UNIT - I

VALUE ENGINEERING BASICS

1. Origin of value engineering
2. Meaning of value engineering
3. Definition of value engineering and Value analysi.
4. Value Management
5. Value Analysis versus Value Engineering
6. Value Analysis versus Traditional cost reduction techniques
7. Steps in Value Analysis / Value Engineering
8. phases of value Analysis / value Engineering
9. Types of value function - Basic and Secondary functio
10. Concept of cost and worth
11. Creativity In Value Engineering
12. Uses, applications, advantages and limitations of Value analysis.

1) ORIGIN OR HISTORY OF VALUE ENGINEERING

* Larry miles an engineer by training, is known as the father of the Value Analysis (VA) / Value Engineering (VE) - Concept
* He developed the technique at General Electric (GE) in the late 1940 s
* Larry miles moved from design engineering to purchasing for General Electric (GE) shortly before the United states entered world war II Later (about 1943) he was assigned to be the procurement officer for a GE manufacturing plan
* He developed a cost-effective operations and using unusual methods for problem solving
* Due to the competition for raw materials, products, personnel, and other resources in the time of war. Mr. Miles developed a procedure for procuring, designing, and using components and products.

* This procedure used "functions" as its basis
* Mr. Miles found that he could more readily obtain what he needed if he used his new procedure, rather than specifying standard designed components. (for example, the required product to be provided must translate a krotational force into a Lateral force. It must be able to withstand these stresses, fit within the area allowed, and connect to these other parts)
* This New "function" based procedure was so successful that it was possible to produce the goods with greater production and operational efficiency, and less expensively.
* The terms value analysis / value engineering Originated in the early days development of the techniques.
* The first approach was rather than reduce costs, to increase values.
* Hence the need to analyze value.
* Soon after Miles developed this systematic methodology, his concepts were acknowledged

as a powerful approach to problem solving through function - based techniques, and they found their way outside GE into areas such as industry, healthcare and government services.

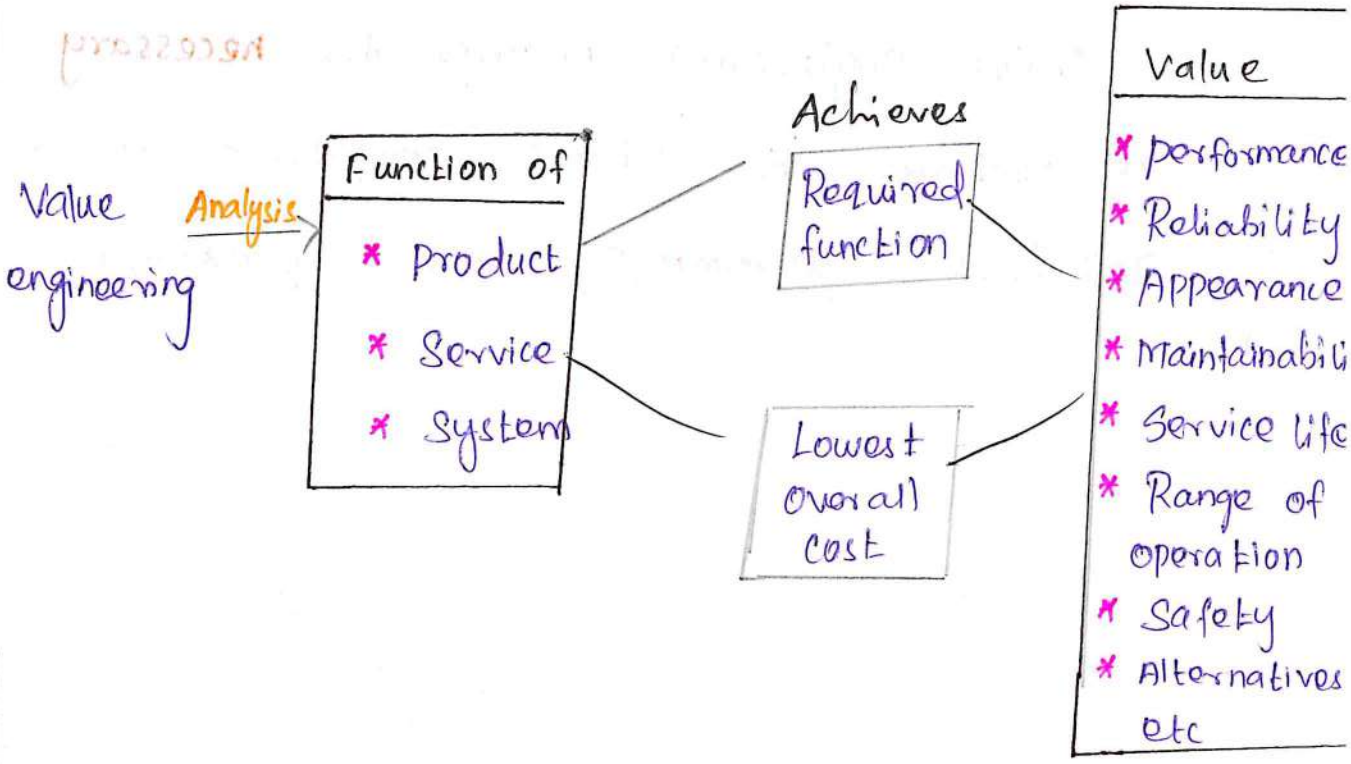
* Miles' techniques resulted in to huge savings for design engineers, Manufacturing engineers, purchasing agents, and service providers exhibiting to the users "why so much unnecessary costs exists in everything we do and how to systematically identify, clarify, and demarcate costs which have no relationship to customers' needs or desires."

* The name value Engineering has subsequently become most universally accepted name for the "function" based procedure.

2.) MEANING OF VALUE ENGINEERING

Value Engineering is one of the major techniques of the cost reduction and cost prevention.

Value Engineering ensures the necessary functions at minimum cost without comprising on quality, reliability, performance, and appearance



Value engineering concept

3/ DEFINITION OF VALUE ENGINEERING AND VALUE ANALYSIS

Value Analysis is a a cost reduction technique applied to the existing product with the aim of Improving the value of a product or service. Thus value analysis is a remedial process.

Value engineering is the application of exactly the same set of techniques to a new product at the design stage itself. Value Engineering is a technique used before the product gets approva for fabrication. Therefore value engineering is a preventive process.

Though the terms value analysis and Value engineering are used synonymously, there is a difference between the two. The difference lies in the time and the phase of product life-cc cl at which the techniques are applied.

4) VALUE MANAGEMENT

Value management is an interconnected approach that results in alignment between product management, marketing, pricing, sales and other business function. The goal is sustainable and profitable revenue growth

5) VALUE ANALYSIS VERSUS VALUE ENGINEERING.

BASIS FOR COMPARISON	VALUE ANALYSIS	VALUE ENGINEERING.
MEANING.	Value Analysis is a cost reduction technique applied to the existing product with the aim of enhancing its worth	Value engineering is a technique used before the product gets approval for fabrication
NATURE OF PROCESS	Remedial process	preventive process
APPLIED WHERE	Can be applied to any type of product or service	Can be applied to any type of product or service
APPLIED WHEN	After the product is introduced	At the design stag

APPROACH	Uses a systematic and structured approach	Uses a more creative and flexible approach
OBJECTIVE	To get better optimized commercial output	To get better engineering results.
WORKED WITH THE HELP OF	With the help of knowledge and experience.	With the help of specific technical knowledge.
UNNECESSARY COST	Elimination of unnecessary cost	prevention of unnecessary cost
CHANGE	May change the existing stage of the product or operation	changes made by value engineering are implemented at initial stage only.
GOAL	Goal is to achieve the best value for the cost	Goal is to achieve the best value for the function
USES	Often used in manufacturing industries	Often used in both manufacturing and service Oriented industries.

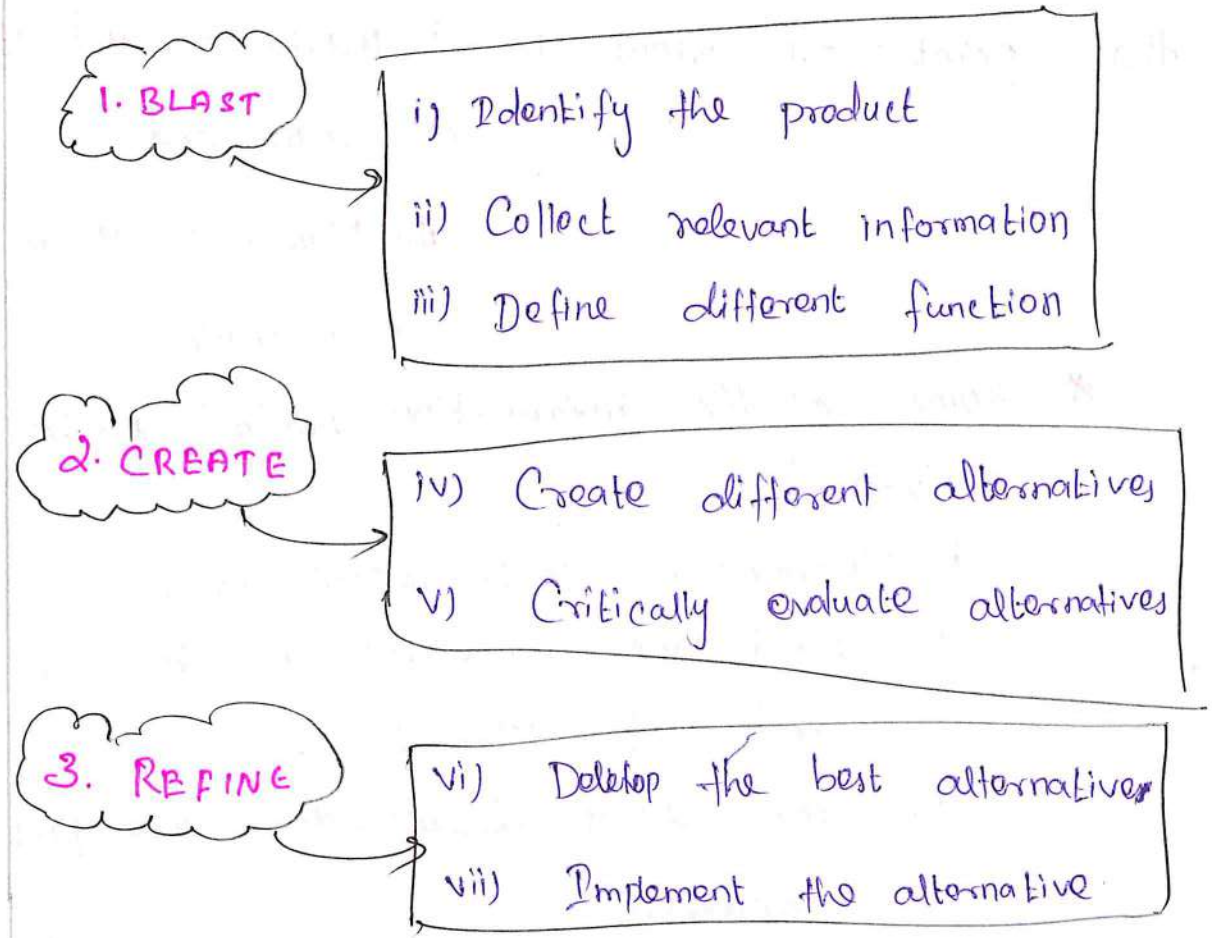
6) VALUE ANALYSIS VERSUS TRADITIONAL / CONVENTIONAL COST REDUCTION TECHNIQUE

In terms of "cost reduction" value analysis is an effective tool of cost reduction which differs from established traditional / conventional approach such as industrial engineering, production engineering, methods engineering and the like.

VALUE ANALYSIS (VA)	TRADITIONAL ANALYSIS
V.A can be the 'pre-production' as well as "post production stage" technique	Traditional approaches concern "post-production" stage.
V.A are "functions concerned"	TRaditional approaches are "methods concerned"
'VA' challenges the existing design specifications, design requirements and the design itself	Traditional approaches follow existing design without any changes

VA' does not accept the designed product and its components "as is" but advocates cost reduction through Identification of the function and subsequent redesign of the product so as to make it perform its functions at the lowest possible cost.	They accept the drawing of the parts "as is" and, therefore, set to improve the part through analysis of manufacturing methods, machines, materials, tools, jigs and fixtures and the like
VA in addition to cost improvement, usually seeks to improve quality, reliability, maintainability, safety, performance and alluring features	Traditional methods are more "cost centered"
VA is more potential than traditional cost reduction techniques	–
VA can remove ten to twenty percent of cost after the traditional methods of cost reduction have applied.	–

7) STEPS IN VALUE ANALYSIS / VALUE ENGINEERING



Steps in value analysis

Step 1. Identify the product

* First, the product should be identified for study.
* Value analysis can be applied to a product as a whole or its subunits.

Step 2. Collect relevant information

* The next step is concerned with collecting all relevant information

regarding the identified product from the point of view of (i) marketing and application

ii) Engineering

iii) Manufacturing and procurem

d) ecnomics

* Some of the information needed to be collected include :

i) Technical specifications with drawings

ii) Production processes, machine Layout and instruction sheet.

iii) Time study details and manufacturing capacity

iv) Complete cost data and marketing de

v) Latest development in related products

Step 3. DEFINE THE FUNCTIONS

* As we know the functional analysis is the heart of value analysis. There fore the primary, secondary, and tertiary functions of the identified product / part should be identified and defined

* Also the value content of each function should be specified and the high cost areas have to be identified

Step A. CREATE DIFFERENT ALTERNATIVES

* Knowing the functions of each part and its manufacturing details the next step is to generate the ideas and create alternatives achieving the defined functions.

* Brain storming technique can be used to generate ideas. Here it is important that all feasible and non-feasible suggestions (alternatives) are only listed and are not discussed or evaluated.

Step 5. Critically evaluate the alternatives

* The ideas generated in the previous step are compared, evaluated, and critically assessed for their virtues, validity and feasibility as

regards their financial and requirements.

* Also the ideas that are technically sound and involving lower costs should be further developed.

Step 6. Develop the best alternative

* Using the detailed development plans that are made in the previous step, the best alternative plans should be selected.

Step 7. Implement the best alternative

* Having obtained the best alternative, then it should be converted into a manufacturing model

* Then the prototype is finally implemented into operation and its results should be recorded

8. PHASES OF VALUE ANALYSIS / VALUE ENGINEERING

1. Phase of Origination
2. Phase of Information
3. Phase of Innovation
4. Phase of Evaluation
5. Phase of Choice
6. Phase of Implementation
7. Phase of Review

1. Phase of Origination

* In the first phase, a value analysis study team is constituted.
* The project is selected and clearly defined
* The team examines in detail the product and its components to understand thoroughly their nature.

