INDUSTRIAL ENGINEERING AND MANAGEMENT (BTME-4701)

Course Name: B.Tech-ME

Semester: 7th

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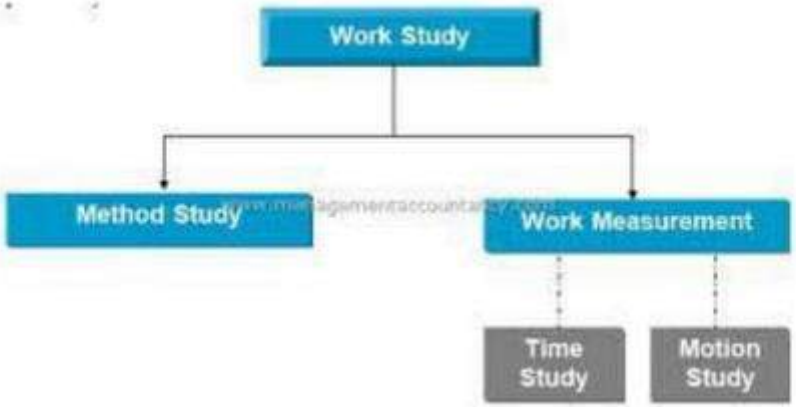
UNIT: IV

Work Study

- The systematic examination of the method of carrying on activities so as to improve the effective use of resources and to set up standards of performance for the activities being carried out.



- It is a generic term for those techniques, method study and work measurement which are used in the examination of human work in all its context. And which lead systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed, in order to effect improvement

OR

- It is that body of knowledge concerned with the analysis of the work methods and the equipment used in performing a job, the design of an optimum work method and the standardization of proposed work methods.

Work Study

- Work study has contributed immeasurably to the search for better method, and the effective utilization of this management tool has helped in the accomplishment of higher productivity.
- Work study is a management tool to achieve higher productivity in any organization whether manufacturing tangible products or offering services to its customers.

Work Study

- **Method study**
- It is the systematic recording & critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective methods and reducing cost

- **Work measurement / Time study**
- It is the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance

UNIT: IV

Objectives

- To analyze the present method of doing a job, systematically in order to develop a new and better method
- To measure the work content of a job by measuring the time required to do the job for a qualified worker and hence to establish standard time.
- To increase the productivity by ensuring the best possible use of human, machine and material resources and to achieve best quality product/ service at minimum possible cost
- To improve operational efficiency

Benefits of work study

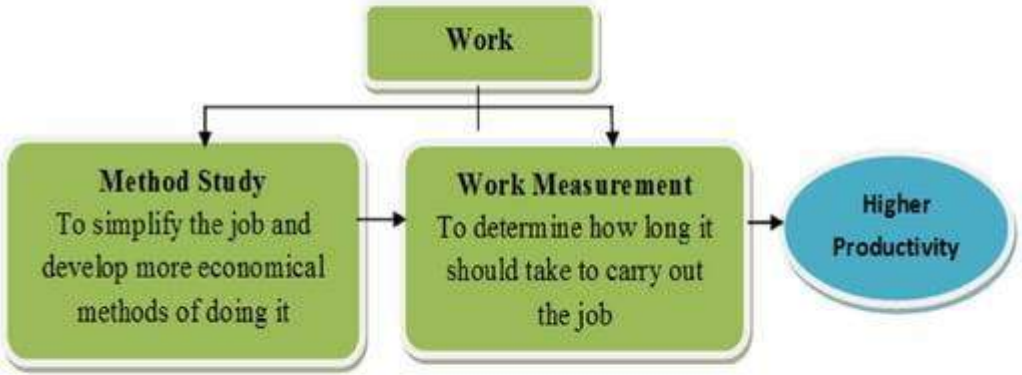
- Increased productivity and operational efficiency
- Reduced manufacturing costs
- Improved work place layout
- Better manpower planning and capacity planning
- Fair wages to employees
- Better working conditions to employees
- Improved work flow
- Reduced material handling costs

Benefits of work study

- Provides a standard of performance to measure labour efficiency
- Better industrial relations and employee morale
- Basis for sound incentive scheme
- Provides better job satisfaction to employees

