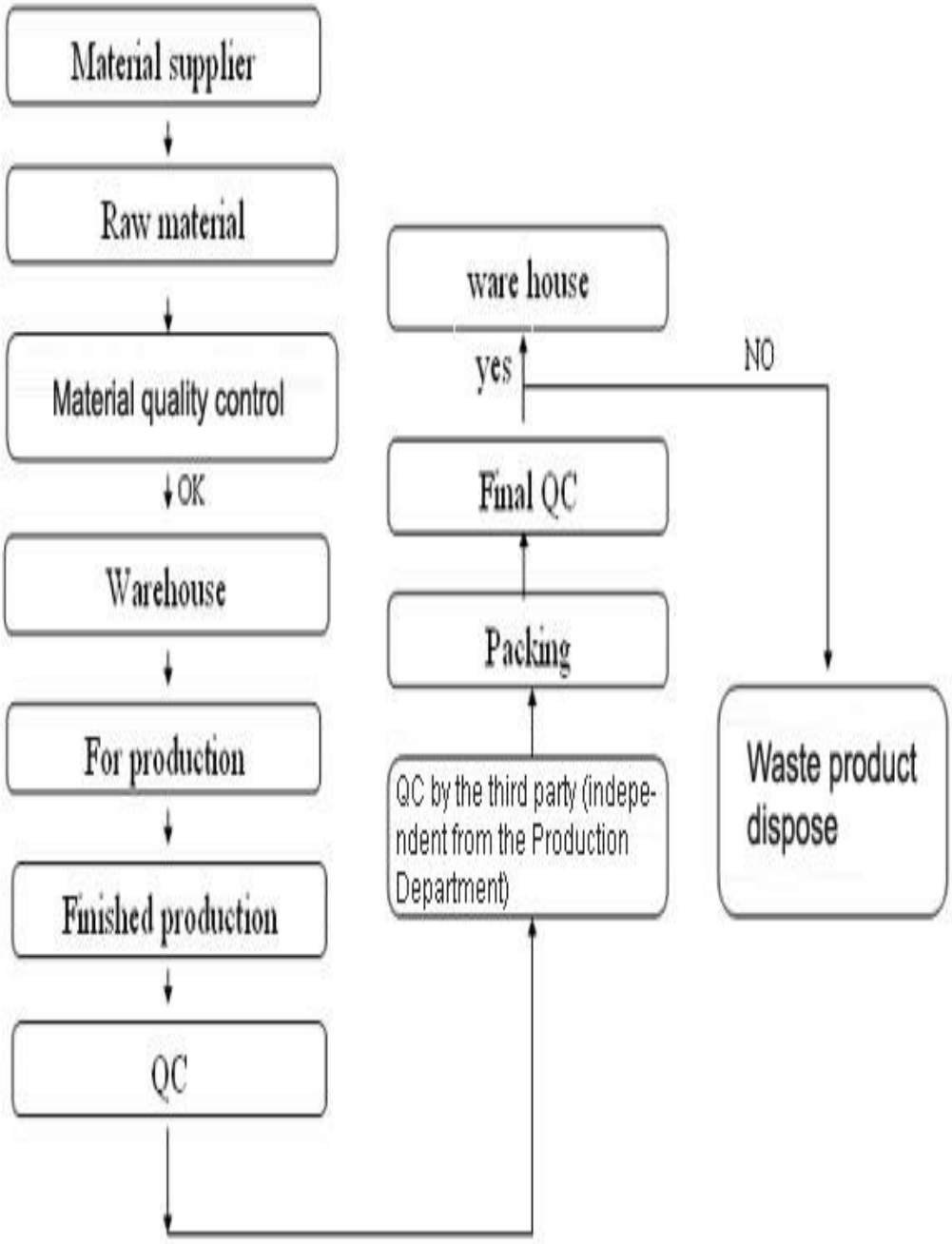
Kaizen - practices participated in by employees from all levels of the company that focus on continuous improvement of business processes

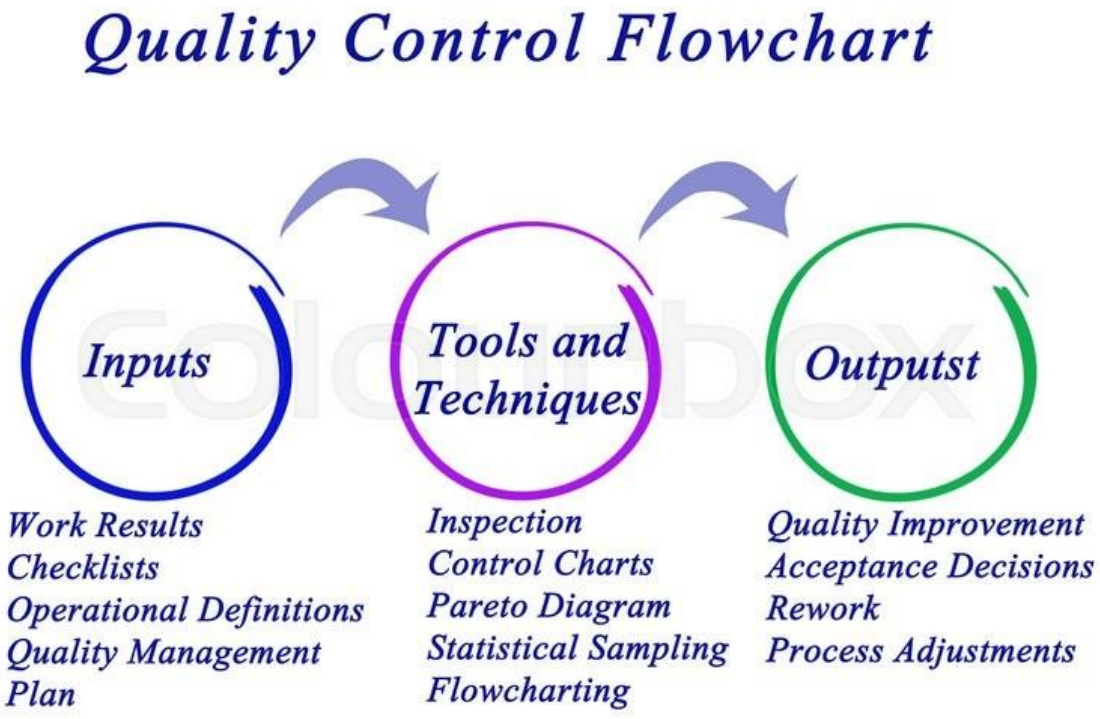
8-16

Quality Control (contd.)

- Tools & Techniques:
  - Inspection
  - Control charts
  - Pareto diagrams
  - Statistical sampling
  - Flowcharting
  - Trend analysis


Incoming Quality Control
Incoming
Incorrect
Receiving Center check packaging
Return to Vender
Pass
Warehouse
Pass
ICC Inspection
Inform Purchasing
Dispatch Make C.A.R.
Check Expired Date
Reject
No
Emergency
Return to Vender
Yes
Production
Pass
MRB
Reject
Defective Material
Pass
Sorting
Rework
Conditional Accept
Pass
No
Yes
Warehouse


Material supplier
Raw material
Material quality control
OK
Warehouse
For production
Finished production
QC
QC by the third party (independent from the Production Department)
Packing
Final QC
yes
NO
ware house
Waste product dispose



HISTORY OF JIT CONCEPT

- The technique was first used by the ford motor company during 1920s
- 1954 Japanese giant Toyota implemented JIT

Real life examples of Just in time

- Toyota
- DELL
- Harley Davidson

Just-in-time Philosophy

JIT manufacturing is defined as the *elimination of all waste and continuous improvement of productivity*.

Waste means anything other than the minimum amount of equipment, parts, space, material, and workers' time absolutely necessary to add value to the product. This means there should be no surplus, there should be no safety stocks, and lead times should be minimal.

The concept of JIT:

To have the right parts and quantities at the right time and place.