2, Phase of Information:

* After familiarisation, a functional analysis is carried out to determine the functions and uses of the product and its components.

* The cost and importance of each function are identified

* A value index is calculated on the basis of cost benefit ratio for each function

* A list is being prepared in which the items of function are arranged in decreasing order of value.

3, Phase of Innovation:

* This is the creative phase concerned with the generation of new alternatives to replace or removing the existing ones.

4) Phase of Evaluation:

* This is the creative Each and every alternative is analysed and the most promising alternatives are selected.

* These alternatives are further examined for economic and technical feasibility.

* The alternatives finally selected must be capable of performances the desired functions satisfactorily.

* These must meet the standards of accuracy, reliability, safety, maintenance and repairs, environmental effects and so on

5, phase of choice:-

* In this phase, report is prepared
* This report contains a summary of the study, conclusions and specific proposals.
* The decision makers choose the alternative.
* The programs and action place then developed to implement the chosen alternative.

6. phase of Implementation

* The chosen alternative is put to the actual use with the help of the programs and action plans so developed in advance.

7. phase of Review:

* The progress of analysis changes in continuously monitored and followed up in order to provide assistance, to clarify any misconceptions and to ensure that the desired results are archieved.

9. TYPES OF VALUE FUNCTION - BASIC AND SECONDARY FUNCTION

DEFINITION OF VALUE

Value, in general, taking the 'use value' as an objective is the ratio between the function and cost

$$\text{value} = [\text{function}] / (\text{cost})$$

In the above expression, function is expressed as units of performance and cost is expressed as a monetary unit (ie, as rupees)

DEFINITION OF FUNCTION:

Function is what makes an item useful. It is the value of a product - its functional utility.

TYPES OF FUNCTION:

Three types of functions are

i) primary
ii) Secondary
iii) Tertiary functions.

1. PRIMARY FUNCTIONS.

* Primary functions are the basic functions which the product is specially designed to perform.

* Therefore, primary functions are the most essential functions whose non-performance would make the product worthless.

2. SECONDARY FUNCTION.

* Secondary functions are those which if deleted would not prevent the device from performing its primary function.

* Secondary functions are usually related to convenience.

* The product can still work work and fulfil its intended objective even if these functions are deleted, but they may be necessary to sell the product.

3. TERTIARY FUCTIONS.

* Tertiary functions are usually related to esteem appearance.

* The tertiary function imparts attractive appearance to the product.

Examples:

* Primary functions:-

Les us consider a single example of painting a company bus to explain all the above three functions. Here the primary function of painting is to avoid corrosion.

* Secondary function:

The secondary function is to identify the company to which the bus belongs by the colours of the paint (eg blue colour for Ashok Leyland Ltd)

* Tertiary function -

The tertiary function is to impart a very good appearance to the bus by using brilliant colours.

10) CONCEPT OF COST AND WORTH

* people are interested in saving money
* Everyone is looking for a sound investment with a high rate of return for their investment money.
* An important factor is that all design products have unnecessary cost regardless of how excellent the design team may be.
* The value engineering analysis is a proven management technique using a systemized approach to seek out the best functional balance between the cost, reliability and the performance of a product or project
* A standard value engineering analyses questionnaire was developed to gather all the necessary information on the various operations such as: production processes, inventory, maintenance, manpower, Labour, material purchase, energy and quality.

* In analysing the data collected, various statistical tools were available for simplifications and representation of the data like pie chart, bar chart or Line graph.

* But the best one used is known as cost - to - worth Ratio model

Cost is what we are paying for an item [Engineering estimate]

Worth is the least cost for performing the function, what ideas do we have that will perform the function at a Lower cost?

Cost - worth Ration should be less than or equal to 1

* In manufacturing companies. The following six areas were evaluated.

(i) Labour - Skilled, Semi-Skilled, motivation and training

ii) Inventory - Ordering, set-up, (Transportation), holding and inspection

iii) Material - purchase

iv) Maintenance - Lubricants and parts. equipment, Labour and Exports, preventive and Cleaning

v) Energy - fuel, maintenance

vi) Quality - Quality assurance (QA) and Quality control (QC) and Rectification.

* Table 1 shows the value analysis (cost to worth ratio) for medium scale manufacturing industry.

* The Labour has the total of 0.48 cost to worth ratio value, Less attention are paid to unskilled labour, it is obvious that the company has taken the advantage of unemployment in the country which adversely affected their Labour force

* The inventory of the company has cost-to-worth ratio of 2.4 though the company has its source locally, yet the cost of ordering, transportation, and inspection all have higher values of cost-to-coorth.

* The material purchase has a normal cost-to worth ratio 1.0. it indis this alright for the company.

* Maintenance for the company has cost-to-worth ratio 2.0. it indicate unnecessary cost, despite the fact that all the parts and the experts to repair the machine are available locally.

* The energy charge has cost-to-worth ratio 2.36 which is considered to be high.

* Quality has 2.0 cost-to-worth ratios. This still be removed upon to reduce the ratio value to normal

11) CREATIVITY IN VALUE ENGINEERING.

CREATIVE PHASE

PURPOSE :

Generate a quantity of ideas related to other ways to perform functions

TYPICAL Out come

The team develops a broad array of ideas that provide a wide variety of possible alternative ways to perform the function(s) to improve the value of the proje

CREATION - EXAMPLES

Example 1 :

* NASA took a decade and spent about USD 12 million to develop a pen which could be used for writing at zero grav
* But the same problem was solved by Russia by using a pencil instead of the pen !

Example 2:

* Once Japan's biggest cosmetic company received a customer complaint that a soap box did not contain soap

* Company engineers came out with a sophisticated X-ray machine which could detect empty boxes and was very costly

* A small company employee came out with a sdution to provide a high speed fan. If box was empty, the box would fly-off!

CREATIVITY DEFINITION

* Creativity is the art of bringing something new into existence.

* It has the art of making, inventing or producing something new and differe

CREATIVITY TECHNIQUES

1) Brainstorming
2) Gordon Technique
3) Nominal Group Technique
4) TRIZ - "Theory of Inventive problem Solving"

1. BRAINSTORMING

* The Brainstorming Technique is widely used in the VE Technique.
* This Technique was developed by Alex Osborn; it is a group Technique.
* The members of the group discuss among themselves and come out with various ideas to achieve the objective.
* The team should elect a Leader who will facilitate the whole process.

Rules For Brain storming

* Generate a large number of ideas - quantity, not quality.
* Listen and improve on the ideas of others
* DON'T Criticize - No evaluation of ideas
* Encourage everyone to participate
* Record all ideas presented
* Time to Let ideas "incubate" should be allowed
* Select an appropriate meeting place

2. GORDON TECHNIQUE

* The idea behind this problem-solving technique is to encourage you to step as far away from a particular problem as possible. Developed by William Gordo

For Example, instead of asking, "How do we get our audiences to spend another Rs 200 each per visit," you might ask the following Steps:

1) "How do we make our audiences happy?

2) After exploring this question in a Little more detail you might ask, "How can we provide good customer service?"

3) Once answers to that question have finished you could get more specific Still, "what do our audiences want from our program?"

4) Finishing with your Original question, "How do we get our audiences Spend another Rs 200 each per visit?"

3. NOMINAL GROUP TECHNIQUE (NGT)

* NGT is a structured variation of a small-group discussion to reach a general agreement.

* NGT gathers information by asking individuals to respond to questions posed by a moderator, and then asking participants to prioritize the ideas or suggestions of all group members.

* The process prevent the domination of the discussion by a single person, encourages all group members to participate, and results in a set of prioritized solutions or recommendations that represent the group's preferences.

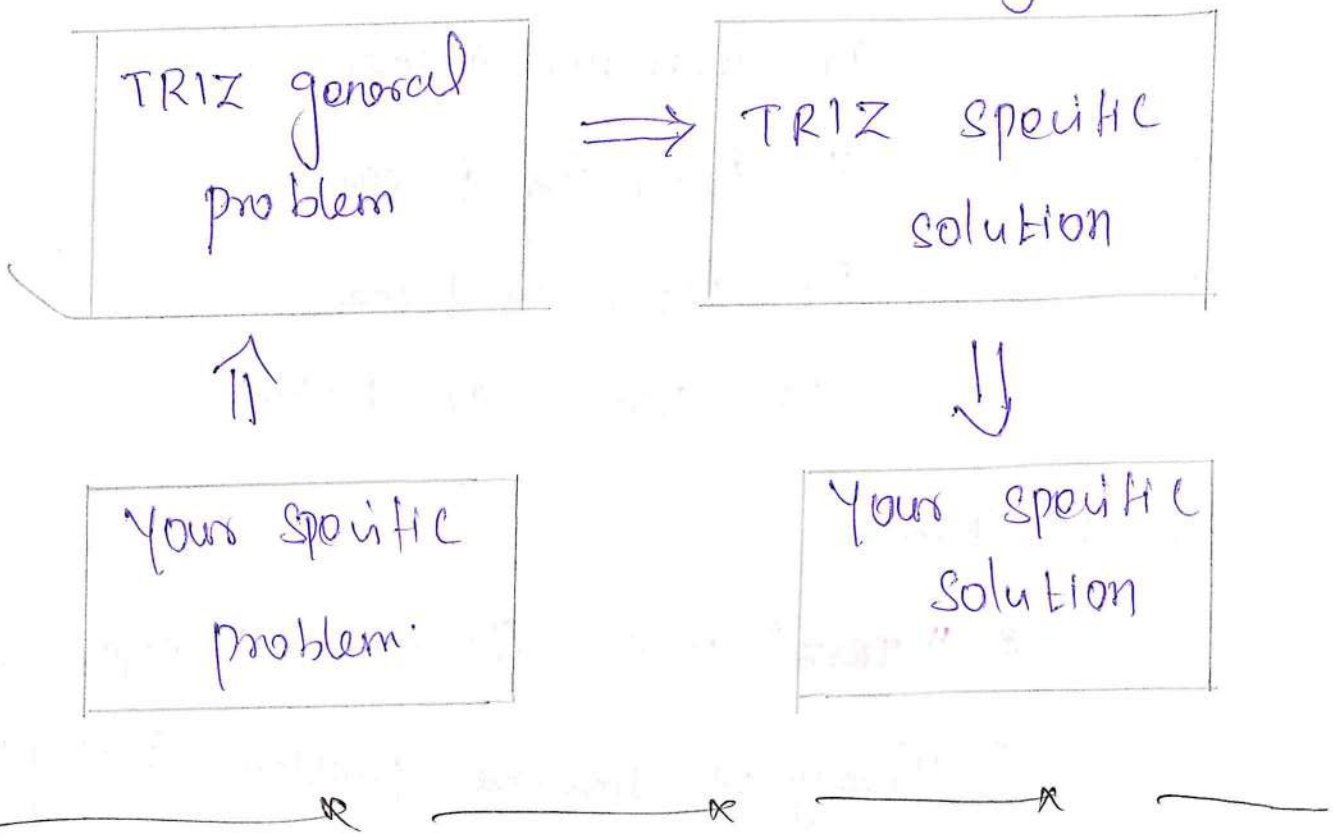
Four Step process To conduct NUT:

1) Generating Ideas
2) Recording Ideas
3) Discussing Ideas
4) voting on Ideas

4. TRIZ

* "TRIZ" is the (Russian) acronym for the "Theory of Inventive problem Solving"
* "TRIZ" is a problem solving methodology based on logic, data and research, not intuition
* It draws on the past knowledge and ingenuity of many thousands of engineers to accelerate the project teams ability to solve problem creatively.
* As Such, TRIZ brings repeatability, predictability, and reliability to the problem-solving process with its structured and algorithmic approach.

The TRIZ Problem-solving Method



12) USES, APPLICATIONS, ADVANTAGES AND LIMITATIONS OF VALUE ANALYSIS

USES OF VALUE ANALYSIS:

1. To provide better value to a product / service.
2. To improve the company's competitive position.
3. To ensure that every element of cost [Labour, material, suppliers and service contribute equally to the function of the product
4. To Eliminate unnecessary cost
5. Improve the value of the product by reducing its cost
6. Save money or increase the cost
7. Ensure Standardization
8. Timely availability of the product.

APPLICATIONS OF VALUE ANALYSIS:

1. Capital goods - plant, equipment, machinery, tools, etc
2) Raw and semi-processed material, including fuel.
3) Materials handling and transportation cost
4) purchased parts, components, sub-assemblies etc.
5. Maintenance, repairs, and operational items
6. Finishing items such as paints, oils, varnishes, etc
7. packing materials and packaging.
8. printing and stationery items.
9. Miscellaneous items of regular consumption
10. Power, water supply, air, steam & other utilities

ADVANTAGES OF VALUE ANALYSIS:

1) Better purchasing techniques
2) Improvement in product design.
3) Better quality.

4) Elimination of wastages

5. Better suppliers & manufacturing methods

6. Lower operating costs, maintenance & overhead cost

7. Standardisation & revaluation

8. Substitution & packing - Better material handling

9. Better inventory control

10. Savings in cost

LIMITATION OF VALUE ANALYSIS:

Like any other cost reduction technique value analysis has its own limitation. The most common limitation are that the man made excuses are the blocks in implementing these plans of value analysis. The most common excuses given are:

(a) Lack of motivation

(b) Resistive to change

(c) Inertia

(d) Lack of knowledge and patience

(e) Attitude of 'It will not work in India'

(f) We are very small or very big

(g) This has been tried earlier and failed

(h) The change is too big

(i) 'Let competitors try before we try'

(j) Difficulty of teams meeting or team meeting for getting agreement.

These limitations are man-made and can be over-come one the company divides to implement. However, they should be educated of the plus and minus points and the main beneficiaries are those are to be told and they are to be taken in to confidence.

UNIT - II

VALUE ENGINEERING JOB PLAN AND PROCESS

1. JOB PLAN
2. SEVEN PHASES OF JOB PLAN
3. FAST DIAGRAMMING AS VALUE ENGINEERING TOOL
4. BEHAVIORAL AND ORGANIZATIONAL ASPECT OF VALUE ENGINEERING
5. TEN PRINCIPLES OF VALUE ANALYSIS
6. BENIFITS OF VALUE ENGINEERING

1. JOB PLAN

Job plans are detailed description of work tasks (operations), Labours, materials, and tools for a type of work. It is organized approach to production management involving formal, step-by-step procedures.

2. SEVEN PHASES OF JOB PLAN

The Seven phases of Job plan are:

i) General phase

2) Information phase

3) Function phase

4. Creation phase

5. Evaluation phase

6. Investigation phase

7. Recommendation phase

1. General phase:

* Throughout the application of entire Job plan, This phase must be applied to create the right environment for value Engineering job plan to be effective

* There are five techniques associated with this phase

a) Use good human relations
b) Dnspire team work
c) Work on specifics
d) Overcome road blocks
e) Apply good Business Judgment

2) Dnformation phase

* The Objective of this phase is to gain an understanding of the project being Studied

and to obtain all essential facts relating to the project as also to estimate the potential value improvement.