Scope of work study

Relationship between Method Study and Work Study



Source: ILO, Introduction to Work Study, *Universal Publishing Corporation, India 1986, PP.34.*

UNIT: IV

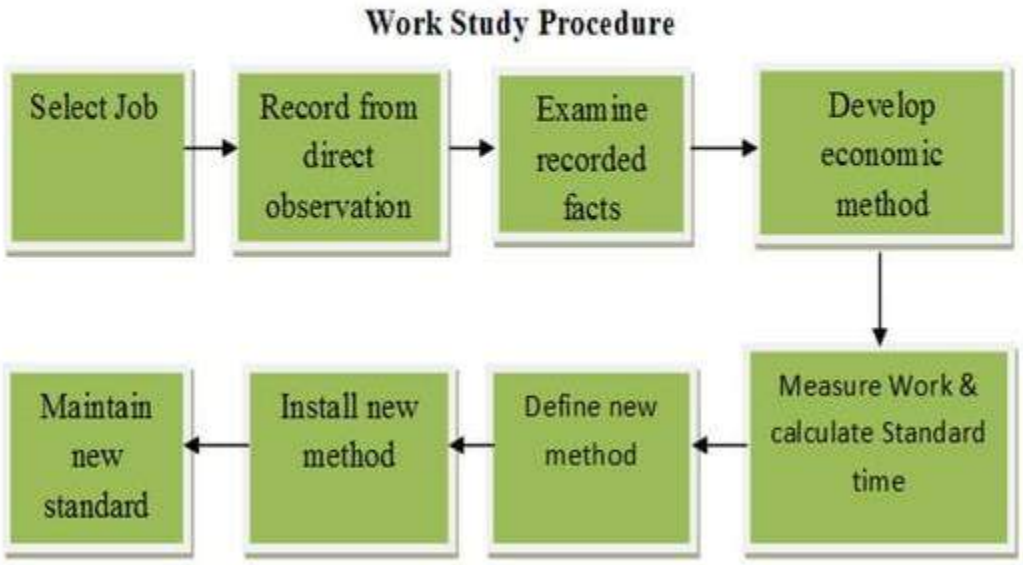
Scope of work study

- Method study and work measurement are closely linked to each other as both are associated with work study.
- Method study reduces the content of job and work measurement investigates and reduces ineffective time associated with job with establishment of standard time.
- This results into efficient working operations leading to increase in productivity of that process