Benefits of Just In Time

- 1. Reduced inventory
- 2. Improved quality
- 3. Lower costs
- 4. Reduced space requirements
- 5. Shorter lead time
- 6. Increased productivity
- 7. Greater flexibility
- 8. Better relations with suppliers
- 9. Simplified scheduling and control activities
- 10. Increased capacity
- 11. Better use of human resources
- 12. More product variety

Characteristics of TQM:

- Customer Oriented
- Long term commitment
- Teamwork
- Leadership and continuous involvement of Top Management
- Continuous Improvement

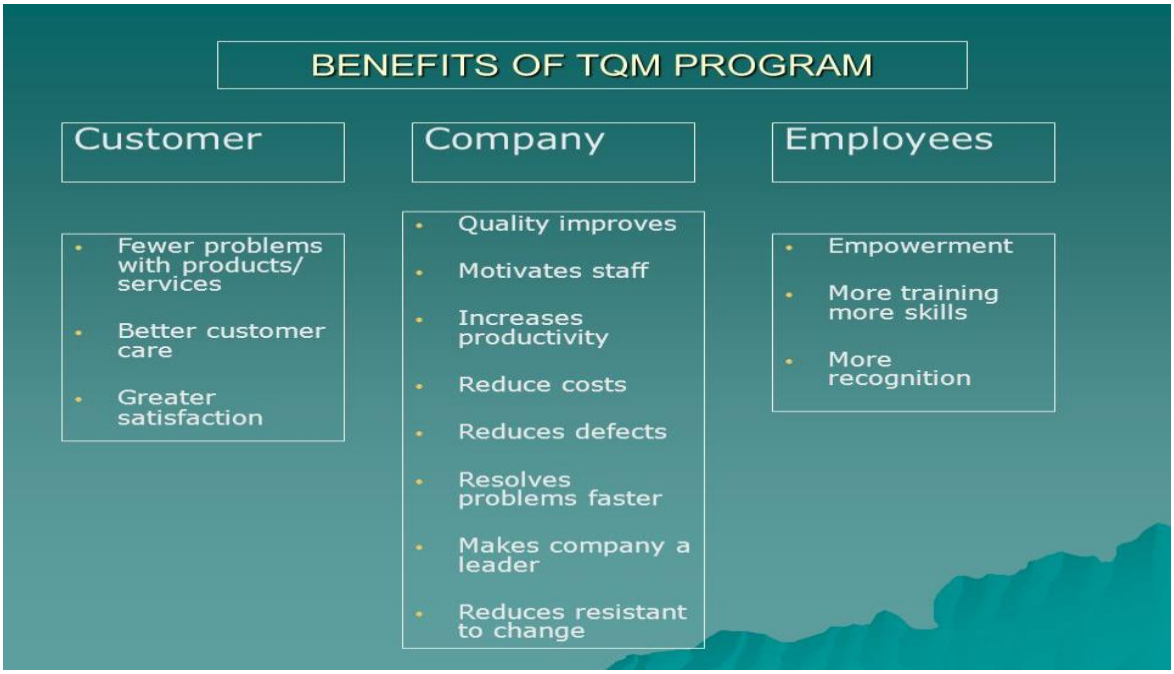
Concepts of TQM:

- Top Management Commitment
- Focus on the customer – *Goal is to identify and meet customer needs.*
- Effective involvement and utilization of the entire work force – Employees are expected to seek out, identify, and correct quality problems.
- Continuous Improvement – A philosophy of never-ending improvement.

- Treating suppliers as partners – Quality concepts must extend to a company's suppliers.
- Establishing performance measures for the processes
- Use of quality tools – Ongoing employee training in the use of quality tools.

12 PRINCIPLES OF TQM:

1. Leadership
2. Customer satisfaction
3. Understand and establish customer supplier chains
4. Do the right things
5. Do things right the first time
6. Measure for success.
7. Continuous improvement is the goal.
8. Management must lead.
9. Training is essential.
10. Communication is essential
11. Right attitude towards quality.
12. Teamwork


BENEFITS OF TQM PROGRAM
Customer
Fewer problems with products/ services
Better customer care
Greater satisfaction
Company
Quality improves
Motivates staff
Increases productivity
Reduce costs
Reduces defects
Resolves problems faster
Makes company a leader
Reduces resistant to change
Employees
Empowerment
More training more skills
More recognition

Traditional approach and TQM

Quality element	Previous state	TQM
Definition	Product-oriented	Customer-oriented
Priorities	Second to service and cost	First among equals of service and cost
Decisions	Short-term	Long-term
Emphasis	Detection	Prevention
Errors	Operations	System
Responsibility	Quality Control	Everyone
Problem solving	Managers	Teams
Manager's role	Plan, assign, control, and enforce	Delegate, coach, facilitate, and mentor

QUALITY AT THE SOURCE

Quality at the source is a **lean manufacturing principle** which defines that quality output is not only measured at the end of the production line but at every step of the productive process and being the responsibility of each individual who contributes to the production or on time delivery of a product or service.

Quality at Source

- Quality means meeting requirements
  - Needs
  - Expectations
- Every staff is an **inspector**, not the next person in the process or the customer
- We can use tools such as **poka yoke** (mistake-proofing) and **visual control** to prevent errors

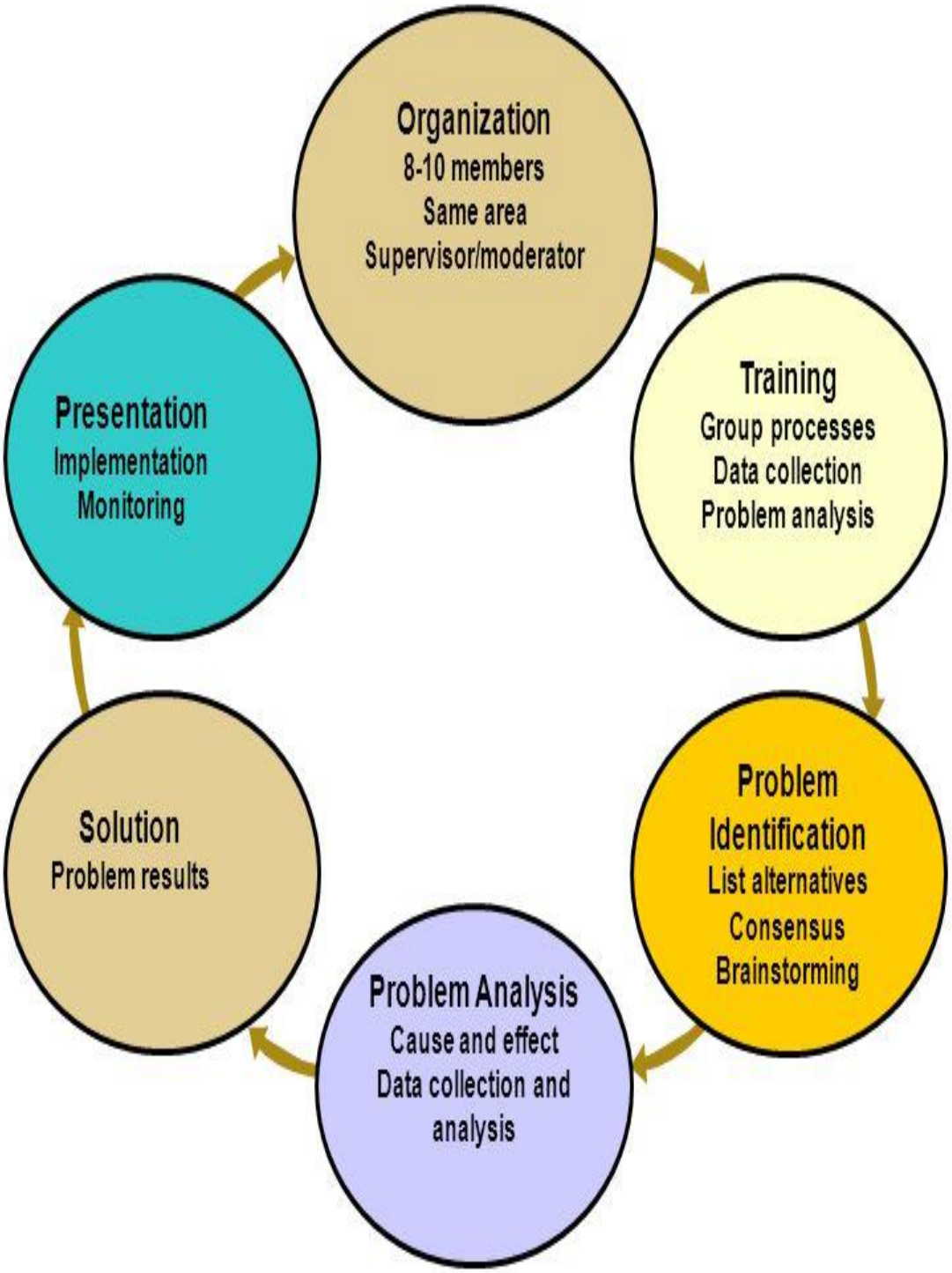
Quality at the Source

- Visual control
  - makes problems visible
- Poka-yokes
  - prevent defects from occurring
- Kaizen
  - a system of continuous improvement; "change for the good of all"
- Jidoka
  - authority to stop the production line
- Andons
  - call lights that signal quality problems
- Under-capacity scheduling
  - leaves time for planning, problem solving, and maintenance