* This phase comprises of three techniques:

a) Secure facts: Information gathered must be authentic; it is one of the most arduous tasks. The type of information required will be:

i) Technical specifications
ii) Environmental specifications
iii) Engineering drawings
iv) Production sample
v) Production data
vi) Cost data
vii) Work specifications
viii) Features preferred by customers

b) Determine costs

c) Fix costs on Specifications and Requirements

3) Function phase:

* The objective of this phase are to define the functions that a product actually performs and is required to perform as well as to relate these functions to the cost and worth of providing them.

* The Two techniques of this phase are

a) Define function: Determine user's need for a product or service. Use only one verb and one noun. The verb should answer the Question "what does it do" The noun should answer "what does it do" Whene possible, noun should be measurable and verb should be action Oriented.

Example 1. Some functional definitions are

Product	Function
Mirror	Reflect light
Brake	Arrest motion

b) Evalute function Relationship:

This technique attempts to determine relative importance of various functions. through this technique a descending order of importance of the functions is established along with the relative value of their importance

4. Creation phase:

* This step requires a certain amount of creative thinking by the team.

* This stage is concerned with developing alternative.

What else will do?

* There are two techniques associated with this phase:

a) Brain storming
b) Develop creative ideas

5. Evaluation phase:

* The objective of this phase is to select for further analysis the most promising of the ideas generated during the creative phase and to subject the ideas to a preliminary screening to identify those which satisfy the following criteria:

✓ Will it work?
✓ Is it less costly than the present design
✓ Is it feasible to implement?

* There are four techniques associated with this phase.

a) Refine and combine ideas

b) Establish cost on all ideas

c) Develop function alternatives

d) Evaluate by comparison

b) Investigation phase:

* This phase further refine the selected ideas into workable and acceptable solutions providing lower cost methods for performing the desired function.

* The three techniques are:

a) Use company and industrial standards

b) consult vendors and specialists

c) Use specialty products, process and procedure.

7. Recommendation phase:

* This is the final phase of the Job plan in which the finally selected value alternative is recommended for acceptance and implementation.

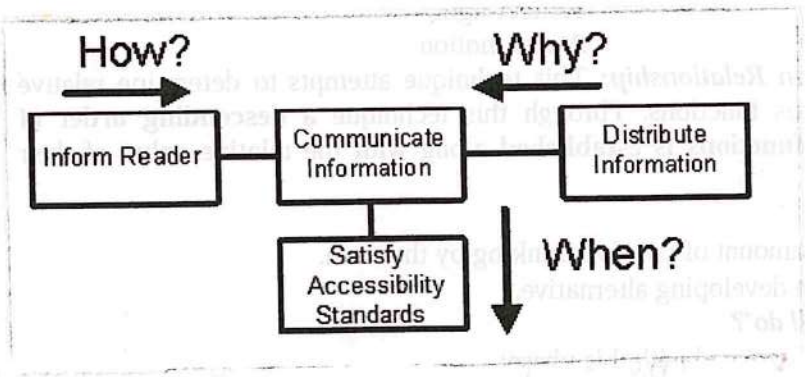
* The Two techniques associated with this phase are.

a) present facts: facts usually speak for themselves.

b) Motivate positive Action: The presentation of specific and detailed facts and costs will motivate positive action.

3. FAST DIAGRAMMING Vs VALUE ENGINEERING TOOL

* FAST [functional Analysis system Technique] was developed in 1965 by Charles W. Bytheway
* It visually represents the relationships of function performed by a product, service or system. and identifies where the functions have the greatest impact on costs.
* FAST (functional Analysis System Technique) is a technique to develop a graphical representation showing the Logical relationships between the functions of a project, product, process or service based on the questions "How" and "why"



IMPORTANCE OF FAST

* FAST aids in thinking about the problem objectively and in identifying the scope of the project by showing the logical relationship between functions.

* The organization of the functions into a function - logic diagram, such as a FAST diagram enables participants to identify of all the required functions.

* FAST diagram can be used to verify if and illustrate how, a proposed solution achieves the needs of the projects and to identify annecessary, duplicated or missing functions.

BENEFITS OF FAST

The development of a fast diagram help team to:

- ✓ Develop a shared understanding of the projec
- ✓ Identify the missing functions.
- ✓ Define, simplify and clarify the problem.
- ✓ Organize and understand the relationships between finctions.

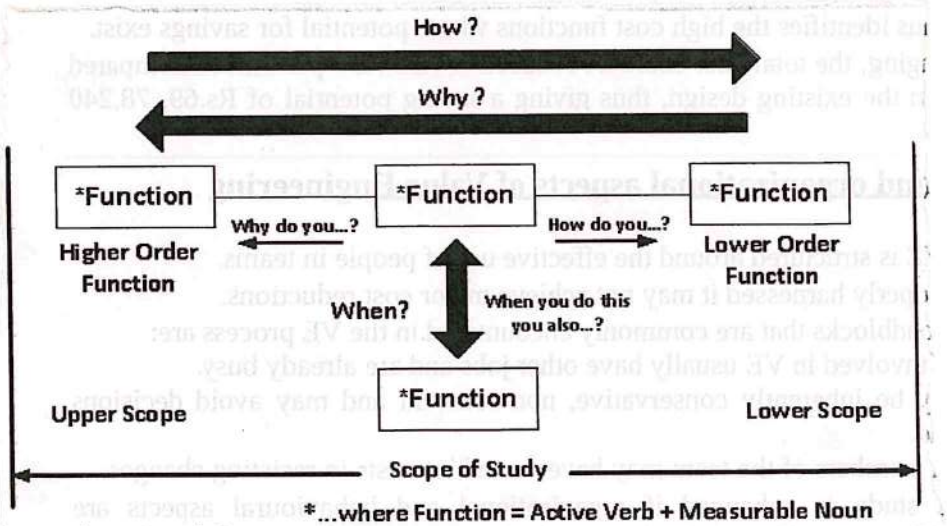
- ✓ Identify the basic function of the project, process or product.
- ✓ Improve communication and consensus
- ✓ Stimulate creativity.

STEPS TO CREATE a FAST DIAGRAM:

Three key questions are addressed in a fast Diagram:

- * How do you achieve this function?
- * why do you do this function?
- * when you do this function, what other function must you do?

The following diagram illustrated how a fenction is expanded in "How" and "why" directions in a FAST diagram.



a) ORGANISING FOR VE :

* Organising of VE function itself is very important
* There are many alternative ways of doing it and there are many question to be answered
* Size, composition, level of participation, leadership is some of the relevant issues.
* VE may be organised as a team of multi disciplinary areas coordinated by a value engineer / industrial engineer
* It may be an independent cell in staff level or It may be visualised as a philosophy - conditioning of mind so that every individual be trained to be value conscious so that it gets reflected in his decisions and attitudes towards problem solving.
* The right choice is contingent upon various situational parameters.

b) DECISION MAKING:

* How are decisions to be made in a team?
* What are the external influences?
* What are the processes of approval?
* Are there some relevant issues that must be debated in the early stage of VE process?

5. TEN PRINCIPLES OF VALUE ANALYSIS

* For successful value Analysis, the following ten principles have been followed.

1. principle of functional utility
2. principle of balanced combination
3. principle of direct motivation
4. principle of effective communication
5. principle of responsibility
6. principle of adequate information
7. principle of objectivity
8. principle of allocation
9. principle of selectivity
10. principle of simplification

1. PRINCIPLE OF FUNCTIONAL UTILITY

* Function is what makes an item useful. It is the value of a product - its functional utility

$$\text{Value} = (\text{function}) / (\text{cost})$$

* In the above expression, function is expressed as units of performance and cost is expressed as a monetary unit (ie, as rupees).

* Three types of functions are primary, secondary, and tertiary functions.

2. PRINCIPLE OF BALANCED COMBINATION

* Many business use the balanced scorecard technique to collect and present a balanced combination of financial and non-financial indicators to executives and decision-makers.

* The intention of the balanced scorecard is to assess the overall performance of an organization along four different planes against formalized goals

- ✓ Financial
- ✓ Customer (ie, Customer expectations and Loyalty)
- ✓ Internal Business processes (ie efficiencies and quality)
- ✓ Learning and growth (ie, recruiting and training)

3. PRINCIPLE OF DIRECT MOTIVATION

* In any organization, direct motivation is an important element to get maximum productivity from employees.

* Strong direct motivation can help individuals to achieve their goals for career growth and development

* Here are some areas where direct motivation can be beneficial for both the employee and employer:

  - ✓ Responsibility
  - ✓ Recognition
  - ✓ Knowledge
  - ✓ Accomplishment

4. PRINCIPLE OF EFFECTIVE COMMUNICATION

* Effective communication is essential for building and maintaining relationships, achieving goals, and resolving conflicts.

* It provides,

  - ✓ Improved understanding and clarity
  - ✓ Increased productivity
  - ✓ Enhanced teamwork
  - ✓ Better decision-making

7 C's of Communication: 1) conciseness. 2) correctness. 3) concreteness. 4) clarity. 5) completeness 6) consideration 7) courtesy.

5. PRINCIPLE OF RESPONSIBILITY

* Responsibility is the task that is entrusted by managers to subordinates. It is a moral commitment to complete the work assigned.

* The following points help to understand more the concept of responsibility:

- ✓ It is response of person to perform the task
- ✓ When a superior officers authority to perform a certain task, he is answerable to his superiors for those tasks.
- ✓ The hierarchy followed is from bottom to top. Every individual is answerable to his/her Superior

6 PRINCIPLE OF ADEQUATE INFORMATION

* The information communicated should be adequate and complete in all respects.
* Inadequate information may delay action and create confusion.
* Inadequate information also efficiency of the receivers
* So adequate information is essential for taking proper decisions and making action plans.

7. PRINCIPLE OF OBJECTIVITY

* Objectivity principle of accounting states that each and every financial transaction shouldbe be supported with evidence
* This means that the accounting information should be independent.
* Accountant should record the transactions on the basis of evidence not on the basis of his or her opinion.
* The main purpose of the objectivity principle is to provide authentic and reliable financial statements.

8, PRINCIPLE OF ALLOCATION

* Resource allocation involves identifying and distributing the available resources to a project to meet its objective
* Resources are crucial elements in any works.
* Resources can be defined as anything in a business that is used to produce goods and services

9. PRINCIPLE OF SELECTIVITY

* Selectivity means the ability of a method to distinguish between the analysis of products being measured and other substances.

* It is an act of intentionally choosing specific test process to rectify any problem in a product or service

10. PRINCIPLE OF SIMPLIFICATION

* Work simplification is an increase in efficiency (cost savings) by reducing the number of tasks that an employee must perform

* Work simplification is based on the principle of scientific management and industrial engineering.

* planned tasks should be simple, repetitive, and standardized.

UNIT - III

VALUE ENGINEERING TECHNIQUES

1. CREATNITY
2. BRAIN STORMING
3. GORDON TECHNIQUE
4. MORPHOLOGICAL ANALYSIS
5. ABC ANALYSIS
6. PROBABILISTIC APPROACH
7. MAKE OR BUY DECISIONS
8. FUNCTION COST WORTH ANALYSIS (FCWA)
9. FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST)
10. BREAK EVEN ANALYSIS
11. LIFE CYCLE COST (LCC)

1. CREATIVITY IN VALUE ENGINEERING

SAME QUESTION – UNIT 1 – Q NO. 11

2. BRAIN STORMING

Brain storming technique is widely used in the value Engineering technique. This technique was developed by Alex Osborn; it is a group technique. The members of the group discuss among themselves and come out various ideas achieve objective

FUNCTION - BASED BRAIN STORMING:

* Function - Based Brainstorming is a brainstorming technique used to generate a wide range of ideas on how to achieve a function in a short period time

* participants are asked questions based on the function. For example, a function might be

" inform public" and the team will be asked to brainstorm by answering the question " how can we inform public ?"

DIFFERENCE BETWEEN FUNCTION-BASED BRAINSTORMING AND TRADITIONAL BRAINSTORMING:

* Brainstorming is a group creativity technique used to generate a large numbers of ideas.

* In a traditional Brain storming session, the facilitator may ask for ideas for to improve the design of a chair and the participants will suggest chair improvements.

* In a function - Based Brainstorming session, the facilitator may ask for creative ideas based on specific functions of a chair, such as support weight. In response, participants might suggest a swing and other ways to support weight.

OBJECTIVES:

* Generate many alternative ideas
* Focus on Basic (most important) function.
* Generate ideas without reference to the current solution

RULES:

* Quantity counts. The more ideas generate the better
* Be positive. Don not criticize or judge ideas durin Brain storming session.
* Welcome out-of-the box ideas. Imaginative ideas can lead to new approaches.
* piggy-back or combine ideas. Good ideas may be combined to form a single better idea.

FACILITATOR HINTS

* Explain the brain storming rules
* Identify the Basic | most essential function of the project or process. Start with the nee or problem the project or process is addressing.

* Select a function to brainstorm where there are expected to be alternative ideas.

* Contribute your own ideas if ideas are not forthcoming

* Brainstorming against Higher order functions [Functions to the left side of the FAST diagram] are likely to generate creative ideas for the greatest change. Lower order functions [Functions farthers to the right of the FAST Diagram) will likely lead to less significant change.

IMPORTANCE OF FUNCTION - BASED BRAINSTORMING

* Using function - based Brainstorming ensures that many ideas are generated based on the project needs or functions, rather than the currently proposed solution.

BENEFITS OF FUNCTION - BASED BRAINSTORMING:

* Function - Based Brainstorming is a useful technique to focus the attention of a group on generating creative ideas in situations such as:

- ✓ projects or problem with an impasse or when stuck on a problem
- ✓ where the same solution has always been used used and something new is needed. For example, when an existing solution has become entrenched.
- ✓ Generating creative approaches to stakeholde consultation.
- ✓ when working alone and there is a need to challenge your ideas.
- ✓ problem solving
- ✓ Identifying alternatives

- ✓ Identifying ideas to reduce cost
- ✓ Generating ideas to streamline a process

3. GORDON TECHNIQUE

Gordon technique is a problem-solving technique. The idea behind this problem-solving technique is to encourage you to step as far away from a particular problem as possible. Gordon technique uses an initial focus on function only. Developed by william J.J Gordon,

* William Gordon worked with creative-Think groups and had a creative variety of other pursuits
* He was concerned that people, when asked to come up with a creative new ideas
* That is they would take an available alternative and improve it bit by bit

* while this might lead to marginally better alternatives the alternatives probably would not be real breakthroughs

* Gordon decided that one way to avoid this problem would be simply not to tell people what they were inventing.