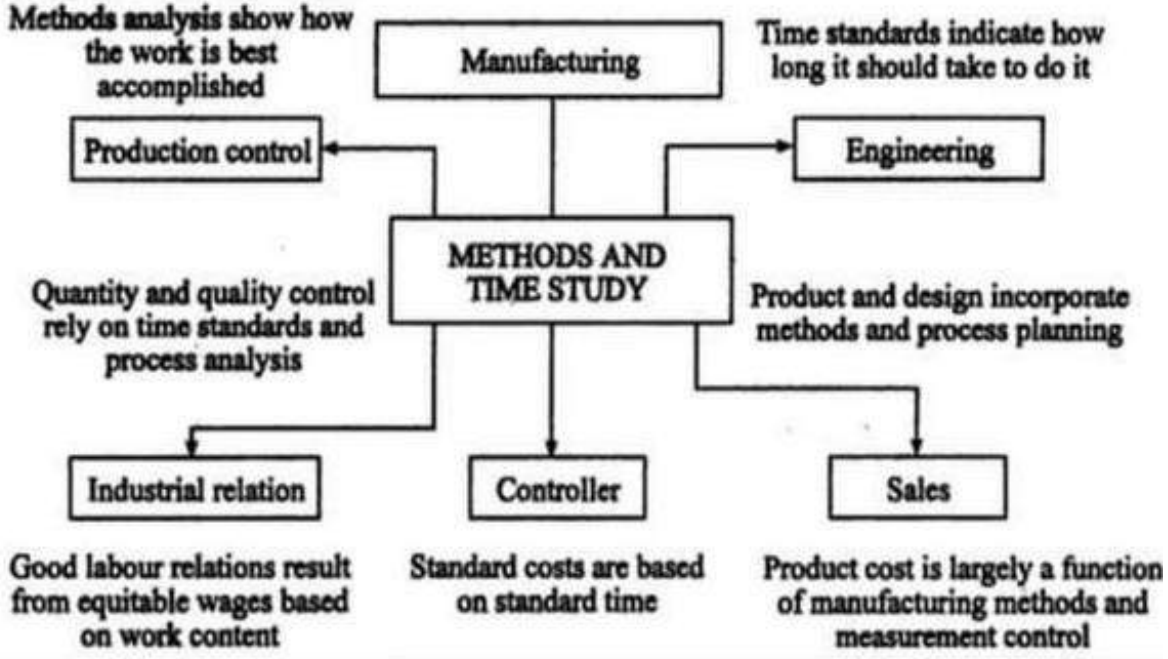
Work Study Procedure

UNIT: IV

Work Study Procedure



INFLUENCE OF METHOD & TIME STUDY IN PRODUCTION ACIVITIES



UNIT: IV

Method study

- Systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective methods and reducing cost
- Work methods analysis or method study is a scientific technique of observing , recording and critically examining the present method of performing a task or operation with the aim of improving the present method and developing a new and cheaper method.
- It is also known as method improvement or work improvement.

Objectives of method study

- To study the existing proposed method of doing any job, operation or activity
- To develop an improved method to improve productivity and to reduce operating costs
- To reduce excessive material handling or movement and thereby reduce fatigue to workmen
- To improve utilization of resources
- To eliminate wasteful and inefficient motions
- To standardize work methods or processes, working conditions , machinery, equipments and tools.

UNIT: IV

Advantages of method study

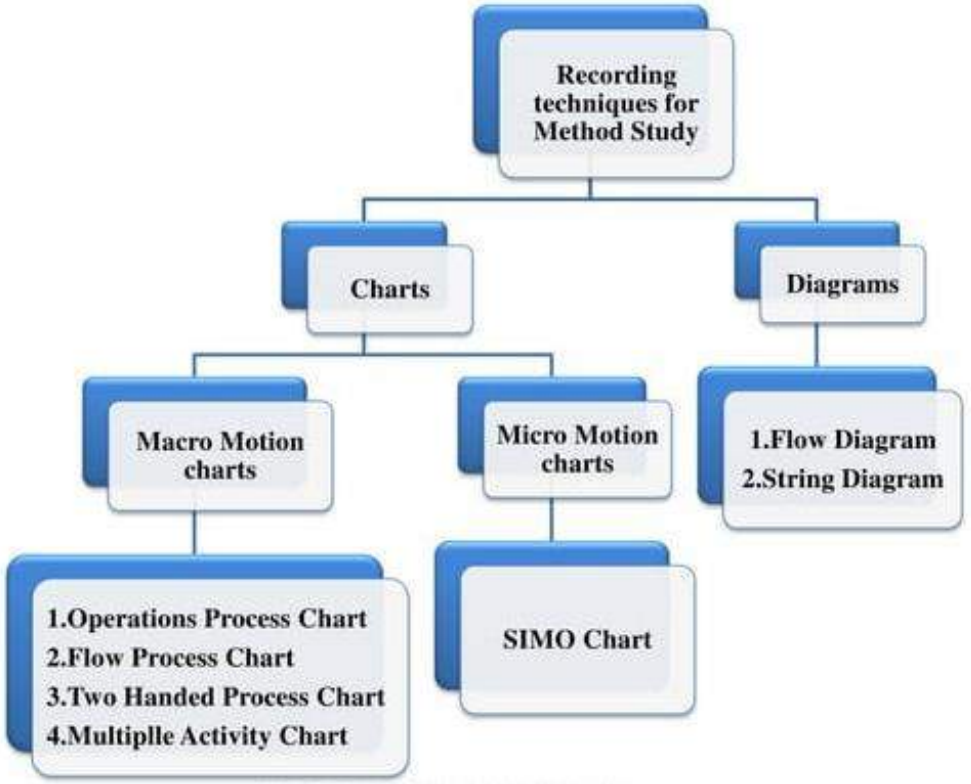
- Less fatigue to the operator
- Optimum utilization of all resources
- Higher safety to work men
- Shorter production cycle time
- Higher job satisfaction
- Reduced material consumption and wastages
- Reduced manufacturing cost and higher productivity