➢ QUALITY CIRCLES

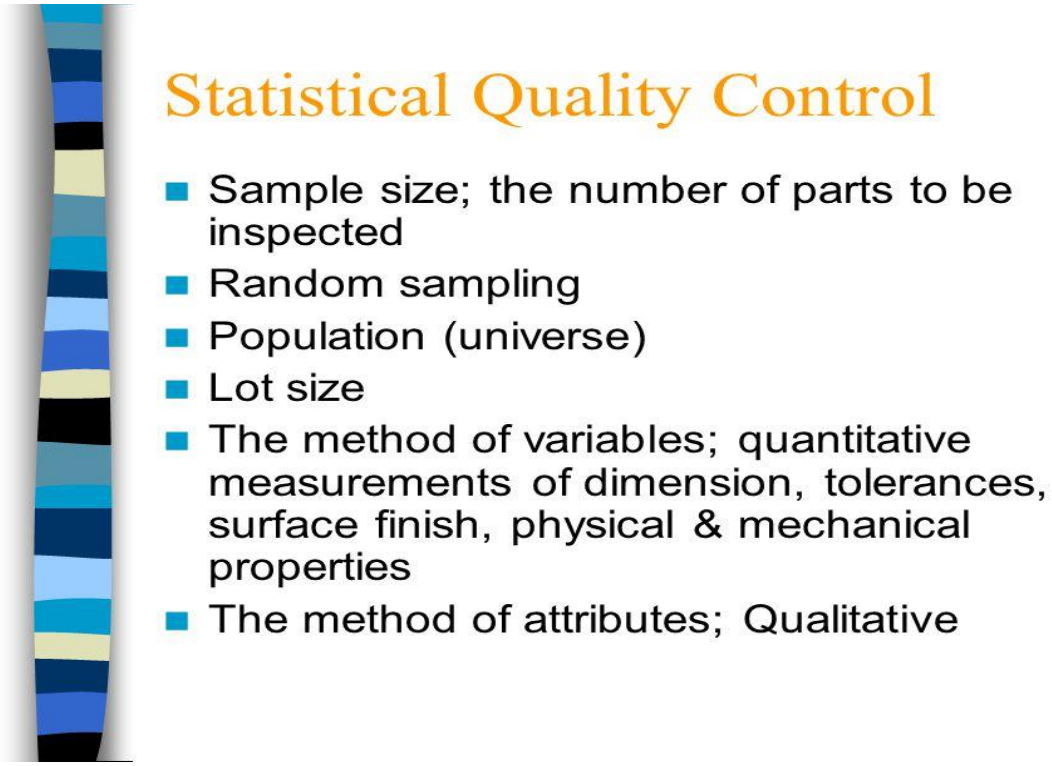
A quality circle or quality control circle is a group of workers who do the same or similar work, who meet **regularly to identify, analyze and solve work-related problems. Normally small in size, the group is usually led by a supervisor or manager and presents its solutions to management;** where possible, workers implement the solutions themselves in order to improve the performance of the organization and motivate employees. Quality circles were at their most popular during the 1980s

Quality Circles



STATISTICAL QUALITY CONTROL

Statistical quality control refers to the use of statistical methods in the monitoring and maintaining of the quality of products and services. One method, referred to as acceptance sampling, can be used when a decision must be made to accept or reject a group of parts or items based on the quality found in a sample.

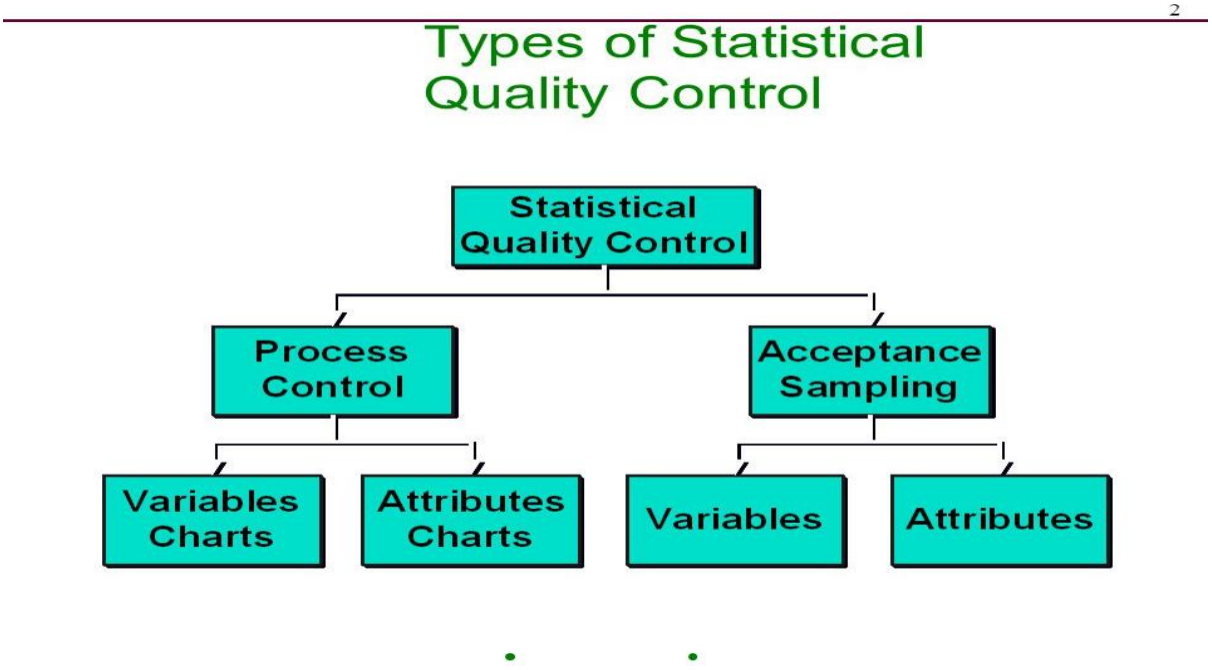


MEANING OF **ACCEPTANCE SAMPLING OR SAMPLING INSPECTION**:

One Method Of Controlling The Quality Of A Product Is 100% Inspection Which Requires Huge Expenditure In Terms Of Time, Money And Labour

ACCEPTANCE SAMPLING

Assume that a consumer receives a shipment of parts called a lot from a producer. A sample of parts will be taken and the number of defective items counted. If the number of defective items is low, the entire lot will be accepted. If the number of defective items is high, the entire lot will be rejected. Correct decisions correspond to accepting a good-quality lot and rejecting a poor-quality lot. Because sampling is being used, the probabilities of erroneous decisions need to be considered. The error of rejecting a good-quality lot creates a problem for the producer; the probability of this error is called the producer's risk. On the other hand, the error of accepting a poor-quality lot creates a problem for the purchaser or consumer; the probability of this error is called the consumer's risk.



STATISTICAL PROCESS CONTROL

- It involves monitoring the production process to detect and prevent poor quality.
- It is a statistical procedure using control charts to see if any part of a production process is not functioning properly and could cause poor quality.
- It is a tool for identifying problems in order to make improvement.