* Rather than being told to build a better mousetrap, the group might first be told that the focus was capturing.

* Instead of the group being instructed to design an improved knife, the function could be given as severing.

* For example, instead of asking. "How do we get our audiences to spend another Rs. 200 each per visit,"

you might ask the following steps:

1) "How do we make our audience happy?"

2) After exploring this question in a little more detail you might ask, "How can we provide good customer service?"

3) Once answers to that question have finished you would get more specific still, "What do our audiences want from our program?"

4) Finishing with your original question, "How do we get our audiences to spend anoth Rs 200 each per visit?

SYNECTICS:

* Gordon also developed a well-known technique called synectics synectics mean "the joining of apparently unrelated elements."

* Synectics techniques have been widely adopted by both businesses and educational institutions.

* Three synectics tools according to Gordon are direct analogy, personal analogy, and fantasy analogy.

1. DIRECT ANALOGY

✓ This involves looking for parallel facts, knowledge, or technology in a different domain from the one being worked on.

✓ For instance, can we think of analog anything similar that occurs in nature?

2. PERSONAL ANALOGY :

✓ With this approach, synectics group members try to identify psychologically with key parts of the problem.

✓ In one case, for example, the group was asked to design a mechanism that would run a shaft turning at 400 to 4000 rpm so that the power-take-off end of the shaft would turn at a constant 400 rpm

✓ To address this question, members of the group metaphorically entered the box and tried to use their bodies to attain the required speed without undue friction.

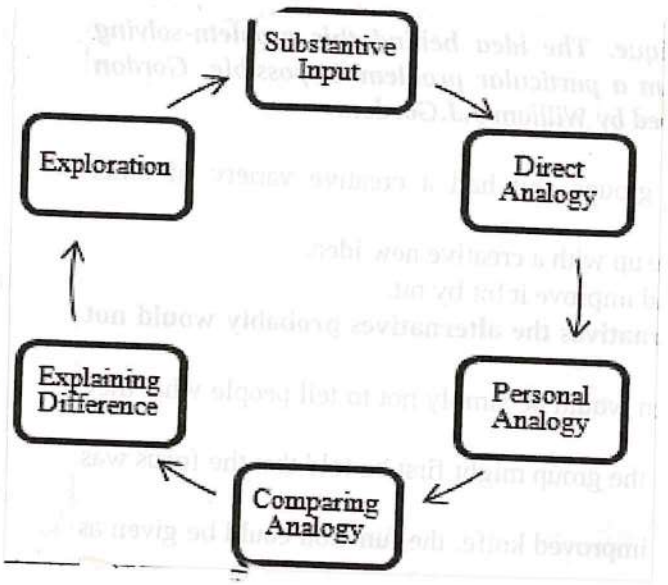
3. FANTASY ANALOGY :

✓ Sigmund Freud saw creativity as the fulfillment of a wish or fantasy.

✓ Fantasy analogy asks how in many wildest dream Can I make this happen ?

✓ Gordon gives the example of a synectics group with the task of inventing a vapour proof closure for space suits.

✓ Their solution was a spring mechanism based on the fantasy analogy of races of trained insects claping claws to hold shut the closure



4) MORPHOLOGICAL ANALYSIS

Morphological Analysis separates an object (product) into as many dimension as variable we can find so they can be individually designed. This helps the designer to evalute every option potentially ideated for each of these variable, presenting new scenarios that will help you make desisions.

* General morphology was developed by Fritz Zwicky, the Bulgarian-born, Swiss-national astrophysicist based at the California Institute of Technology.

* Among others, Zwicky applied Morphological Analysis (MA) to astronomical studies and the development of jet and rocket propulsion system.

* In order to apply morphological analysis to product design, we simply identify the critical functions in our function structure diagram (FSD) and then identify many different solutions for each function.

* The results of this research are compiled and presented in morphological chart.

* A morphological chart has the critical sub. functions listed across the 1st row and then each column contains the different solutions for each critical function.

* To use a morphological matrix to generate concepts simply requires the user to select one solution from each column and then try to integrate the solutions into a complete concept.

Critical Function 1	Critical Function 2	Critical Function 3	Critical Function 3
Solution 11	Solution 12	Solution 13	Solution 14
Solution 21	Solution 22	Solution 23	Solution 24
Solution 31	Solution 32	Solution 33	Solution 34

ILLUSTRATIVE EXAMPLE 1.

* We are going to show an extremely simple case to understand it

* To design a fork, we must know what its shape should look like, but... is there only one type of fork? If we start splitting it up into its multiple dimensions, we could write a long list of variable:

- ✓ Number of tips
- ✓ Shape of the tips
- ✓ Handle

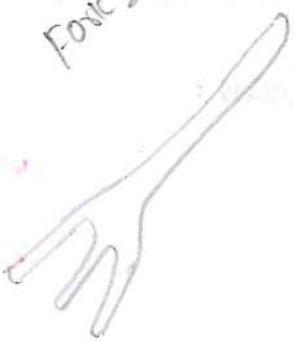
* Once we have all this written, it is not difficult to see that if we choose an option from each variable, we will get the fork #1.

* If we choose different options again, we will find the fork #2, and so on, as far as how many different forks, we want throughout those variations.

DIMENSIONS	OPTION 1	OPTION 2	OPTION 3
N# TIPS	Two	Three	Four
TIP ENDS	Sharp	Blunt	Rounded
HANDLE	There isn't	Curved	Flat

Fork 1

Fork 2



5. ABC ANALYSIS

ABC Analysis helps to exercise selective control when confronted with Large number of items if the number of orders, number of items & reduce the inventory. This is based on cost criteria. [ABC Always Better control]

CATEGORY 'A' ITEMS:

* The most important Items of the company.
* Accounts for only 10 to 25 % of the total inventory Items
* Accounts for 70 to 80 % of the Annual consumption value of the company. [which is the Highest Value
* Have very Tight Inventory control
* Managed by Top Level Management

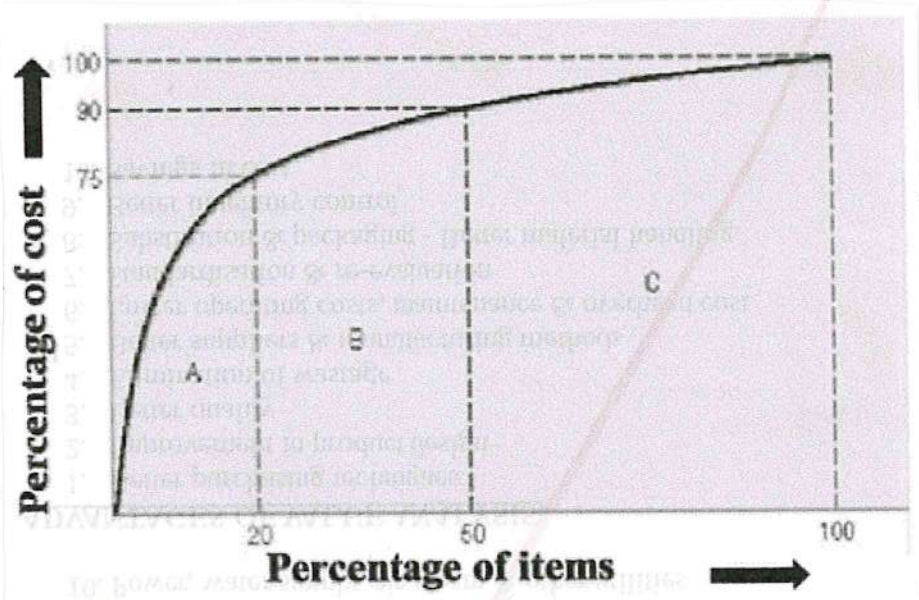
CATEGORY 'B' ITEMS:

* Less important Items than 'A' Item but more Important than 'C' items of the company
* Accounts for 25 to 30 % of the total inventory items.
* Accounts for 15 to 25 % of the Annual consumption value of the company.

* Have Intermediate Inventory control
* Managed by middle level Management

CATEGORY 'C' ITEMS:

* Marginally Important Items of the company
* Accounts for 45 to 50% of the total Inventory Items
* Accounts for 5 to 10% of the Annual consumption value of the company
* Have Low Inventory control
* Managed by Management Middle & Lower Level.



when & why to use it?

* The ABC Analysis can be also be useful in se
  - ral steps of
    - ✓ Sourcing value chain
    - ✓ Demand Identification, to gather the annu
      spend of a site

✓ Opportunity Assessment, to identify Leveraging opportunities.

* The ABC tool is used to identify the vital few from the trivial many, according to defined set of criteria

* Different decisions may be taken from the result of ABC analysis

STEPS FOR IMPLEMENTATION OF ABC ANALYSIS:

1. Classify the items of inventories determining the expected use in units and the price per unit for each item

2. Determine the total value for each item by multiplying expected units by its unit price i.e (Annual demand) x (item cost per unit)

3) Rank the items in accordance with the total value, giving first rank to the items with higher

total value and so on.

4) Compute the ratio (percentages) of number of units of each item to total units of all items and the ratio of total value of each item to total value of all items

5) Combine items on the basis of their relative value to form three categories A, B and C.

ADVANTAGE:

- CONTROL: a better mix of the right inventory allows a company to control on over-sup and under-supply of important.
- COST: Once a company has determined which ite fall into each ABC category it can establis cost-reduction initiatives at the level.
- IMPROVED SERVICE: Improvement in customers service and order fulfilment. ABC analysis provides a company with information to stock the right-mix of inventory.
- WAREHOUSING: ABC inventory extends to warehouse management han well. companies utilizing ABC analysis in warehousing give priority space to faster moving.

6. PROBABILISTIC APPROACH

probabilistic approach is a discipline within engineering design. It deals primarily with the consideration of the effects of random variability upon the performance of an engineering system during the design phase.

* when using a probabilistic approach to design, the designers no longer thinks of each variable as a single value or numbers. Instead, each variable is viewed as a probability distribution

* The probabilistic approach is named with PPT [preferential probabilities from Transcripts].

* Figure 1 gives a flow chart for using PPT in studying design team discussion

* The general process centers around a design team as they discuss possible design choices and make trade-offs between the choices.

* The design discussion is audio recorded, transcribed and time tagged.

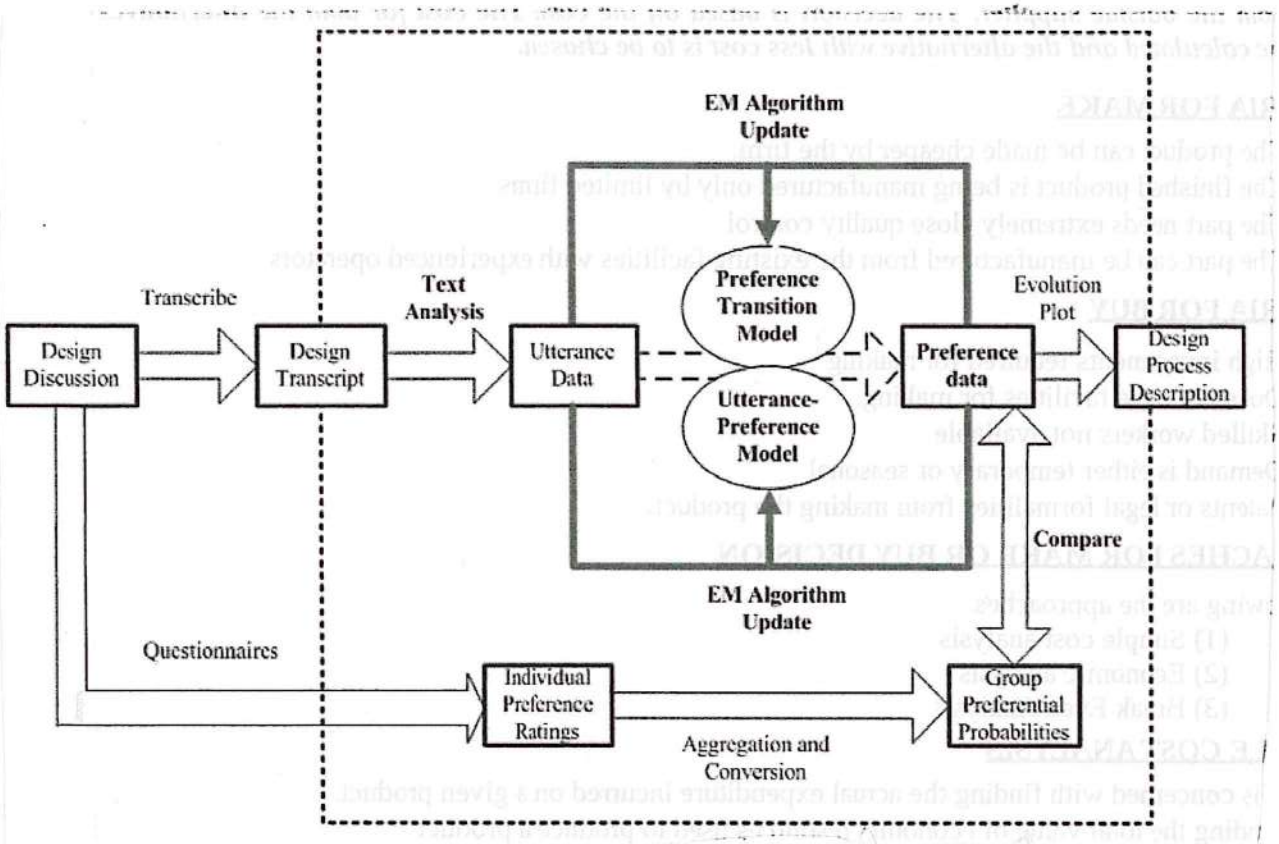
* Text analysis techniques are used to collect the design specific information. which is called utterance data in this research, from the transcripts

* Utterance data is converted to preference data with the employment of two models - Preference Transition model and Utterance - preference model.

* Initially both models and preference data are unknown.

* EM (Expectation maximum) algorithm is applied to seek the parameters of the two models. Finally, the evolution of design preference is represented

Graphically, illustrated by preference strengths at different time intervals.



The basic procedures of this approach to resolve this problem are shown as follows:

STEP 1:

* collect word occurences of all design alternatives in a transcript of a design team's discussion.

* The collection of word occurences is called utterence data.

* In this step, variations of specific term (synonyms) that represent the same alternative are also included as occurences.

STEP 2:

* Build a preference transition model to describe the relationship between preference in two consecutive time intervals, along with an utterance-preference model to describe the relationship between what designers say and what designers prefer within the same time interval.