Method Study Procedure

UNIT: IV

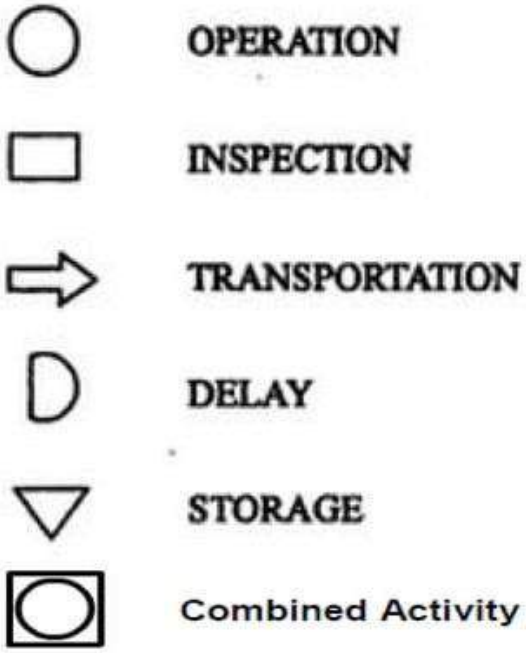
- Procedure to accomplish method study, called "SREDIM" shall be as follow:
  - **Select:** the job or operation that needs improvement,
  - **Record:** all facts, how work is done by chart methods,
  - **Examine:** every aspect of the job by asking; what, why, where, when, who and how
  - **Develop:** review ideas, eliminate, simplify, combine, re-arrange, make new method which more safe, chart new method, submit for approval,
  - **Install:** the new method, consider best time to introduce, convince all, train users,
  - **Maintain:** check frequently, match results, correct deviations.

Recording techniques



UNIT: IV

Method Study Symbols



Process Chart Symbols

1.Operation

Indicates the main steps in a process, method or procedure. Usually the part, material or product concerned is modified or changed during the operation.

2.Inspection

Indicates an inspection for quality and / or check for quantity

3.Transport

Indicates the movement of workers, materials or equipment from place to place

4.Temporary Storage or Delay

Indicates a delay in the sequence of events : for example, work waiting between consecutive operations, or any object laid aside temporarily without record until required.

5.Permanent Storage

Indicates a controlled storage in which material is received into or issued from a store under some form of authorization; or an item is retained for reference purposes.

6.Combined Activities

Indicates a controlled storage in which material is received into or issued from a store under some form of authorization; or an item is retained for reference purposes.

Process Charts Used In Method Study

Outline process chart:

An outline process chart records an overall picture of the process and records only the main events sequence-wise. It considers only the main operations and inspections.

Operation process chart:

The basic process chart, called an operation process chart, is understood as a graphic representation of the points at which the materials are introduced into the process and of the sequence of inspections and all operations except those involved in materials handling. It includes information considered desirable for analysis such as time required to carry out the operation and the location.

UNIT: IV

Flow process chart:

Flow process charts are graphic representations of the sequences of all operations, transportation, inspections, delays, delays and storages occurring during a process or a procedure and include information considered for analysis such as, time required and distance moved.

The flow process chart could be of two types namely,

(i) Flow process chart material or product type.

(ii) Flow process chart machine type or equipment.

Two handed process chart:

In this chart, the activities of a workers' or operators' both hands or limbs are recorded chronographically.

Multiple Activity Chart:

In this chart, the activities of more than one subject worker, machine or equipment are recorded on a common time scale to show their inter-relationship.

Flow diagram:

The flow diagram is a drawing or diagram drawn to a scale to show the relative position of a machine or equipment, jigs and fixtures, gangways or aisles and shows the path followed by materials or machines.

String diagram:

It is scale plan or model on which a string or a thread is used to trace and measure the path of workers, material or equipments during a specified sequence of events.

SIMO chart:

These indicate the basic motions consisting of three parts, viz.,

(i) When the motion begins.