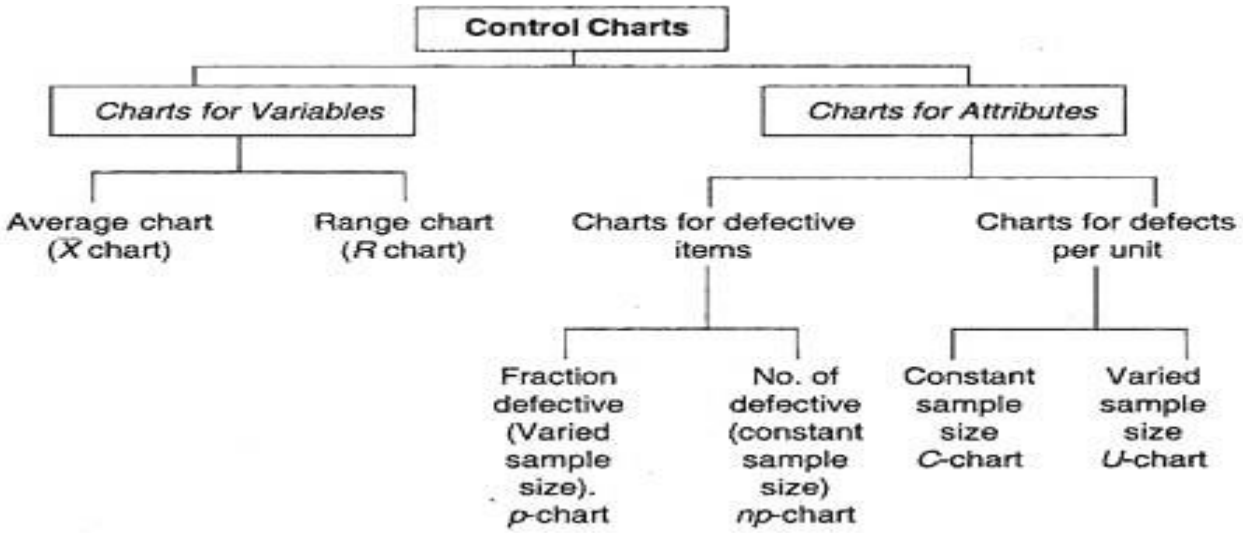
- ATTRIBUTE: An attribute is a product characteristics such as colour , surface texture,cleanlines, smell and taste.
- Attribute can be evaluated quickly with a discrete response such as good or bad.
- If quality specification are complex and extensive , a simple attribute test might be used to determine whether or not a product or service is defective.

VARIABLE :

A product characteristics that is continuous counting and can be measured.

	Variables	Attribute
Characteristics	measurable continuous may derive from counting	countable discrete units or occurrences good/bad
Types of Data	length volume time	no. of defects no. of defectives no. of scrap items
Examples	width of door gap lug nut torque fan belt tension	audit points lost paint chips per unit defective lamps
Data Examples	1.7 inches 32.06 psi 10.542 seconds	10 scratches 6 rejected parts 25 paint runs

A Comparison of Variables and Attribute Data



Types of Control

Control Chart	Monitors
Attribute control charts	
p chart	Process fraction defective
c chart	number of defects
u chart	defects per unit
Variables control charts	
X-bar chart	Process mean
R chart (Range Chart)	Process variability

S- CHART means STANARED DEVIATION

Control Charts for Attributes –P-Charts & C-Charts

Attributes are discrete events: yes/no or pass/fail

- **Use P-Charts for quality characteristics that are discrete and involve yes/no or good/bad decisions**
  - Number of leaking caulking tubes in a box of 48
  - Number of broken eggs in a carton
- **Use C-Charts for discrete defects when there can be more than one defect per unit**
  - Number of flaws or stains in a carpet sample cut from a production run
  - Number of complaints per customer at a hotel

Acceptance sampling uses statistical sampling to determine whether to accept or reject a production lot of material. It has been a common quality control technique used in industry.

- testing is destructive;
- the cost of 100% inspection is very high; and
- 100% inspection takes too long.

Six Sigma

- Six Sigma is a **set of techniques and tools** for process **improvemen**t. It was introduced by **engineer Bill Smith** while working at **Motorola** in 1980.
- **Six Sigma** is a fact-based, data-driven philosophy of improvement that values defect **prevention over defect detection**. It drives **customer satisfaction and bottom-line results** by **reducing variation, waste, and cycle time,** while promoting the use of work standardization and flow, thereby creating a competitive advantage.

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DMAIC


DEFINE
MEASURE
ANALYZE
IMPROVE
CONTROL
SIX
SIGMA
6σ
dreamstime.com

UNIT-5

UNIT-5

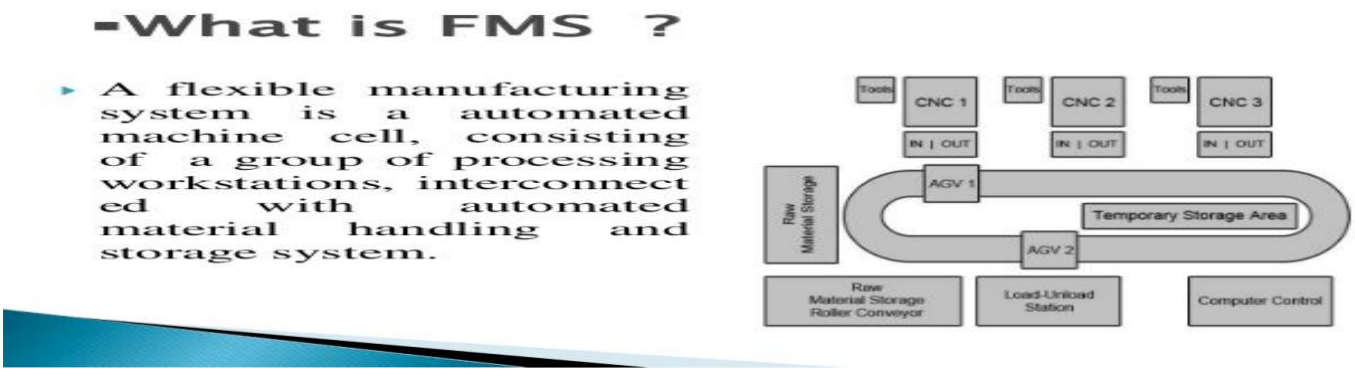
Flexible Manufacturing Systems. Poka yoke-Characteristics, levels, classification, principles, device. Kaizen-Elements, classification, steps in implementing kaizen.

Flexible Manufacturing Systems

- This concept is credited to David Williamson, a British engineer during mid-1960s.
- In late 1960s the first FMS machining system was installed at Ingersoll-Rand company in Virginia.

What is Flexible Manufacturing System?

- ✓ A Flexible manufacturing system is a ***automated machine cell***, consisting of a group of processing ***workstations***, interconnected with ***automated material handling*** *and* ***storage system*.**
- ✓ The FMS is most suited for the mid-variety, mid-volume production range.



CNC - COMPUTER NUMERICAL CONTROL

Classification of Flexible Manufacturing System

It is classified according to the number of machines in the system,

1. Single machine cell
2. Flexible manufacturing cell
3. Flexible Manufacturing system

1. Single Machine cell:

A single machine cell consists of one CNC machining center combined with a part storage for unattended operation.

Raw work parts are loaded into it.

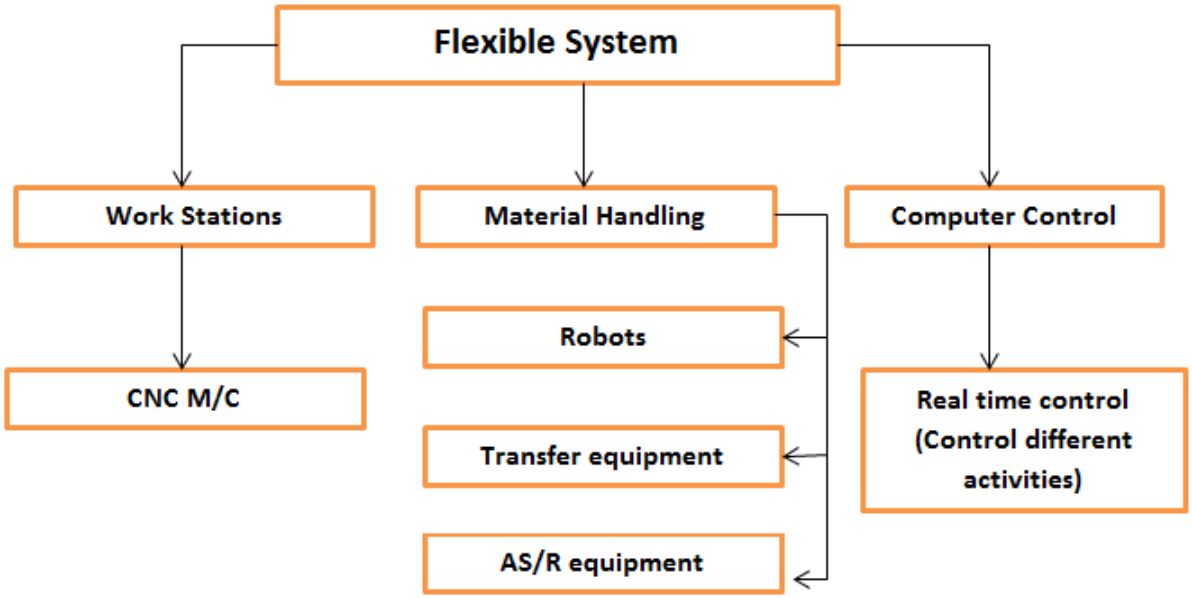
2. Flexible manufacturing cell:

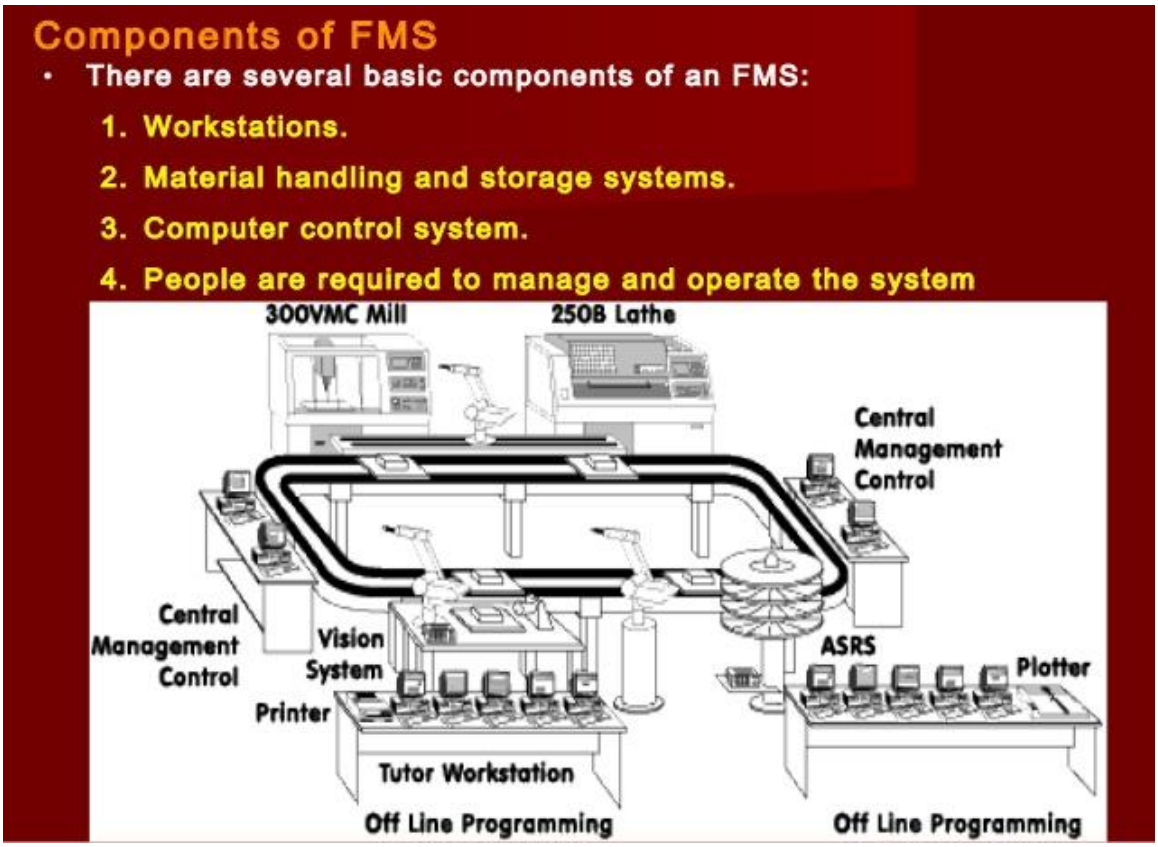
A flexible manufacturing cell consists of two or three processing workstations (typically CNC machining centers) plus a part handling system.

The parts handling system is connected to a load / unloads station.

3. Flexible manufacturing system:

A flexible manufacturing system has four or more processing workstations connected mechanically by a common part handling system and electronically by a distributed computer system





Basic component of FMS

- ***Workstations***
- ***Automated Material Handling and Storage system***
- ***Computer Control System***

❖ **WorkStation**

✓ Substations

1. Load / Unload Stations
2. Machining Stations
3. Other processing stations
4. Assembly

❖ ***Automated Material Handling and Storage system***

Automated fork lifting and Rail traveler

Human Resources (Loading raw parts into the system, Changing and setting tools, Equipment maintenance and repair, NC part programming in a machining)

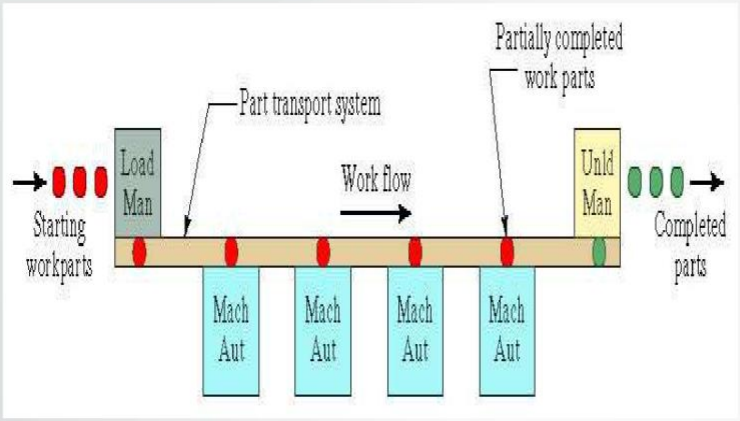
❖ **Computer control system**

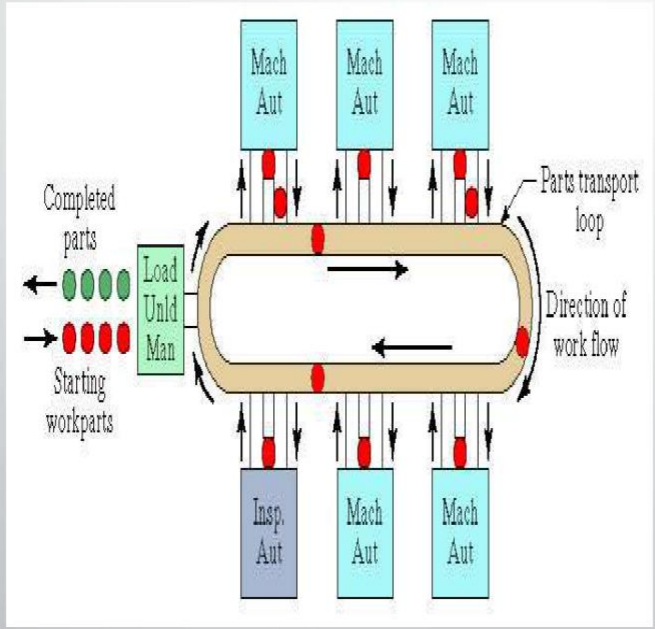
Computer Control Programmable Logic Controller

Layouts of FMS

- Progressive or Line Type
- Loop Type
- Ladder Type
- Open field Type
- Robot centered Type