STEP 3:

* Assign reasonable initial values to the parameters of these two models.

STEP 4:

* Apply both models to a transcript to predict preference data

* The preference data will be used to describe the evolution of preference information over the design process.

STEP 5:

* Update the parameters of these two models using a traditional Expectation-maximum (EM) algorithm on the predicted preference data and the given utterance data.

STEP 6:

* Repeat steps 4 and 5 until there is convergence on the hidden parameters of the model parameters converge because the EM algorithm is guaranteed to improve the probability of the occurences of the utterance data at each iteration.

7. MAKE OR BUY DECISION

Make or buy decision is the determination whether to produce a component internally or to buy it from the outside supplier. The decision is based on the cost. The cost for both the alternatives should be calculated and the alternative with less cost is to be chosen.

CRITERIA FOR MAKE

* The product can be made cheaper by the firm
* The finished product is being manufactured only by limited firms
* The parts needs extremely close quality control
* The part can be manufactured from the existing facilities with experienced operators

CRITERIA FOR BUY

* High investments required for making
* Does not have facilities for making
* Skilled workers not available
* Demand is either temporary or seasonal
* Patents or legal formalities from making the product

APPROACHES FOR MAKE OR BUY DECISION

The following are the approaches

1) Simple cost analysis
2) Economic analysis
3) Break Even Analysis

1) SIMPLE COST ANALYSIS

* It is concerned with finding the actual Expenditure incurred on a given product
* Finding the total value of economic resources used to produce a product

Example :

A company has been buying a part of machinary for Rs, 1000/- each. It has an extra capacity that can be used to produce the same. The annual fixed cost of the unused capasity is if the company decided to make the product it will incur material cost of Rs 350/- per unit, labour cost of Rs 300 per unit and variable overhead cost of Rs 100 - per unit. The future demand is estimated as 5000 which decision is profitable for the company.

Given data:

1. Fixed cost Rs 10,00,000
2) Labour cost Rs 300/unit
3) Material cost Rs 350/unit
4) Overhead cost Rs 100/unit
5) Demand : 5000 units
6) Buying price : Rs 1000 each

Solution:

a) Cost of making

* Total cost = FC + VC
* Fixed cost, FC = Rs. 10,00,000/-
* Variable cost, VC/unit = Material cost + Labour cost + Overhead cost = 300 + 350 + 100 = Rs 750/unit
* Demand = 5000 units
* Total variable cost = 5000 × 750 Rs 37,50,000/-
* Total cost = FC + VC = 10,00,000 + 37,50,000 = Rs. 47,50,000

b) Cost of buying:

TC = FC + Buying cost = 10,00,000 + (5000 × 1000) = Rs 60,00,000/-

c) Decision

Since the cost of making is < cost of buying it is decided to make the product

2. ECNOMIC ANALYSIS

The following inventory models are considered to illustrate this concept:

1. purchase model
2. Manufacturing model

Purchase model

$$Q1 = \sqrt{\frac{2C_0 D}{C_c}}$$

$$TC = D \times P + \frac{DC_0}{Q1} + \frac{Q1 \times C_c}{2}$$

Manufacturing model

$$Q2 = \sqrt{\frac{2C_0 D}{C_c(1 - r/k)}}$$

$$TC = D \times P + \frac{DC_0}{Q2} + C_c(k - r)\frac{Q2}{2 \times k}$$

where

D = demand / years

P = purchase price / unit

C_c = Carrying cost / unit / year

C_0 = Ordering cost / order or set-up cost / set-up

K = production rate No. of units / year

r = demand / years.

Q_1 = economic order size.

Q_2 = economic production size

T_C = Total cost per year.

Example : 2.

* A part of the machine has a yearly demand of 3000 units. The different cost in respect of make or buy are as given below

Details	Buy	make
item cost / unit	Rs. 10	Rs. 8.0
procurement cost / order	Rs 150	-
Setup cost / setup		Rs. 80/-
Annual Carrying cost / year	Rs. 2	Rs. 1.50/-
Production rate / years	-	10,000 units.

Purchase model

$D = 3000$ units / years

C_o = Rs. 150 / orders

C_c = Rs. 2.0 / item / years

P = Rs. 10 / unit

$$Q_1 = \frac{\sqrt{2 C_o D}}{C_c} = 670.82 \text{ unit}$$

$$TC = 3000 \times 10 \times 3000 \times 150 / 670.82 + 670.82 \times 2/2$$

$$= \text{Rs. } 31,341.64$$

* Manufacturing model

$$Q_2 = \frac{\sqrt{2 C_o r}}{C_c \left[1 - \left(\frac{r}{k}\right)\right]} = 676.12$$

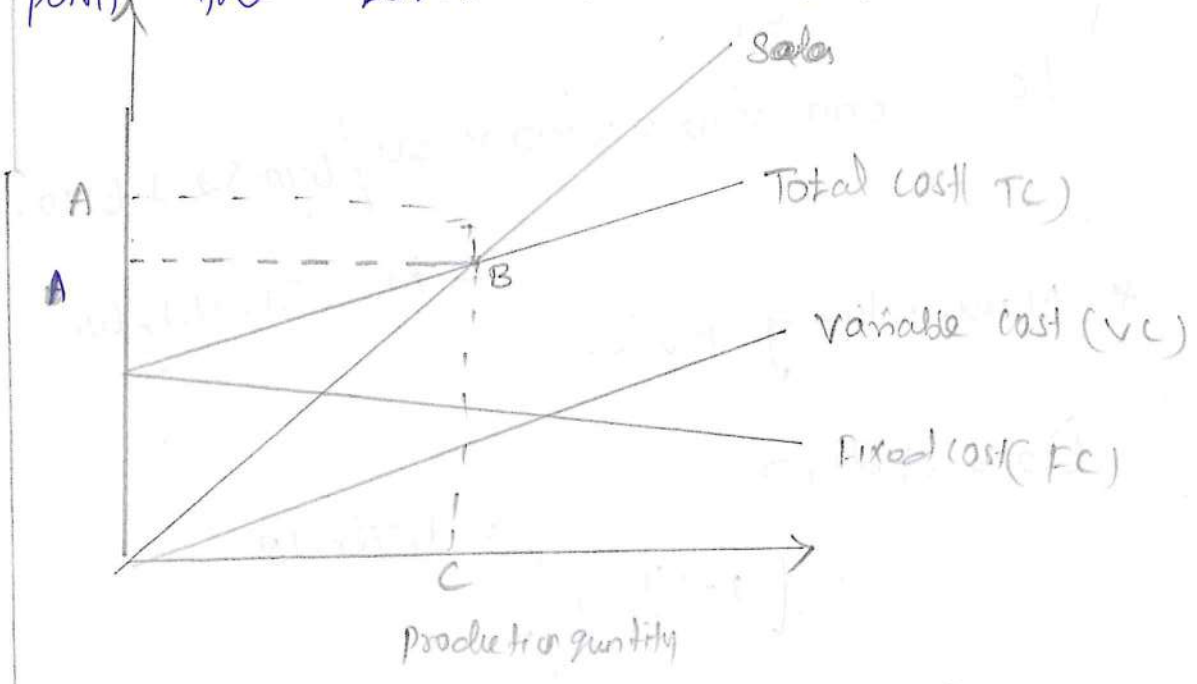
$$TC = 3000 \times 8 + 3000 \times 80 / 676.12 + 1.5 \left[10,000 - 3000\right] 676.12/2 \times 10,000 = \text{Rs } 24,709.93$$

Decision : Since the cost of making the item is < the cost of producing it is decided to make the product

3) BREAK EVEN ANALYSIS

A break-even analysis is a financial calculation used to determine a company's break-even point (BEP)

Break even analysis implies at a particular point, the total revenue = total cost.



Break-even chart

Example:

A manufacturing of TV buys TV cabinet at Rs 500 each. In case the company makes it within the factory the fixed and variable costs would be Rs, 4,10,000 and Rs 300 per cabinet respectively. Should the manufacturer make or buy the cabinet if the demand is 1500 TV cabinet.

8. FUNCTION COST WORTH ANALYSIS (FCWA)

Function - cost - worth Analysis (FCWA) involves estimating the cost and worth of each function of a system. FCWA is an excellent tool to identify the value improvement potential in any function.

* This tool will not only help to identify the potential but will also give some creative ideas as to how to achieve that
* The ultimate aim of the function - cost - worth analysis is to find out the value improvement in various functions.
* Based on these findings, the team will approach the problem.

CONCEPT OF WORTH :

* Worth is the minimum cost of achieving a function.
* Worth is an indispensable element of VE

* worth varies with time
* worth depends upon information
* worth is usually determined by developing or thinking of other methods of performing functions.
* worth is just a technique, not an absolute value.
* where an item has several functions, determine worth of each function separately and add them to get overall worth.

CONCEPT OF COST ALLOCATION:

* Split the product into components and service / system into activities.
* Define function of components / activities
* Divide the total cost of product / service / system into components / activities cost.
* processes performed to achieve particular function; cost allocated to that function.
* component provided to achieve particular function; cost allocated to that function

* Component accomplishes more than one function; allocation should be based on weight, volume, surface area and length

* Hold each function in isolation of the others to do this.

VALUE GAP AND VALUE INDEX

* The difference between cost and worth is known as 'value gap' it indicates the scope of possible value improvement.

* The value index is the ratio of cost by worth. In other words, it is the cost per unit of worth.

Cost - Worth Ratio should be less than or equal to 1

ILLUSTARTIVE EXAMPLE:

* In manufacturing companies. The following six areas were evaluated

i) Labour - skilled, semi-skilled, motivation and train

ii) Inventory - ordering, set-up (transportation), holding and inspection

iii) Material - purchase

iv) Maintenance - Lubricant and parts. equipment labours and exports, preventive and cleaning

v) Energy - fuel, maintenance

vi) Quality - Quality assurance (QA) and Quality control (QC) and Rectification.

* Table 1 shows the value analysis (cost-to-worth ratio) for medium scale manufacturing industry.

* The labours, it is obvious that the company has taken the advantage of unemployment in the country which adversely affected their labour force

* The inventory, of the company has cost-to worth ratio of 2.4 though the company has its source locally, yet the cost of ordering, transportation, and inspection all have highes values of cost-to-worth

* The material purchase has a normal cost-to-worth ratio of 1.0 this alright for the company.

* maintenance for the company has cost-to-worth ratio 2.0. it indicate unnecessary cost, despite the fact that all the parts and the experts to repair the machine are available locally.

* The energy charge has cost-to-worth ratio 2.36 which is considered to be high.

* Quality has 2.0 cost-to-worth ratios. This still be removed upon to reduce the ratio value to normal.

9. FAST [FUNTIONAL ANALYSIS SYSTEM TECHNIQUE]

(Same Question - unit 2 - Q NO : 3)

10. BREAK EVEN ANALYSIS

Break-even analysis, also known as cost-volume-profit analysis, is the study of inter relationships among a firm's sales, cost and operating profit at various levels of output.

* A break-even analysis is a financial calculation used to determine a company's break-even point (BEP)
* Break even analysis implies at a particular point the total revenue = total cost.
* This point is known as break-even point.

AIMS OF BREAK-EVEN ANALYSIS

The important aims and objects of break-even analysis are:

- ✓ To help in deciding profitable level of output, below which losses will occur

- ✓ To compute costs and revenues for all possible volumes of output to fix budgeted sales
- ✓ To take decision regarding make or buy.
- ✓ To decide the product mix and promotion mix
- ✓ To take plant expansion decisions.
- ✓ To take equipment replacement decisions.
- ✓ To indicate margin of safety
- ✓ To fix the price of an article to give the desired profit

ASSUMPTION IN ANALYSIS

The break-even analysis is based on the following assumptions:

1. Selling prices will remain constant at all sales levels (ie quantity discounts are not available).
2. There is linear relationship between sales volume and costs
3. It assumes that costs are classified into fixed and variable costs. ignoring semi-variable costs.
4. It considers the production is equal to the sales (ie. there is no inventory)
5. No other factors will influence the cost except the quantity

BREAK EVEN POINTS

* The break-even points may be defined as the level of sales at which total revenues and total costs are equal. It is a point at which the profit is zero

* It is also known as "No-profit no-loss point"

* If a firm produces and sells above the break-even point, it makes profit. In case it produces and sells less than the break-even point, the firm would suffer losses.

DETERMINATION OF BREAK-EVEN POINT:

Two approaches used to determine break-even point are

1) The algebraic method
2) The graphical method

1. The Algebraic method:

Let, FC - fixed cost, VC - variable cost per unit

TVC - Total variable cost, TC - Total costs.

TR - Total revenue i.e., total income

Q - Sales volume i.e., quantity sold

SP - Selling price per unit.

We know that,

Total cost = Fixed cost + variable cost

$TC = FC + (VC Q)$

We also know that,

Total revenue = selling price/unit × Quantity sold

$TR = SP \times Q$

At Break-Even point (BEP)

Total costs = Total revenue

$TC = TR$

$FC + VCQ = SP \times Q$

Or

$Q_{BEP} = FC / (SP - VC)$

Break-even quantity = Fixed costs / (selling price/unit) - variable cost/unit

* In break-even chart, cost and revenue in rupees is represented on vertical axis, while output in quantity is represented on horizontal axis

* In Fig, the fixed cost line is horizontal and parallel to the X-axis. It indicates that fixed costs remains unchanged for any volume.

* The variable cost line is superimposed on the fixed cost line to show total costs.

* The total sales revenue line is drawn as shown in Fig. 1.8 This line indicates sales income at various levels of output.

* The point at which the total revenue line intersects the total cost line is the break-even point.