(ii) The nature of the motion.

(iii) When the motion ends.

The simultaneous motion cycle chart (SIMO) is a type of two handed process chart in which the micro motions of both hands are recorded.

1.Operation Process Chart

- Also called Outline process chart
- Bird's eye view of whole process
- Records only major activities and inspections
- Uses only two symbols i.e. operations & inspection
- Constructed by placing symbols one below another
- An operation process chart is a graphic representation of the sequence of all operations and inspections taking place in a process.
- **Uses:-**
- Visualize sequence of operations & inspections in process
- Know where operations selected fits into the entire process

Procedure Followed In Preparing The Chart

1. Write title at the top of the chart.
2. Begin the chart from the right hand side top corner.
3. Represent the main component at the right extreme.
4. Represent the sequence of operations and inspections by their symbols. Connect them by vertical flow lines.
5. Record the brief description of the activity to the right side of the symbols.
6. Note down the time for each activity to the left of the symbol.
7. Number all operations in one serial order. Start from the right hand top (from number 1).
8. Similarly number all inspections in another serial order (starting from 1).
9. Continue numbering, till the entry of the second component.
10. Show the entry of purchased parts by horizontal lines.

Flow Process Chart

- A flow process chart is a graphical representation of the sequence of all the activities (operation, inspection, transport, delay and storage) taking place in a process.
- It is the detail version of outline process chart recording all the event.
- Process chart symbols are used here to represent the activities.

Guidelines For Making A Flow Process Chart

1. The details must be obtained by direct observation—charts must not be based on memory.
2. All the facts must be correctly recorded.
3. No assumptions should be made.
4. Make it easy for future reference.
5. All charts must have the following details:
   (a) Name of the product, material or equipment that is observed.
   (b) Starting point and ending point.
   (c) The location where the activities take place.
   (d) The chart reference number, sheet number and number of total sheets.
   (e) Key to the symbols used must be stated.

UNIT: IV

Type of flow process charts

1. **Man/ Worker type flow process chart**

   This flow process chart records what the worker does.

2. **Material type flow process chart**

   This flow process chart records how the material is handled or treated.

3. **Equipment type flow process chart**

   This flow process chart records how the equipment or machine is used.

Machine/ Equipment Flow Process Chart:

Flow Process Chart Job : Requisition of petty cash	Analyst ABC	Page 1 of 2	Operation	Movement	Inspection	Delay	Storage	Distance
Details of method								
Requisition made out by department head			●	⇨	□	D	▽	
Put in "pick-up" flag			○	⇨	□	D	▽	
To accounting department			○	⇨	□	D	▽	10 m
Account and signature verified			○	⇨	■	D	▽	
Amount approved by treasurer			●	⇨	□	D	▽	
Amount counted by cashier			●	⇨	□	D	▽	
Amount recorded by bookkeeper			●	⇨	□	D	▽	
Petty cash sealed in envelope			●	⇨	□	D	▽	5 m
Petty cash carried to department			○	⇨	□	D	▽	
Petty cash checked against requisition			○	⇨	■	D	▽	
Receipt signed			●	⇨	□	D	▽	
Petty cash stored in a box			○	⇨	□	D	▼	

	Summary	Distance
Operations	6	
Inspections	2	
Transport	2	15 m
Delays	1	
Total	11	

Two-Handed Process Chart (or) Right Hand, Left Hand Chart

- It is the process chart in which the activities of two hands of the operator are recorded.
- Motions of both hands of worker are Right hand-Left hand chart recorded independently.
- It shows whether the two hands of the operator are idle or moving in relation to one another, in a timescale.
- It is generally used for repetitive operations.

Two-Handed Process Chart (or) Right Hand, Left Hand Chart

- **Operation:** Represents the activities grasp, position, use, release etc. of a tool, component or material.
- **Transport:** Represents the movement of the hand or limb to or from the work or a tool or material.
- **Delay:** Refers to the time when the hand or limb is idle.
- **Storage (Hold):** The term 'hold' is used here instead of storage. This refers to the time when the work is held by hand.
- The activity **'inspection'** by hand is considered as an operation. Hence, the symbol for inspection is not used in this chart.
- Two-handed process chart can be used for assembly, machining and clerical jobs.