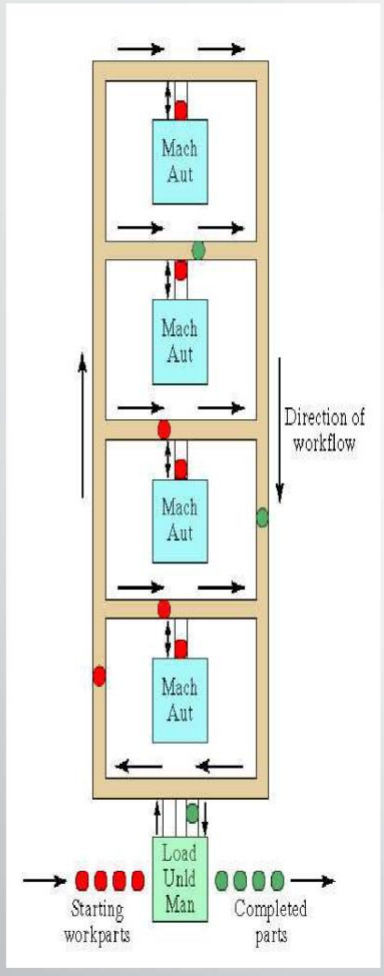
Progressive Line Type

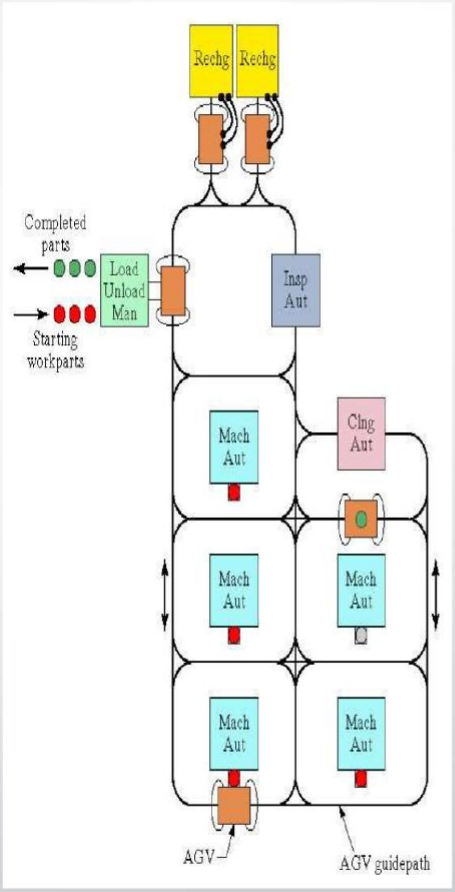




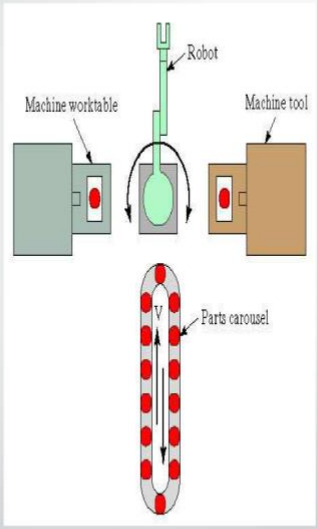
LOOP TYPE

Ladder Type & Open field Type





Robot centered Type



Advantages of FMS

- ✓ Faster, low- cost
- ✓ Reduced errors, rework, repairs and rejects
- ✓ Reduce inventory
- ✓ Lower direct labor cost
- ✓ To reduce set up and queue times
- ✓ Improve efficiency
- ✓ Reduce time for product completion
- ✓ utilize human workers better
- ✓ Improve product routing
- ✓ Improve product Quality
- ✓ Produce more product more quickly

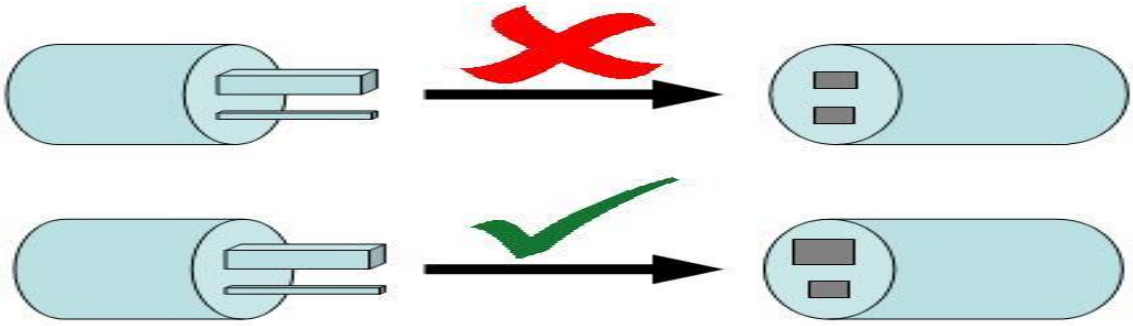
Disadvantages of FMS:

- ✓ Expensive
- ✓ Substantial pre – planning activity
- ✓ Limited ability to adapt changes
- ✓ May be arise technological problems

Poka – Yoke mean Mistake –Proofing

Poka – yoke:

- ✓ A **poka-yoke** is any mechanism in any process that helps an equipment operator Avoids (**yokeru**) mistakes (**poka**).
- ✓ A Japanese term meaning '**to make fail - safe'** . Any mechanism or process that prevents mistakes being made can be called a **poka - yoke**. They are techniques and thinking designed ***to prevent errors in manufacture and service provision.***

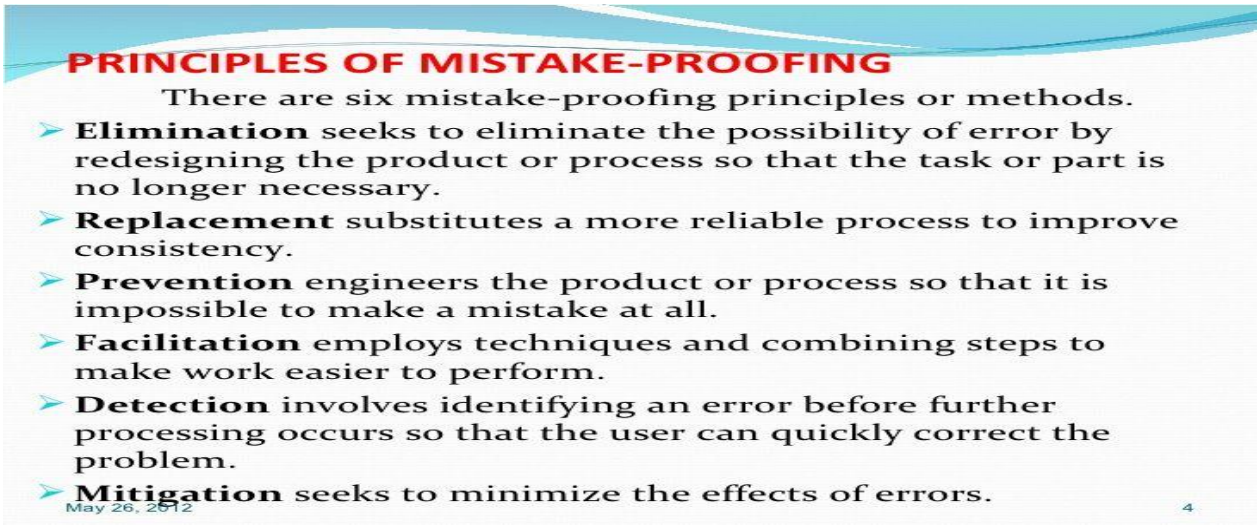


Characteristics:

- Useable by all workers
- Simple and cheap
- Permitting 100% inspection
- Simple to install
- Does not require continuous attention from the operator
- Low cost
- Designed to stop a particular mistake
- Provides instantaneous feedback, prevention, or correction, minimum supervising

Principles of Mistake –Proofing:

1. Elimination
2. Replacement
3. Prevention
4. Facilitation
5. Detection
6. Mitigation



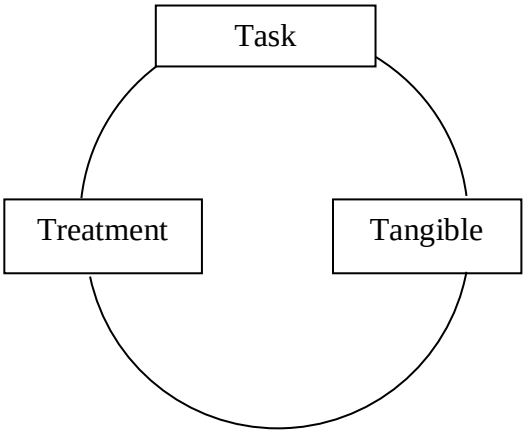
Status and Function of Poka – Yoke:

Status **-** 1.The fault will happen 2.The fault has happened

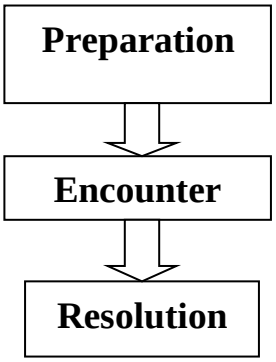
Functions: ***1.*** Stop 2 . Check 3.Alarm.

Classification of Poka – Yoke:

1. Server Poka – Yoke



2. Customer Poka – Yoke



Devices Poka – Yoke

- Guide pins
- Error Detection and alarms.
- Limit Switches
- Sensors
    1. Proximity sensors
    2. Laser displacement sensors
- Vision system
- Counters and timers
- Checklists

These devices help eliminate errors and defects by giving machines the "intelligence" to stop and signal when an error occurs.

Poka – Yoke devices stop machines and alert workers when a problem exists.

Three level of Poka – Yoke:

1. **Eliminate errors** defects and losses at the source or prevention of a mistake from being committed.
2. **Detection of a loss or mistakes** it occurs, allowing **correction before** it becomes a problem.
3. **Detection of a loss or mistakes** after it has occurred **just in time** before it blows up into a major issue (Least effective)

POKA – YOKE APPROACH

- Proactive approach
- Reactive approach

4.