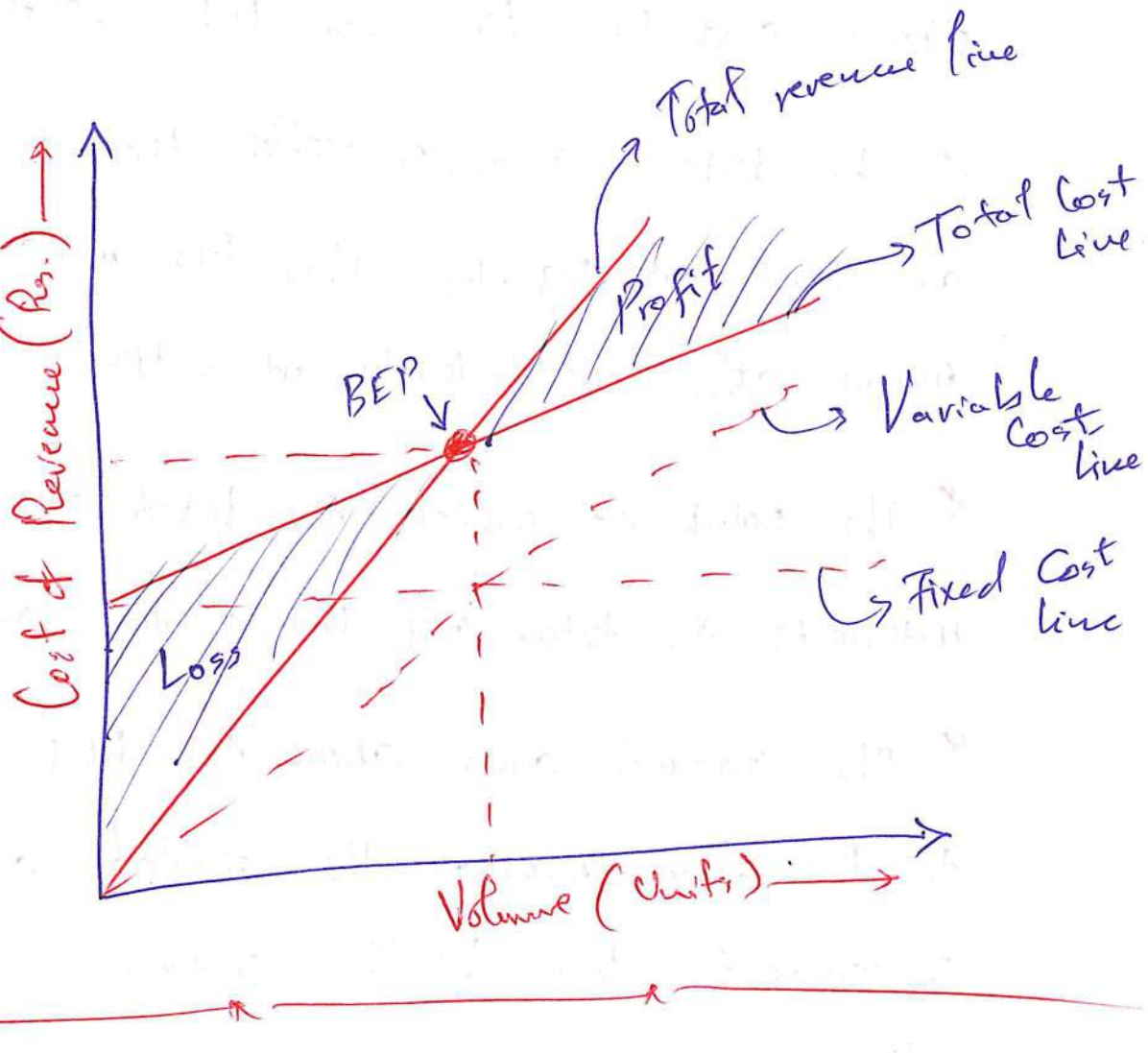
* The shaded area above the BEP marks profit to the firm whereas the shaded area below BEP represents loss to the concern.

2. The Graphical method (Break-Even chart)

Break-even chart is a graphical representation of the relationship between costs and revenue at a given time.

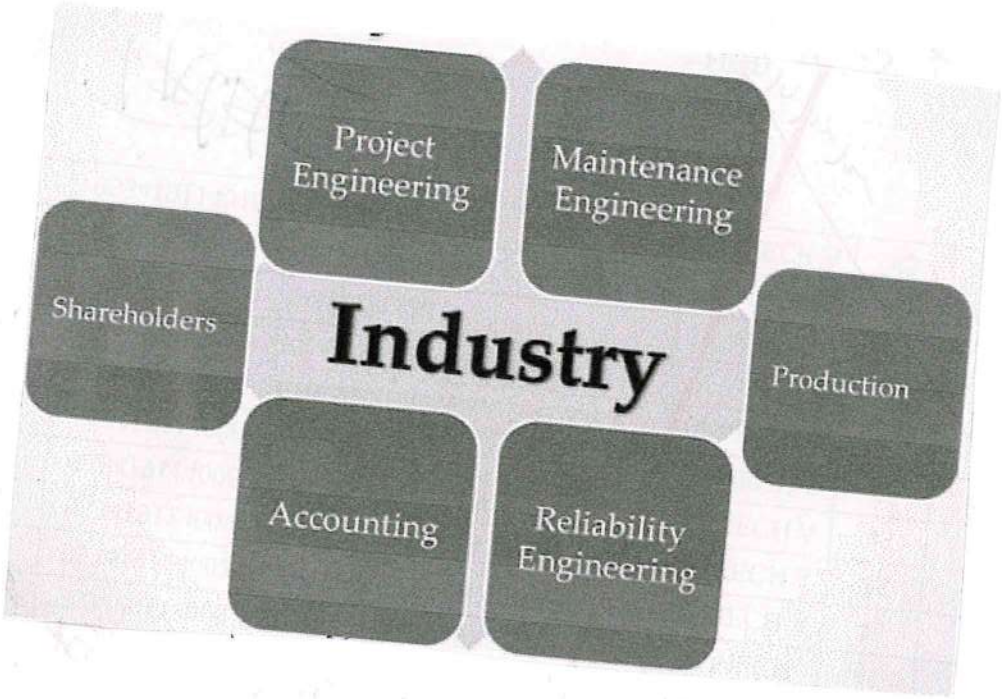
* It is a graphic device to determine the break-even point and amount of loss or profit under varying conditions of output and costs.

* A break-even chart is illustrated Figure:



11. LIFE CYCLE COST (LCC) ANALYSIS

Life-cycle cost (LCC) analysis is a process for evaluating the total economic worth of a usable project segment by analysing initial costs and discounted future costs.



KEY PARAMETERS USED IN CALCULATING LCC:

* Time value of Money - 1. Rate of Return
  2. Inflation.
* Opportunity cost
* Discount Rate
* Analysis

STEPS TO DETERMINE LIFE CYCLE COSTS:

- ✓ Establish alternative design Strategies.
- ✓ Determine activity timing
- ✓ Estimate agency costs.
- ✓ Estimate user costs.
- ✓ Determine life-cycle cost.

* STEP 1. Identify what has to be analysed and the time period for the project life study along with the appropriate financial criteria.

* STEP 2 - Focus on the technical feature by way of the economic consequences to code for alternative solutions.

* STEP 3 - Develop the cost details by years.

* STEP 4 - Select the cost model, Simple discrete, Simple with some variability for repairs and replacements, complex with random variations, as required by project complexity.

STEP 5- Cost details are acquired.

STEP 6- yearly cost profiles are found.

COSTS INVOLVED:

1. Direct costs

- Initial costs: Investment costs, construction costs, Purchasing price. (PV = TV)
- Salvage value: Scrap value of any equipment (or any other property) at the end of its service life.
- Future Investments
- Residual cost
- Annuly Recurring fixed cost.

2. Indirect costs:

- Deterministic Approach
  - motorist delay time
  - vehicle operating costs
  - Accident cost

CALCULATION OF LIFE CYCLE COST:

1. Deterministic Approach
2. Probabilistic Approach

1. Deterministic Approach

* An Exact cost is Determined
* Fixed discrete value are assigned to various parameters and all uncertainties are ignored
* Lcc calculated is fixed value.

2. probabilistic Approach

* A range of value is determined with a specific probability distribution.
* Cost parameters are assigned with some appropriate probability distribution.
* Random numbers are generated.
* There random numbers are used to calculate the Lcc.

UNIT – IV

WORKSHEETS AND GUIDELINES

1. PREPARATION OF WORKSHEETS - GENERAL AND INFORMATION PHASE
2. FUNCTION CLASSIFICATION, RELATIONSHIP AND SUMMARY
3. MEANINGFUL COSTS
4. COST ANALYSIS
5. IDEA LISTING AND COMPARISON
6. FEASIBILITY RANKING
7. INVESTIGATOR PHASE, STUDY SUMMARY
8. GUIDELINES FOR WRITING VALUE ENGINEERING PROPOSA
9. FINANCIAL ASPECTS
10. LIFE CYCLE COST ANALYSIS
11. ORAL PRESENTATION
12. AUDIT - CASE STUDIES AND DISCUSSION

1) PREPARATION OF WORKSHEETS - GENERAL AND INFORMATION PHASE

DEFINITION :-

Multiple column sheets wherein all necessary information and functions used for the preparation of the value analysis is recorded in a systematic process is called worksheet.

OBJECTIVE :

* It is a device used for easy preparation of adjusting entries and value analysis.

* If the worksheet is not prepared in bigger organization where the vdume of functions and adjustments are much more, the possibility of error remains at the time of adjustment of adjusting entries.

TYPES OF WORKSHEETS :-

1, General phase

2) Informative phase

3) Audit phase

General Phase

basic format of a worksheet

..... Company
Worksheet
for the year ended .....

Account Titles	Trial Balance		Adjustments		Adjusted Trial Balance		Income Statement		Balance Sheet	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.

* The general worksheet contain four to six pairs of columns

* Generally, five pair columns or ten columns worksheets can serve the purpose of general business. There five columns are:

- ✓ Trial balance
- ✓ Adjustment
- ✓ Adjusted trial balance
- ✓ An income statement
- ✓ Balance sheet.

2. INFORMATIVE PHASE

* In this phase the detailed worksheet is prepared for containing more detailed information over a general worksheet.

* Sometimes extra sheet containing columns are enclosed for explaining particular items

* The matters for which items-wise list are to be prepared are:

- ✓ Accounts receivable and accounts payable lists,
- ✓ production expenditure lists
- ✓ Break-even point
- ✓ Return of investment. etc.

3. Audit phase:

* Audit worksheet is used for preparing financial statements and lists for various uses of business concerns.

* The Audit worksheet is prepared in the light of the auditing of various items included in the worksheet.

* The main objective of the worksheet is to verify the accuracy of accounting information before the preparation of value analysis.

STEPS OF PREPARING WORKSHEET:

1. Name of business organization and preparation date
2. Drawing column and mentioning the head of the column
3. Unadjusted trial balance
4. Adjustment column.
5. Adjusted trial balance column.
6. Income statement column
7. Retained earnings statement
8. Balance Sheet.

1. NAME OF BUSINESS ORGANIZATION AND PREPARATION DATE

* At the begining of the worksheet the name of the organization for which worksheet is prepared is to be written in the bold form and also the date of preparation of the worksheet is to be mentioned.

2. DRAWING COLUMN AND MENTIONING THE HEAD OF THE COLUMN:

* Drawing column titles are to be mentioned here.

* For example, serial number in the first colum the title of accounts in the second column and thereafter pair columns.

3. UNADJUSTED TRIAL BALANCE

* After the serial number and functions title columns, in the unadjusted trial balance, pair column ledger accounts balances are posted staight to chene the agreement of trial balance with function

4. ADJUSTMENT COLUMN:-

* At the end of the analysis period, the functions which have not been analysed for are written in the adjustment column.

* At the end time of making adjustments, if there does not exist any function in the trial balance, there adjuting functions are to be written below the trial balance under appropriate head(s).

* To identify the adjusting function, separate code numbers for each item be given in this column.

5. ADJUSTED TRIAL BALANCE COLUMN.

* Writting necessary adjustment in the adjustment column, the balance of every function relating to adjustments is ascertained and thereafter all analysis of functions are recorded.

* That is unadjusted balances of trial balance are adjusted as per rules and these are written down in the column of adjusted trial balance.

6. INCOME STATEMENT COLUMN:

* All periodical expenses and incomes of the value analysis are written in this column of income statement respectively.

* The difference between total income and total expenses of the income statement is called profit or loss.

7. RETAINED EARNINGS STATEMENT:

* Here previous year's profit, loss if any and income, loss of income statement of the worksheet are written in the credit money column and distribution of items regarding distribution of profit are shown in the debit money column of retained earnings statem

* The difference between the totals of debit and credit columns is transferred to the balance sheet column of the worksheet

8. BALANCE SHEET

* All assets and amounts including the balance of income statement, retained earnings statement are written in the debit and credit columns of the balance sheet or worksheet i.e; assets are written in debit money column and liabilities, owners equity are written in the credit money column.

* Totals of debit and credit column of the balance sheet are determined.

* The numbers of columns of worksheet and titles of columns depends on the nature and demand of the business concern.

2. FUNCTION CLASSIFICATION, RELATIONSHIP AND SUMMARY

DEFINITION OF FUNCTION:

Function is what makes an item useful. It is the value of a product - its functional utility.

FUNCTION PHASE:

* The objectives of this phase are to define the functions that a product actually performs and is required to perform as well as to relate these functions to the cost and worth of providing them.

* The Two techniques of this phase are:

a) DEFINE FUNCTION: Determine user's need for a product or service. Use only one verb and one noun. The verb should answers the question "what does it do?" The noun should answers "what does it do?" Where possible, noun should be measurable and verb should be action oriented.

Example 1. Some functional definitions are:

Product	Function
Mirror	Reflect light.
Brake	Arrest motion

b) Evaluate function Relationship:

This technique attempts to determine relative importance of various function. through this technique a descending order of importance of the function is established along with the relative value of their importance.

TYPES OF FUNCTION

Three types of function are primary, Secondary, and tertiary functions.

1. PRIMARY FUNCTION

* Primary functions are the basic functions which the product is specially designed to perform.

* Therefore, primary functions are the most essential functions whose non-performance would make the product worthless

2. SECONDARY FUNCTION

* Secondary functions are those which if deleted would not prevent the device from performing its primary function.

3. TERTIARY FUNCTION

* Tertiary function are usually related to esteem appearance

* The tertiary function imparts attractive appearance to the product.

EXAMPLES

* primary function: - Let us consider a single example of painting a company bus to explain all

the above three functions. Here the primary function of painting is to avoid corrosion.

* Secondary function - The secondary function is to identify the company to which the bus belongs by the colour of the paint (e.g blue colour for Ashok Leyland Ltd)

* Tertiary function: The tertiary function is to impart a very good appearance to the bus by using brilliant colours.

FUNCTIONAL RELATIONSHIP AND SUMMARY

* It is common practice to describe systems

1) in terms function and their relationship within the next larger assembly,

2) in terms of their own components or subparts (or)

(3) in terms of their indivisibility or uniqueness.

* The relative position that a system or item occupies in the scheme of the total assembly is called its "Level function"

* In value Engineering, the significance of level of function is that the designated of functions as basic (or) secondary depends upon the function level.

* A function that exist to support the method of performing the basic function is a secondary function.

* But when considered by itself and with respect to itself, it is a basic function, System and items may have many levels of function.

* The rule of functional evaluation is to work from the top, down; and to consider the items or system under study as the top assembly.