UNIT: IV

- The objective of this investigation is to eliminate or reduce the unwanted motions and to arrange the remaining motions in a best sequence.
- A two-handed process chart is made up of two columns in which the activities of the left hand and right hand and the appropriate symbols are respectively recorded in sequence.
  - ➢ The activities of the two hands are inter-related by aligning the symbols on the chart so that movements by both hands appear opposite to each other.
  - ➢ Additional columns can be designed to record the activities of the other parts of the body whenever necessary.

Multiple activity chart

•A Chart in which the activities of more than one item are recorded on a common time scale to show their inter-relationship.

•Man machine chart is the type of multiple activity charts.

•TYPES:

- Man - Machine chart: One man handling one job or one machine.
- Man - Multi machine chart: One man handling a numbers of machines.
- Machine Multi - man chart: A group or gang doing collectively one job as in riveting.
- Multi – Man - Machine chart: A number of persons working on a computer system.

Multiple Activity Chart

- In it, the activities of more than one item, worker, machine or equipment are recorded on a common time scale to show their inter relation ship.
- It is used when a worker operates a number of machines at a time. It is also used when a number of workers jointly do a job.

Why:

➢Multiple Activity Charts are very useful tool for understanding the flow of work in a cyclic process and as a consequence understanding which resource is controlling the overall progress of the work.

➢The tool can be used to model different scenarios to determine the optimum mix of resources for the work.

Purpose of Multiple Activity Chart

- To detect the idle time on machine and workers
- To optimize work distribution between workers and machines.
- To decide no. of workers in a group.
- To balance the work team
- To examine the activities.
- It is used for recording the complex movements of material or men.
- Used to find out the most economical route.

Application Of Multiple Activity Chart

- Plant repair & maintenance.
- Job construction.
- Planning team work.
- It is used to check whether the work station is correctly located.

Micro-motion Study

- **Therbligs**
- Search (SH) – attempt to find an object using eyes or hand
- Find (F) – mental reaction at end of search
- Select (ST) – choose among several objects in a group
- Grasp (G) – grasp an object
- Hold (H) – hold an object
- Transport loaded (TL) – move an object with hand and arm
- Transport empty (TE) – reach for an object
- Position (P) – position object in defined location
- Assemble (A) – join two parts
- Use (U) – manipulate a tool
- Disassemble (DA) – separate multiple parts that were previously joined
- Inspect (I) – determine quality of object
- Pre-position (PP) – position object for next operation
- Release load (RL) – release control of an object
- Unavoidable delay (UD) – waiting due to factors beyond worker control
- Avoidable delay (AD) – worker waiting
- Plan (PN) – decide on an action
- Rest (R) – resting to overcome fatigue

UNIT: IV

SIMO CHART

- "SIMO" stands for simultaneous-Motion Cycle chart. It is one of micro motion study devised by Gilbreth
- It presents graphically the separable steps of each pertinent limb of the operator under study.
- It is an extremely detailed left and right hand operation chart.
- It records simultaneously the different therbligs performed by different parts of the body of one more operators on a common time scale.
- The movements are recorded against time measured in "Winks" (1 wink= 1/2000 minute).
- These are recorded by a "Wink Counter" positioned in such a location that it can be seen rotating during filming process.

Flow Diagram

1)Layout of w/p is drawn to scale

2)Relative positions of m/c tools, work benches, etc are marked

3)Path followed by the subject under study is traced by drawing lines

4)Each movement is serially numbered and indicated by arrow for direction

5)Different colors are used to denote different types of movements

String Diagram

✓**String/Thread** is used to measure the distance

✓Records the pattern of movement of a worker working **within a limited area** during a certain period of time

✓**Repetitive movements** can be conveniently traced

String Diagram

1)Layout of the w/p or factory is drawn to scale on a soft board

2)Pins are fixed into boards to mark the location of work stations,

3)Pins are also driven at the turning point of the routes

4)A measured length of thread is taken to trace the movement (path)

5)The distance covered by the object is obtained by measuring the remaining part of the thread and subtracting it from the original length

Applications

1) It is used for recording the complex movements of material or men.