POKA-YOKE APPROACH

- Proactive Approach :
- A fully implemented ZERO DEFECT QUALITY system requires Poka-Yoke usage at or before the inspection points during the process.
- Poka-yoke will catch the errors before a defective part is manufactured 100% of the time.
- Reactive Approach :
- Check occurs immediately after the process.
- Can be an operator check at the process or successive check at the next process.
- Not 100% effective, will not eliminate all defects.
- Effective in preventing defects from being passed to next process.

May 26, 2012 11

KEY PRINCIPLE

Error is inevitable, but it should be eliminated.

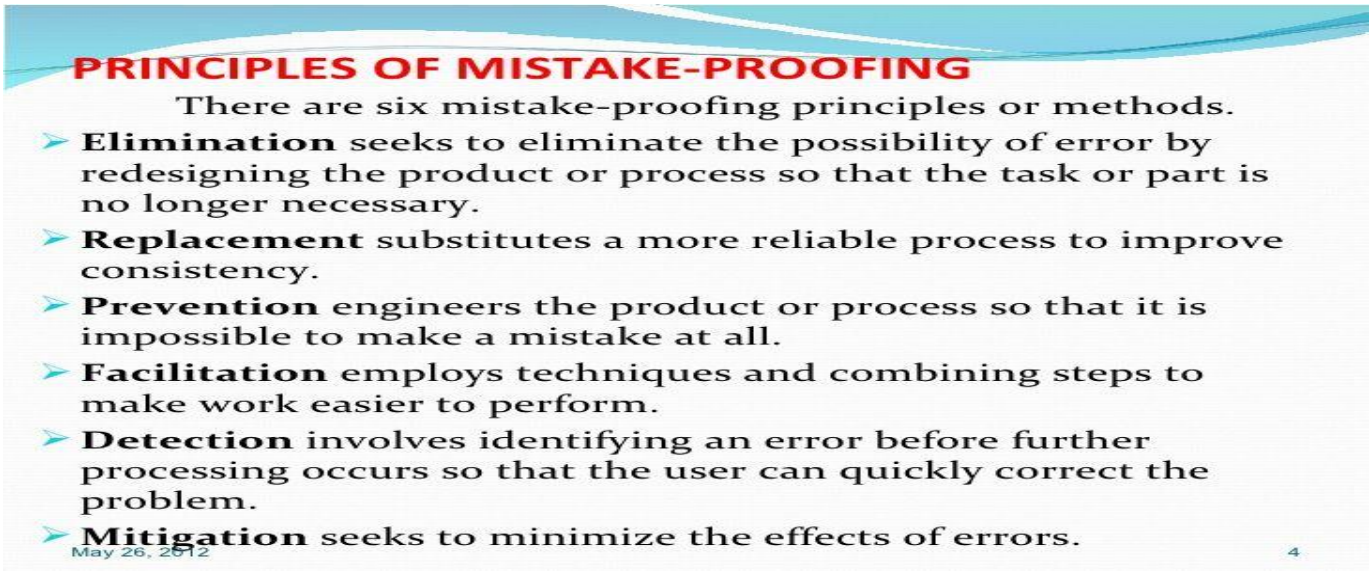
Before Poka Yoke

After Poka Yoke

Principles of Mistake –Proofing:

1.Elimination 2. Replacement 3.Prevention 4.Facilitation

5.Detection 6. Mitigation



KAIZEN

KAIZEN:

- ✓ Masaaki lmai is known as the **developer** of KAIZEN
- ✓ 'KAI' means 'Change or the action to correct'.
- ✓ 'ZEN' means 'Good'.

What is KAIZEN?

KAIZEN means Improvement,Improvements without spending much money, involving everyone from managers to employees, and using much common sense.

The aspect of KAIZEN is that it is On-going and never –ending improvement process.

Elements of kaizen

1. Teamwork 2.Personal Discipline 3.Improved morale 4.Quality
5 .Suggestion for improvement

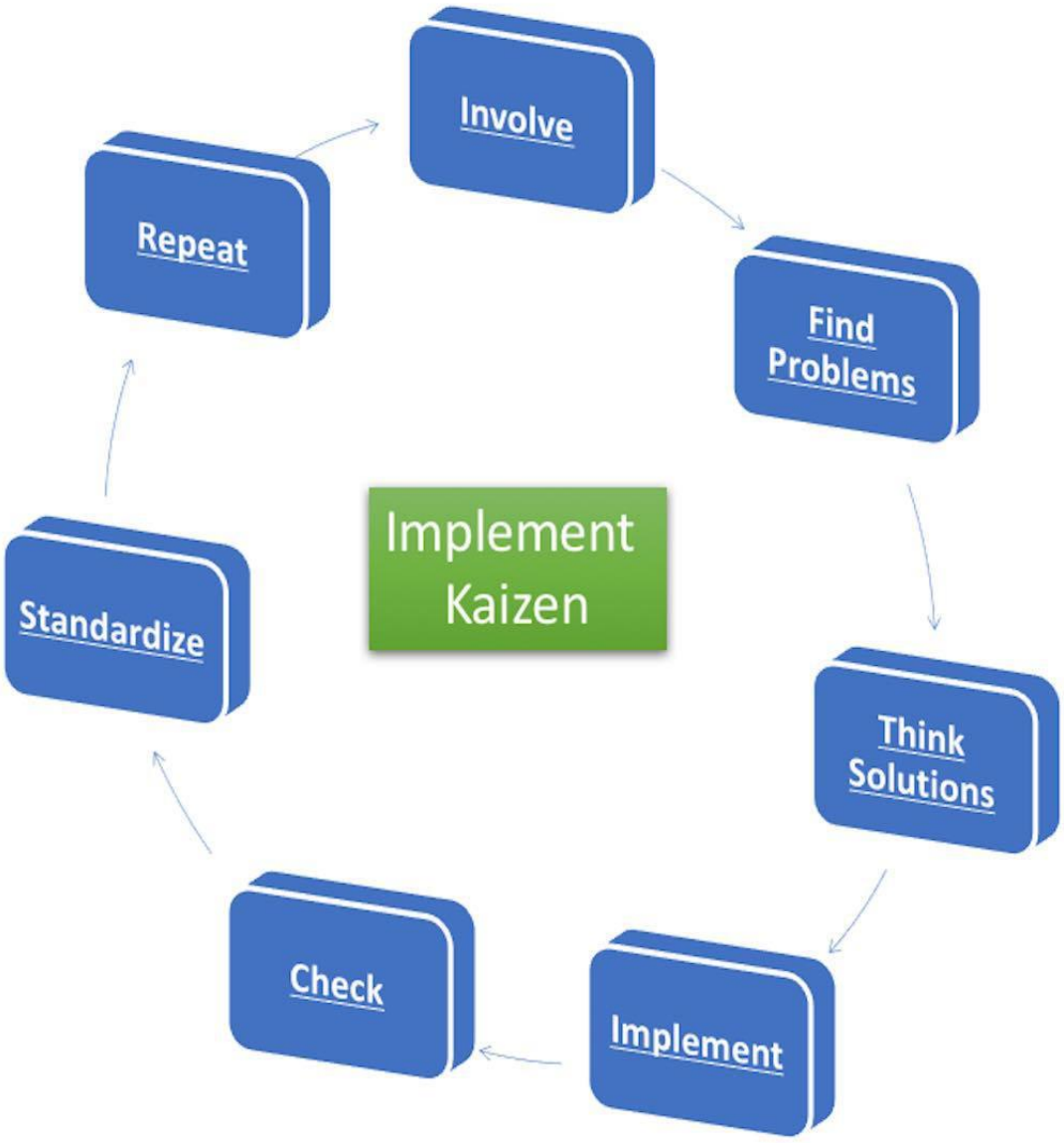
Six Steps in implementing KAIZEN:

1. Discover Improvement Potential
2. Analyze the current Methods
3. Generate Original Ideas
4. Develop an Implementation plan
5. Implement the plan
6. Develop an Implementation plan

Six Steps of Kaizen

	DESCRIPTION
1 Discover Improvement Potential	▪ Learn to see waste or improvement potential around the work areas. ▪ Develop mindset and attitude required for people to be successful in process improvement.
2 Analyze the Current Methods	▪ Analyze current methods of various work-related processes. ▪ Examples of analytical methods include work analysis, motion analysis, time study, standardized work, machine loss analysis, and material flow analysis.
3 Generate Original Ideas	▪ Apply techniques for stimulating original ideas and synthesizing solutions.
4 Develop an Implementation Plan	▪ Create effective plan for implementation, including communication and tracking purposes. When possible, make changes quickly and effectively as the situation allows.
5 Implement the Plan	▪ Create a positive atmosphere and attitude toward implementing kaizen. ▪ Communicate thoroughly with affected parties in the organization. ▪ Follow up on implementation as needed
6 Evaluate the New Method	▪ Evaluate the results of the action items performed in order to verify the actual level of improvement. ▪ Standardize work practices and follow up to ensure gains are sustained.