Illustrative Example:

MANUAL FIRE ALARM SYSTEM

Level of Service	Component	Functions	Classification B=Basic S=Secondary
1	Fire Alarm System	Make Noise	B
		Detect Fire	B
		Protect Build.	S
2	Person	Detect Fire	B
		Pull Lever	S
	Equipment	Make Noise	B
		Transfer Sign	S
3	Pull Boxes	Break Circuit	S
	Bells	Make Noise	B
	Panels	Provide Power	S
		Control Circuits	S
	Conduit & Wires	Transmit Signal	S
		Transmit Power	S

Figure 30.8-1 - Functional Relationships

* Figure illustrates the first three levels of function for a manually operated fire alarm system

* Observe that the system, as defined, must perform two basic functions. Rather than choosing the restrictive function of "ring bell", the broader term "make noise" was selected to permit greater freedom in developing alternative ways of making noise, i.e, horn, bell, siren, etc.

* Both items in the second level of function have functions that are basic, because the function of the system is dependent upon them.

* All other functions in the second level of function are secondary, because they only exist to support the method or design selected to achieve the basic functions.

* Similarly, in the third level of function, only the bells perform a basic function.

3, MEANINGFUL COSTS

DEFINITION OF COST :

The expenses faced by the business in the process of supplying goods and service to consumers

Types of costs

- ✓ Opportunity cost and actual cost
- ✓ Direct and indirect cost
- ✓ Explicit and implicit cost
- ✓ Historical and replacement cost
- ✓ Fixed cost and variable cost
- ✓ Real and prime cost
- ✓ Total, average, and marginal cost

Opportunity cost and actual cost:

* Opportunity cost: Cost incurred for loosing next best alternative

* Actual cost: An actual amount paid or incurred, as opposed to estimated cost or standard cost

Explicit and implicit cost

* Explicit cost refers to the money expended to buy or hire resources from outside the organizati for the process of production

* Implicit cost refers to the cost of use of the self owned resources of organization that are used in production

Direct and indirect cost:

* Direct cost:

Direct costs are those cost that have directly accountable to specific cost object such as a process or product Ex: wages paid, salary paid labour, material ... etc

* Indirect cost:

Indirect cost are those costs which are not directly accountable to specific cost object or not directly related to production.

Ex: insurance, maintainence, telecom, ... etc.

HISTORICAL AND REPLACEMENT COST

* historical cost refers to the original (actual) cost incurred at the time the asset was acquired

* The Replacement cost is the price that an entity would pay replace an existing asset at current market price that may not be market value of that asset.

FIXED AND VARIABLE COST:.

* fixed cost is the cost that remains unchanged irrespective of the output level or sales revenue such as interest, rent, salaries etc.

* Variable cost: are those cost that vary depending on a company's production volume; they raise as production increases and fall as production decreases

REAL COST AND PRIME COST:

* Real cost of a production refers to the physical quantities of various factors used in

producing commodity ex: Real cost of a table composes of a carpenter's labor to cubic feet of a wood, a dozen of nails, half a bottle of varnish .... etc

* Prime cost: The direct cost of commodity in term of the materials and labor involved in its production excluding fixed cost. By calculating prime cost the firm can decide how much should be their selling price to earn profit

TOTAL COST:

* It is the cost refers to the total expenses incurred in reaching a particular level of output

$$TC = TVC + TFC$$

MARGINAL COST:

* The marginal cost is also per unit cost of production, It is the addition made to the total cost by producing one more unit of output

$$MCn = TCn - TCn - 1$$

i.e the marginal cost of the unit of output is the total cost producing 'n' units minus the total cost of

producing 'n' units n-1 (ie... one less in the total) units of output.

AVERAGE COST:

* Average cost is the total cost divided by total units of output

$$AC = TC/Q$$

where Q is the quantity produced

AVERAGE FIXED COST (AFC)

* Average fixed cost is the total fixed cost divided by total units of output

$$AFC = TFC/Q$$

where Q is the number of units produced

AVERAGE VARIABLE COST:

* Average variable cost is total variable cost divided by quantity produced

$$AVC = TVC/Q$$

where Q is the quantity produced

Direct cost Vs. Indirect Cost

Basis for comparison	Direct cost	Indirect cost
Meaning	These are the costs that can be easily identified as per the cost objects.	These are the costs that aren't easy to identify as per the cost object
Expended on	particular cost objects	Multiple cost objects.
Can be identified as	It can also be called as variable costs.	It can also be called as fixed costs.
Aggregate in the cost sheet	An aggregate of direct costs in the cost sheet is called Time cost	The aggregate of indirect costs in the cost sheet is called overhead Cost
Example	Direct material, direct labor, and direct wages	Rent, advertisement etc.

4) COST ANALYSIS

COST - BENEFIT ANALYSIS

The cost - benefit analysis compares the cost and benefits of a project and then makes a decision on whether or not to proceed with the project.

NEED FOR COST - BENEFIT ANALYSIS

* Before building a new plant or taking on a new project, the managers conduct a cost-benefit analysis to evaluate all the potential costs and revenues that a company might generate from the project

* The outcome of the analysis will determine whether the project is financially feasible or if the company should pursue another project.

COST- BENEFIT ANALYSIS PROCESS

* There is no single universally accepted method of performing a cost - benefit analysis. However, every process usually has some variation of the following five steps.

1. Identify project scope
2. Determine the costs
3. Determine the Benefits
4. Compute Analysis calculations.
5. Make Recommendation and Implement

1. Identify project scope:

* The first step of a cost-benefit analysis is to understand your situation, identify your goals, and create a framework to mold your scope.

* The project scope is kicked off by identifying the purpose of the cost-benefit analysis

* An example of a cost-benefit analysis purpose could be "to determine whether to expand to increase market share" or "to decide whether to renovate a company's website".

2. Determine the costs:

* The second step of a cost-benefit analysis is to understand your situation, identify your goals is to determine the project costs.

* When determining costs, it's important to consider whether the expenses are reccurring or a one-time cost.

* It's also important to evaluate whether costs are variable or fixed; if they are fixed, consider what step costs and relevant range will impact those costs.

3. Determine the Benefits:

* Every project will have different underlying principles benefits might include the following.

* Higher revenue and sales from increased production or new product

* Intangible benefits, such as improved employee safety and morale, as well as customer satisfaction due to enhanced product offerings or faster delivery.

* Competitive advantage or market share gained as a result of the decision.

4) Compute Analysis calculations:

* with the cost and benefit figures in hand, it's time to perform the analysis.

* Depending on the timeframe of the project, this may be as simple as subtracting one from another; if the benefits are higher than cost, the project has a net benefit to the company.

* Some cost - benefit analysis require more indepth critiquing. This may include:

✓ Applying discount rates to determine the net present value of cashflows.

✓ Utilizing various discount rates depending on various situations.

✓ Calculating cost - benefit analysis for multiple options. Each option may have a different cost and different benefit.

✓ Level - setting different options by calculating the cost - benefit ratio.

✓ performing sensitivity analysis to understand how slight changes in estimates may impact outcomes.

5. IDEA LISTING AND COMPARISON

Idea evaluation matrix

* Great ideas are the lifeblood of innovation
* But gathering ideas in, of course, just the start of the process
* It is important to evaluate the ideas
* It is essential to have a clear idea assesment process in place so that you can select your best ideas as efficiently and effective as possible
* Ideally, this process would be both Standardi and Scalable so that it can be applied across your entire organization.
* This can be achieved by using an idea evaluation matrix (also known as a concept evaluation matrix or an innovation evaluation matrix)

STEPS OF IDEA EVALUATION MATRIX

The following are the Six steps to building your idea evaluation matrix

1) Select the ideas to put through your matrix
2) choose your idea screening criteria
3) Rate your criteria
4) Calculate each idea's weighted score
5) Sum the weighted scores and compare

1. Select the ideas to put through your matrix

* An idea matrix can work effectively with many ideas, but you'll need to 'filter' those ideas to select the ones that you believe are the most innovative
* You can use your team idea generators as the first filters, letting everyone vote, rate and comment on the ideas that have been submitted
* At this stage of the screening process, you might find that some ideas are "quick wins" and they won't need to go through the evaluation matrix

* For these quick wins, simply get going! For the bigger ideas, though, an idea evaluation matrix is invaluable

2. Choose your idea screening criteria

* The second step in building the matrix is to decide which criteria to use for scoring your idea.

* It is vital that you choose the right criteria to screen and rank your ideas, otherwise they won't be aligned with your overall goals or strategy.

* While these criteria will vary for each organisation and depending on the type of ideas you're evaluating, they'll generally include the following.

Examples of idea screening criteria.

- ✓ Time
- ✓ Cost
- ✓ potential impact
- ✓ Monetary impact
- ✓ Business critical

Step 1 :-

IDEA DROP				
Criteria Coefficient				
Idea A				
Weighted rating				
Idea B				
Weighted rating				
...				

Step 2 :-

IDEA DROP	Time	Cost	Potential Impact	Monetary Impact
Criteria Coefficient				
Idea A				
Weighted rating				
Idea B				
Weighted rating				
...				

3. Rate your criteria.

* Next, you'll need to establish a rating scale- a "Criteria coefficient" for each of the criteria you've chosen for your matrix.

* The scale will go from 1 (low importance) to 5 (high importance). Add these rating to the matrix, below each criterion.

* For example; if cost is critical when rating each idea, give that criterion a ranking of 5.

* If time to implementation is less critical, you might rank that as a 2.

IDEA DROP	Time	Cost	Potential Impact	Monetary Impact
Criteria Coefficient	1	2	3	5
Idea A				
Weighted rating				
Idea B				
Weighted rating				
...				

4. SCORE EACH IDEA:

* Once you've rated your criteria you can move on to scoring each idea based on the criteria you've chosen.

* Score from 1 to 5 (1 being the least effective, 5 being the most) how well each idea meets each of your chosen criteria.

* For example, if idea A rank very well in terms of cost, award it a score of 5 for that criterion, and if its monetary impact is low, you may choose to give it a a score of 1 or 2 there.

IDEA DROP	Time	Cost	Potential Impact	Monetary Impact
Criteria Coefficient	1	2	3	5
Idea A	5	4	3	1
Weighted rating				
Idea B	2	3	4	5
Weighted rating				

5. Calculate each idea's weighted score:

Finally, you need to calculate each idea's weighted score for each of the criteria

* To calculate the weighted score for each idea, first you need to find the weighted score for each idea in each of your chosen criteria

* To do that, simply multiply the ranking you've given to each criterion with the score you've awarded for each idea in that particular criterion.

* For example, if you've ranked your cost criterion as a 2 and Idea A has a score in the cost criterion of 3, the weighted score for idea A in the cost criterion is 6 (2x3). You'll need to calculate these weighted scores for each idea across each of yours criteria.

IDEADROP	Time	Cost	Potential Impact	Monetary Impact
Criteria Coefficient	1	2	3	5
Idea A	5	4	3	1
Weighted rating	1x5=5	2x4=8	3x3=9	5x1=5
Idea B	2	3	4	5
Weighted rating	1x2=2	2x3=6	3x4=12	5x5=25
...				

6. SUM THE WEIGHTED SCORES AND COMPARE

* The final step is to sum the weighted scores across each criterion for every idea in your matrix. and to write these scores in the final column of the matrix.

* you can then compare these scores to evaluate which ideas are the most viable (those with the highest scores) and which are the least.

* By scoring every idea based on the evaluation criteria you deem critical, an idea evaluation matrix can prove an invaluable decision-making tool for helping you to find the best, most workable ideas for propelling your business forward.

IDEA ◊ DROP	Time	Cost	Potential Impact	Monetary Impact	TOTAL
Criteria Coefficient	1	2	3	5	
Idea A	5	4	3	1	
Weighted rating	1x5=5	2x4=8	3x3=9	5x1=5	sum=27
Idea B	2	3	4	5	
Weighted rating	1x2=2	2x3=6	3x4=12	5x5=25	sum=45
...					

6, FEASIBILITY RANKING

Feasibility ranking:

Feasibility ranking for innovation is a simple table that allows you to assess your idea from four perspectives; technical, economic, social and environmental.

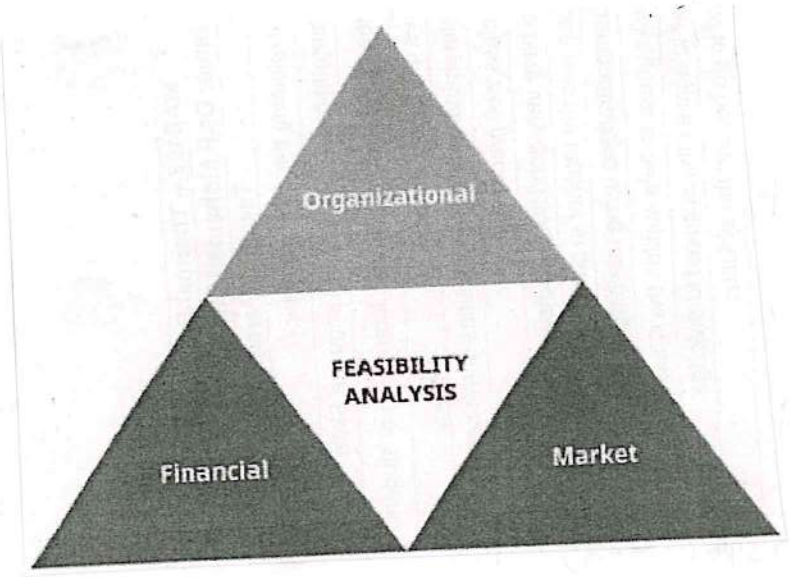
* Each perspective has a set of criteria that you can use to score your idea from 1 (low feasibility) to 5 (high feasibility)

* For example, technical criteria may include the availability of skills, equipment, and materials, while economic criteria may include the cost, revenue and profitability of your idea.

* By adding up the scores for each perspective you can get a total feasibility score for your idea

Types of feasibility Analysis:

- ✓ Organizational feasibility Analysis
- ✓ Financial feasibility Analysis
- ✓ Market feasibility Analysis



* Organizational feasibility analysis aims to assess the prowess of management and sufficiency of resources to bring a product or idea to market.

* Financial feasibility analysis seeks to project revenue and expenses [forecast come later in the full business plan]; project a financial narrative; and estimate project costs, valuations, and cash flow projections

* Market feasibility analysis enables you to define competitors and quantify target customers and / or users in the market within your chosen industry by analyzing the overall interest in the product or service within the industry by its target market

STEPS TO CREATE A FEASIBILITY MATRIX FOR INNOVATION:

1. To Create a feasibility matrix for innovation, you must first define your idea concisely and identify the relevant criteria for each perspective.
2. Then, collect and analyze data to support your scoring, which can be done through primary or secondary sources
3. Score your idea for each criterion from 1 to 5, being realistic and objective while using evidence to justify your scores
4. Finally, calculate the total feasibility score by adding up the scores for each perspective, or you can calculate the average score to see which one is strongest or weakest

USES OF FEASIBILITY RANKING

* It can be help you asess the gaps and risks in your idea, compare different alternatives, and communicat and justify your idea to stakeholders.