2)Back tracking, congestion, bottlenecks, under utilized paths are easily found out.

3)It is used to check whether the work station is correctly located.

4)Used to record irregular movements.

5) Used to find out the most economical route

Value Engineering

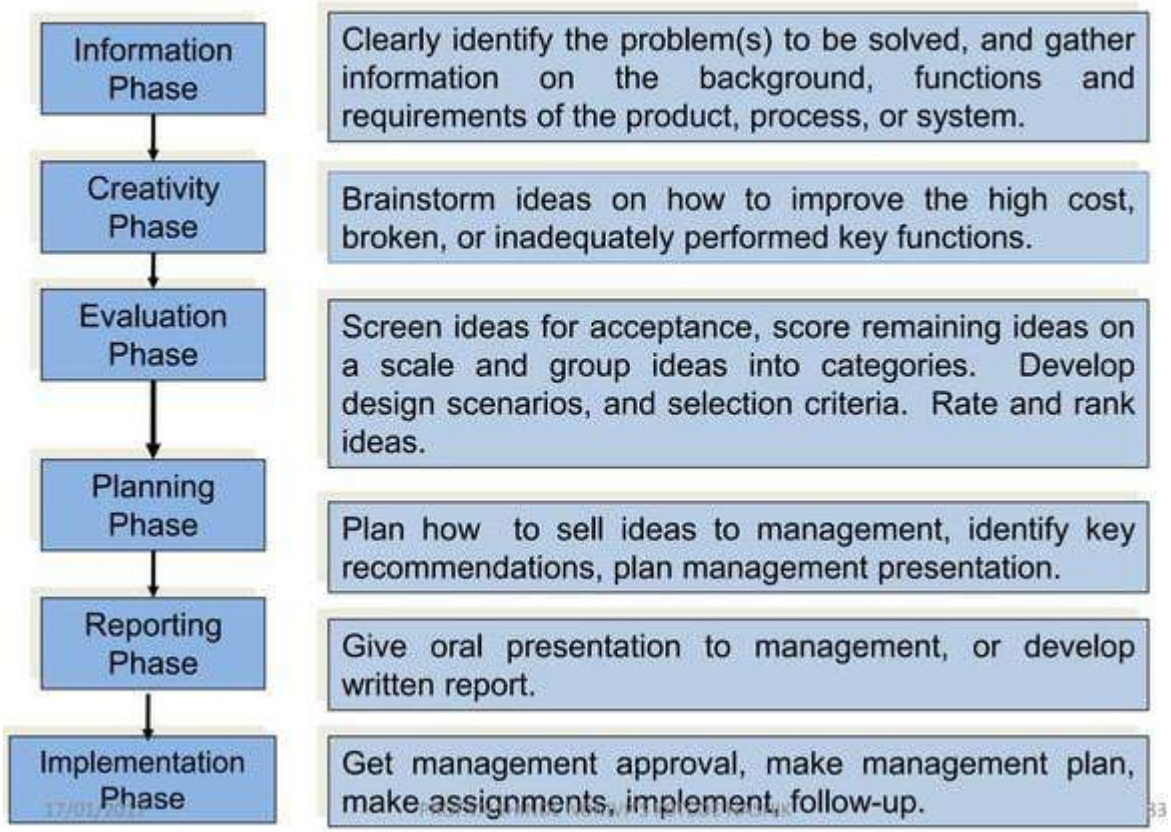
- Value Engineering (VE) is defined as an organized effort directed at analyzing the functions of systems, equipment, facilities, services, and supplies for the purpose of achieving the essential functions at the lowest life-cycle cost consistent with required performance, quality, reliability and safety.
- Value engineering (VE) is systematic method to improve the "value" of goods or products and services by using an examination of function.
- Value Engineering is an organizational creative approach for the purpose of identifying of unnecessary cost.
- Unnecessary cost are that which provides neither quality, nor use, not appearance, not life and customer features