Source: Kato & Smalley


Involve
Find Problems
Think Solutions
Implement
Check
Standardize
Repeat
Implement Kaizen

CONTINUOUS IMPROVEMENT EVENT STEPS (KAIZEN)

Lean Enterprise

Start

Document Reality

Identify Waste

Separate value added from non value added steps

Eliminate unnecessary non value added and plan counter measures

Reality Check

Make Changes

Verify Change

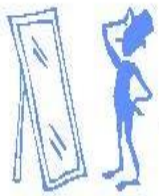
Measure Results

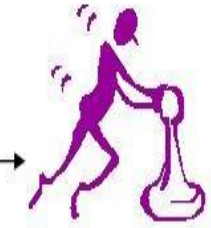
Make this the Standard

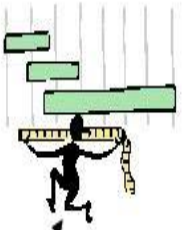
Celebrate

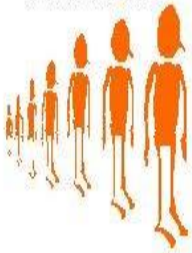
Do It Again

In 2 to 5 days









Archfield Consulting Group

(Company Proprietary)

January 2004

Classification of KAIZEN:

1.Point Kaizen 2. System Kaizen 3.Line Kaizen 4.Plane Kaizen

5.Cube Kaizen

Point Kaizen

It is one of the most commonly implemented types of Kaizen. It happens very quickly and usually without much planning. As soon as something is found broken or incorrect, quick and immediate measures are taken to correct the issues.

These measures are small, isolated and easy to implement. However, they can have a huge impact.

In some cases, it is also possible that the positive effects of point kaizen in one area can reduce or eliminate benefits of point Kaizen in some other area. An example of Point Kaizen could be a shop inspection by a supervisor and he finds broken materials or other small issues, and then asks the owner of the shop to perform a quick Kaizen (5S) to rectify those issues.

System Kaizen

System Kaizen is accomplished in an organised manner and is devised to address system-level problems in an organisation.

It is an upper-level strategic planning method which results in some planned Kaizen events over a long period. It is in contrast to point Kaizen which happens as a result of identification of a small issue which is resolved in a short period.

Line Kaizen

'Line' in this context refers to a structured spreading of Lean from the point or discrete to the line. For example, Kaizen might be applied to a process (point), but also to the downstream process. Those two points constitute a Line Kaizen.

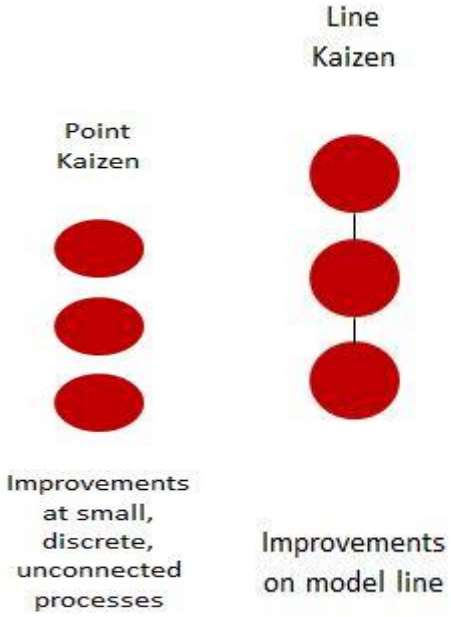
Another example might be in Lean implemented in procurement, but also being carried out in the planning department. Here, in this case, planning is upstream from procurement, and Kaizen is performed at those two points, which thus forms a line.

Plane Kaizen

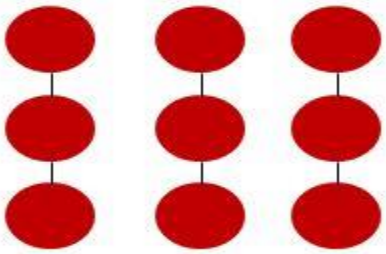
It is the next upper level of Line Kaizen, in that several lines are connected. In modern terminologies, this can also be described as value stream, where instead of traditional departments; the organisation is structured into product lines or families and value streams. It can be visualised as changes or improvements made to one line being implemented to multiple other lines or processes.

Cube Kaizen

Cube Kaizen describes the situation where all the points of the planes are connected to each other, and no point is disjointed from each other. This would resemble a situation where Lean has spread across the entire organisation. Improvements are made up and down through the plane, or upstream or downstream, including the entire organisation, suppliers and customers. This might require some changes in the standard business processes as well

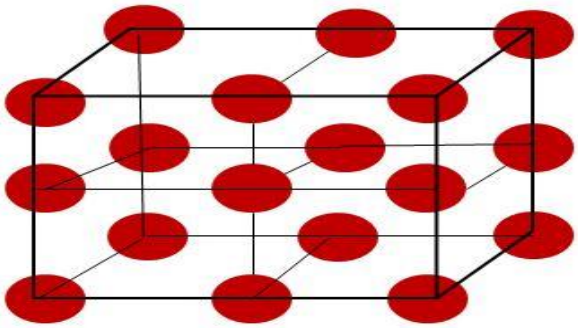


Plane
Kaizen



Improvements from model line to multiple processes

Cube
Kaizen



Improvements across a value stream or enterprise wide

KAIZEN Process

Solving problems at working place, and improve situation and condition

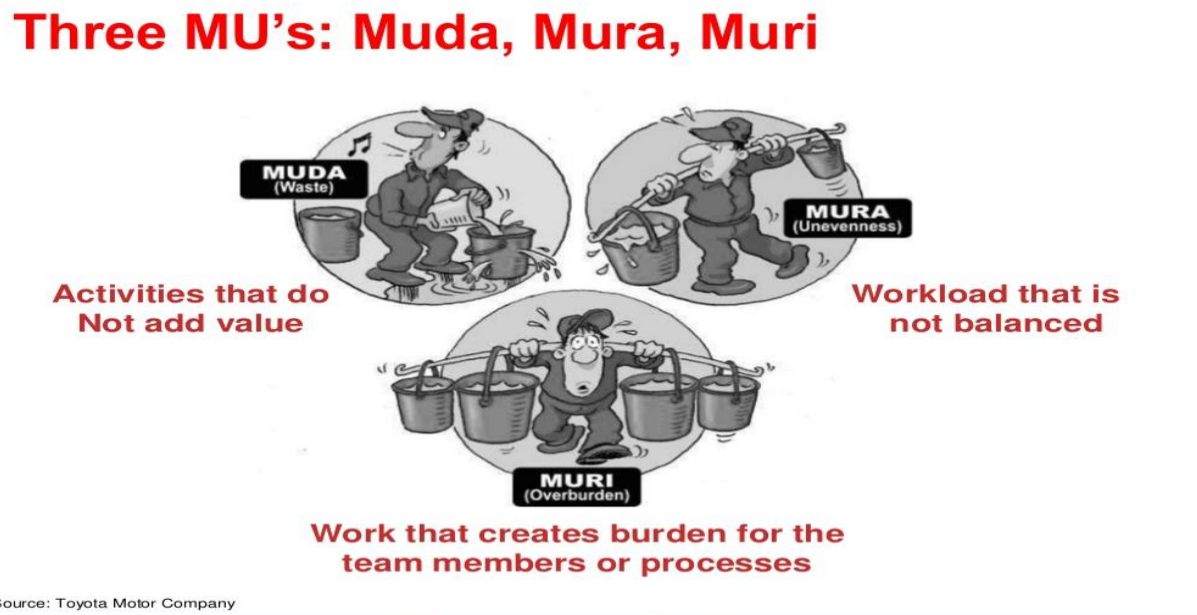
Details of each steps will be explained later, followed by lectures and practice sessions

Three MU's: (Muda, Mura, Muri)

Muda – Waste (Activities that do not add value)

Mura – Unevenness (Workload that is not balance)

Muri – Overburden (Work that creates burden for the team members or process)



Source: Toyota Motor Company