UNIT: IV

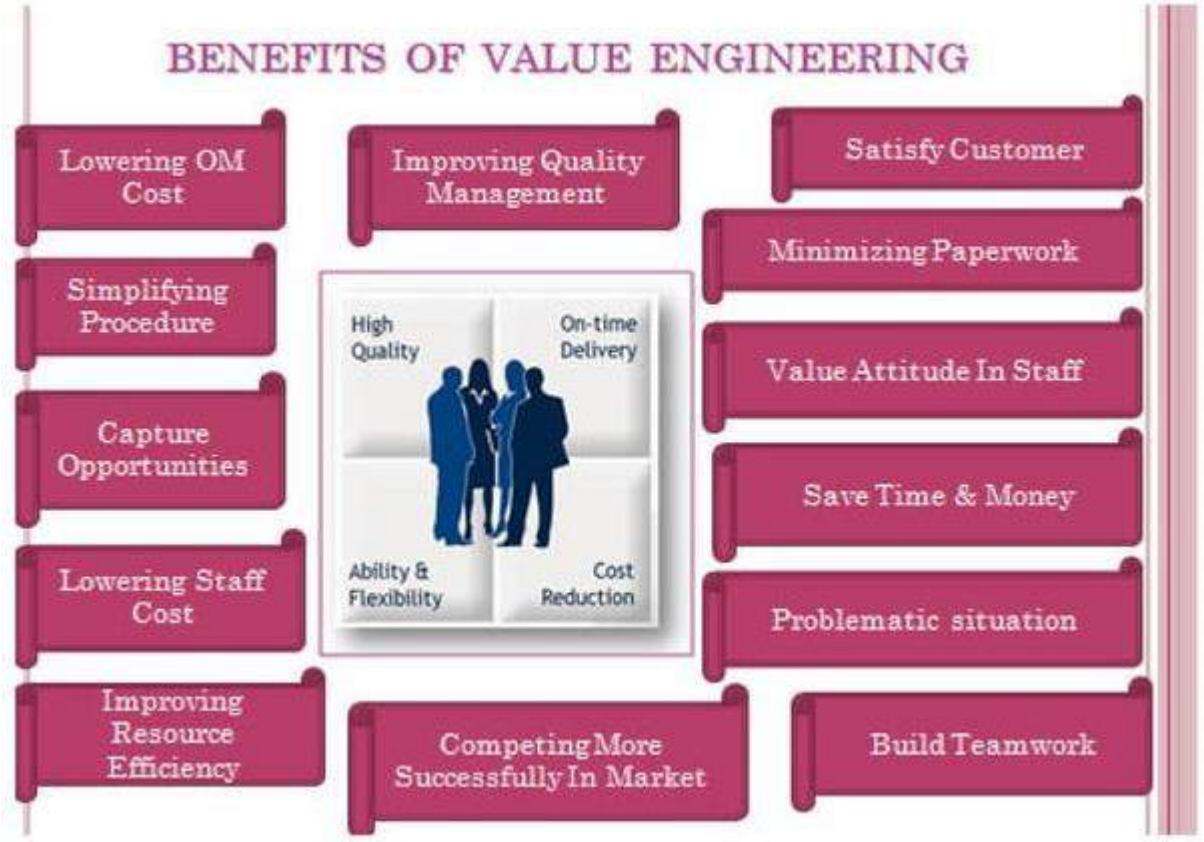
When is VE used ?

- Value Engineering is used to determine the best design alternatives for Projects, Processes, Products, or Services
- Value Engineering is used to reduce cost on existing Projects, Processes, Products, or Services.
- Value Engineering is used to improve quality, increase reliability and availability, and customer satisfaction .
- Value Engineering is also used to improve organizational performance.
- Value Engineering is a powerful tool used to identify problems and develop recommended solutions.

Six steps in value engineering



UNIT: IV


BENEFITS OF VALUE ENGINEERING
Lowering OM Cost
Improving Quality Management
Satisfy Customer
Simplifying Procedure
Minimizing Paperwork
High Quality
On-time Delivery
Capture Opportunities
Value Attitude In Staff
Ability & Flexibility
Cost Reduction
Lowering Staff Cost
Save Time & Money
Problematic situation
Improving Resource Efficiency
Competing More Successfully In Market
Build Teamwork