* Additionally, it can assist in monitoring and evaluatin the progress and impact of your ideas as you implement it.

BENEFITS AND LIMITATIONS OF A FEASIBILITY MATRI

* It is a simple and flexible tool that can be adapted to various situations and domains, as it is comprehensive and holistic in its approach

* Furthermore, It is a participatory and collabrative tool that can involve different perspectives from your team and stakeholders.

* However, It is important to note that the tool is subjective and qualitative, as it depends on the quality and availability of data as well as the judgment and bias of the scorers

* Additionally, the matrix is relative and dynamic, which means it may change over time and in different contexts.

7) INVESTIGATOR PHASE - STUDY SUMMARY

INVESTIGATION PHASE

Investigation (or Analysis) phase is where the study team determines what they know about the project from readily available information and what they must know in order to really define and (or solve the problem

OBJECTIVE:

* The objective of the Investigation phase of the value Engineering Job plan is to acquire knowledge of the design to be studied and to assess its major functions, cost and relative worth

* The Investigation phase immediately brings the three fundamental concepts of VE [function, cost, and worth] to bear on the problem. It is these concepts that make the VE process different from all other management and cost control techniques. This Phase requires the team to ask and answer the

following basic questions:

- ✓ what is it?
- ✓ what does it do? (what is the function?)
- ✓ what must it do? (is its function basic?)
- ✓ what is it worth?
- ✓ what does it cost?

INVESTIGATION PHASE OUTLINE

* Collect detailed information and data
  - ✓ Gather all types of information from the best sources.
  - ✓ Obtain complete, pertinent information
  - ✓ Get the facts
  - ✓ Get all available costs
  - ✓ Gather all Environmental Constraints and Commitments.
  - ✓ Gather other constraints.

* DETERMINE THE FUNCTION.

- ✓ Identify and define functions
- ✓ Classify functions
- ✓ Determine function relationships.

* DETERMINE THE FUNCTION

- ✓ Identify and define functions
- ✓ Classify functions
- ✓ Determine function relationships

* DETERMINE FUNCTION COST

- ✓ DETERMINE cost of each function.
- ✓ Determine overall cost of project
- ✓ Identify high-cost function.

* DETERMINE WORTH OF EACH FUNCTION.

- ✓ Determine worth of each function.
- ✓ Determine overall worth of project.

* DETERMINE FUNCTION VALUE

- ✓ Determine value opportunity index for each function.

✓ Determine value opportunity index for each function.

✓ Determine overall value opportunity index.

✓ Identify areas of poor value.

* Analyze project potential

✓ Review life cycle cost aspects.

✓ Establish target cost for areas of low value

✓ choose specific elements to be studied.

STUDY SUMMARY :

* for example, the function of a bridge is to "cross obstacle"

* The VE study team should not care whether that obstacle is a ditch, river, creek, railroad, another highway or a building.

* The bridge's basic function is to provide a mean to cross that obstacle.

* If it does not accomplish that function that function, we wouldn't buy it, therefore the cross obstacle function is considered to be basic

* The Study team should be as non-specific as possible when describing functions to leave as many option open as possible to perform the generalized problem or function that the project presents.

* TO SUMMARIZE, THE GOALS OF THE VE STUDY TEAM BY THE END OF THE INVESTIGATION PHASE ARE TO:

- ✓ Identify the project's high-cost elements.
- ✓ conduct a functional analysis of the high-cost elements.

Assess their cost / worth relationships.

8. GUIDELINES FOR WRITING VALUE ENGINEERING PROPOSAL

VALUE ENGINEERING PROPOSAL :

* The value management office has two programs that apply principles of value engineering.

* One involves value engineering studies which occurs in the early stages of the design development

* The second is the value engineering proposal (VEP) which are done and initiated by the contractor.

OBJECTIVE

A value Engineering proposal (VEP) brings an innovative idea to the department from a contractor.

1. Contractor Idea
2. Cost Savings
3. Innovative solution
4. Time Savings.

VEP PROCESS:

Contractor Submits preliminary proposal ⟹ preliminary proposal Reviewed ⇒ contractor Submits final proposal ⇒ Final proposal Reviewed.

PROPOSAL FOR VE STUDIES

* The VE proposal must be a separate section of the application and must contain adequate information so that it can be reviewed independently.

* The proposal should be complete but concise. It need not explain VE concepts.

* The following outlines is suggested as a guide for submitting VE proposal to EPA

I. PROTECT INFORMATION

A) project name and BPA identification number

B) process and methodology (Brief description)

C) Estimation construction costs (grant eligible costs.

D) Design Statis

II PROPOSED SCOPE OF VE STUDY

A) proposed constraints with detailed reason

B) Scope of technical areas to be investigated

III PROPOSED ORGANIZATION OF VE STUDY

A) Timing of the VE study (at what percentage) of design completion)

B) Numbers and length of workshops (40 hours or less per workshop)

i) Discuss effects on design & schedule with overall work plan showing intergration of VE effort into design schedule

2) Number of VE teams

C) Composition of teams

1) primary study area for each team

2) Specific skills to be included on each team

3) Selection criteria for VE team members

4) List of individual team members and alternates with resumes of each

D) plan for conduct of VE study

i) pre-workshop preparation

a) specific documents to be furnished and distributed and by whom

b) plan for co-ordinating with designer to obtain agreeable basis of costs.

2) VE workshop

a) location and day-by-day agenda for workshop

b) plan for availability of design staff to answer questions

3) post workshop procedure:

a) schedule for oral presentation.

b) schedule for preparation and submittal of preliminary VE report

c) schedule for preparation and submittal of final VE report.

IV) VE FEE PROPOSAL

* Procurement of VE services, the VE contract and the estimated fee of effort for the design firm Should be shown separately

V) PROPOSED VE CONTRACT

Vi) APPENDEX - QUALIFICATIONS OF VE TEAM MEMBERS

9. FINANCIAL ASPECTS

FINANCIAL WORKSHEET

* The financial aspect worksheet displays the summarized costs and financial benefits of each alternative projects for value engineering management.
* The financial worksheet contains summary level information, which provides the basis to perform an evaluation of each alternative both in terms of costs to implement the alternative and the positive or negative impact on operations resulting from the implementation of the system.
* Financial worksheet provides information on the relative benefits of implementing each alternative based on the total project costs.
* Financial worksheet is organized into vertical and horizontal sections.

VERTICAL SECTION :

The aspects in vertical section (columns) for each alternative are :

1. Average current operations costs (Before project)
2. planning costs (Before project)
3. project costs (During project)
4. Total one-Time (project) costs
5. future operation costs (After project)
6. change in operations costs
7. Total project costs

1. AVERAGE CURRENT OPERATIONS COSTS [Before project]

* This column includes the annual cost to operate the project as they exist today before the new solution has been implemented

a) personal services
   - ✓ Existing staff
   - ✓ program / IT
   - ✓ Monthly salary
   - ✓ Current Annual operation costs
   - ✓ Total current operation costs

✓ . Average current operation costs

b) operating Expenses and Equipment (OE & E)

2. Planning costs [Before project)

* These columns show the estimated year-by ear cost to plan the project ; this reflects total one-time costs

3) project cost (During project)

* These columns show the estimated year-by-year cost to implement the project ; this reflects total one-time costs.

a) personal services

b) operating Expenses and Equipment (OE & E)

c) Annual Savings | Revenue Adjustments

4) Total one-time (project) costs

* These columns combine the total project costs for all financial years, broken down by positions and dollars, OE & E Expenditures, Local assistance.

5, Future operations costs (After project)

* These columns show the projected cost to operate the project after the alternative has been implemented and changes have been made to project.

a) personal services

b) operating expenses and Equipment (OE/OE)

c) Average future operations costs.

6) Change in operations costs

* These columns shows the differences between what it costs to operate the current program and supporting system (today) and what it is estimated it will cost to operate the program and supporting systems in the future after the project has been completed and the new system has been implemented.

7) Total project costs.

* This column represents the sum of costs for planning + one-time + Total future Annual costs

HORIZONTAL SECTION:

The aspects in horizontal sections (rows) for each alternative are:

1. Total project costs
2. Annual Savings | Revenue adjustments
3. Annual Future operations costs
4) Simple Return on Investment (ROI)

1. Total project costs:

* These rows show a summary of the total personal services Expenditures, total OE & E Expenditures, broken down by the vertical columns identified above.

2. Annual Savings / Revenue Adjustments:

* These rows show a summary of the cost savings and increased program revenues achieved by implementing each alternative.

* These rows also shows a summary of the net cost or benefit from implementing each alternative

3. Annual future operation costs:

* This row provides the final personal services costs plus OE/OE expenditures for the final financial year only

4) Simple Return on Investment (ROI)

* This row identifies the future percentage of cost compared to the current costs and whether it increases or decreases operations costs.

10. LIFE CYCLE COST (LCC) ANALYSIS

Same question unit 1 – Q no. 11

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11. ORAL PRESENTATION

Oral presentation

An oral presentation is a formal, structural and systematic presentation of a message to audience occasionally accompanied by visually based presentations such as a slide show.

Features:

* An oral presentation is a form of communicatic
* It is participative two way communication process characterized by the formal and structured presentation of a message using visual aids.
* It is purposeful, interactive and audience oriented.
* It communicates a message to audience in a way that brings about the desired changes in their understanding and opinion

OBJECTIVES OF ORAL PRESENTATION:

* Select appropriate points of emphasis in your presentation.
* Develop a useful level of detail
* Choose and prepare appropriate visual aids
* Create a tone that is sensitives to your audience's circumstance

BARRIERS TO EFFECTIVE PRESENTATION:

* Fear
* Lack of preparation
* Unable to control one's ideas

FOR EFFECTIVE PRESENTATION:

1. Conquering stage fright
2. Knowing the audience
3. Content of the presentation
4.

4, Structure of the presentation

5, Delivery of the presentation

6, Remembring API's

1. CONQUERING STAGE FRIGHT:

- ✓ Some amount of stage fright is helpful
- ✓ The main reason is that we are not accustomed to speak in public
- ✓ Prepare the subject thoroughly.
- ✓ Do some warm up exercises such as rotating arms, moving the facial muscles, taking deep breath etc before speaking
- ✓ Take carbohydrate rich meal before going to make presentation.
- ✓ positive thinking - 'I will make the presentation' and 'I am confident

2. Knowing the audience

Before planning we should consider

- ✓ The age group of the audience
- ✓ Know the need of the audience
- ✓ Utility of the presentation for the audience
- ✓ Information gained after attending the presentation

3, content of the presentation

- ✓ It should not be too difficult to understand
- ✓ If too long Shorten the content according to time available
- ✓ Include examples and instructions to support the argument

4) Structure of the presentation

- ✓ Introduction - Introduce the topic
- ✓ Body of presentation - provide detail information to audience about the opic
- ✓ conclusion - State the goal and uses of topic.
- ✓ Leave the audience with a positive feeling about the topic

5, Delivery of the presentation

✓ The quality of the voice

- ▷ Adjust your tone according to the size of the audience
- ▷ Use micro phone or collar mike
- ▷ Give pauses to allow the listeners to understand
- ▷ Pronounce difficult words properly and correctly

✓ Communicate with the audience

- ▷ Look into the eyes of the audience while presenting
- ▷ Shift from one pair of eye to another so that you have a glance of all of them
- ▷ Try to involve the audience in present action by asking questions

✓ pay attention to Body Language

- ▷ Express your confidence in your smile and movements
- ▷ Stand straight and donot stagnate at one place
- ▷ Avoid unnecessary movements of hands
- ▷ Always dress in formal

✓ Effective use of visuals aids

- Remembers the value of pictures, symbols and objectives
- use a plain font of substantial size
- Do not use more than three colors
- practice before how to operate the equipment

6) Remembering API's

→ planning
→ preparation
→ practice
→ perform

✓ A) planning

- Define a purpose
- Analyze the audience
- Analyze the occasion
- Select a suitable title

✓ B) preparation

- Develop the central
- Delbvop the main ideas
- Gather supporting information

✓ C) practice

- Rehearse before presenting it to the audience
- Time the presentation
- Outline the presentation

✓ D) perform

- Begin the presentation with confidence
- Be organized
- Pay attention to non-verbal behavior
- Use appropriate visual aids.

PROCEDURE

The following steps will serve to foster and promote the success of future VE effort:

1. Obtain copies of all completed implementation actions.
2. Compare actual results with original expectations to verify the accomplishment
3. Submit reports on cost savings or other improvements to management
4. Distribute information to all interested parties and other agencies
5. Review the project to identify the any problems that arose, and recommend corrective action for the next project
6. Initiate recommendations for potential VE study ideas identified during the study just completed
7. Screen all contributors to the VE study for possible recognition, and initiate recommendations to management.

12. AUDIT PHASE

OBJECTIVE

The objective of the Audit phase of the value Engineering Job plan is to assure the desired results have been attained, properly documented, and reported

AUDIT PHASE OUTLINE

1) perform an adult
2) Evaluate results
3) prepare final project report
4) Distribute information to interested parties.
5) Compile results of all VE Studies in "Annual VE Report"

DISCUSSION

* Until audit of results are completed, the records on the project cannot be closed

* Sometimes an audit is not accomplished because the audit requires additional effort (time - money - energy)

* Yet, the audit process is essential to the continuing success of the organization's VE program

* There are two points of emphasis for completion of the audit phase of the VE program

- The first point of emphasis for completion involves the VE coordinator establishing and maintaining a file on all completed VE studies

- These files should include all projects utilizing VE, including those projects requiring VE studies, VE change proposals by contractors, and VE studies performed on other functions within the organization.

- The second point of emphasis involves the compilation and submission of the "Annual VE report"

8) Determine the effect on maintenance and other life cycle costs

AUDIT RESPONSIBILITY

The VE coordinator is responsible for completing phase of the Job plan. completed audit results will be included in Annual VE Report.

AUDIT PHASE CHECKLIST

- ✓ obtain and file A copy of the final VE Study Report.
- ✓ Did the idea work?
- ✓ Was money saved?
- ✓ Was design improved?
- ✓ Could it benefit others?
- ✓ Has it had proper publicity and distribution
- ✓ Should any awards be made?
- ✓ Prepare Annual VE Report

UNIT – V

VERSATILITY OF VALUE ENGINEERING

1. VALUE ENGINEERING OPERATION IN MAINTENANCE AND REPAIR ACTIVITIES
2. VALUE ENGINEERING IN NON HARDWARE PROJECTS
3. INITIATING A VALUE ENGINEERING PROGRAMME INTRODUCTION
4. TRAINING PLAN
5. CAREER DEVELOPMENT FOR VALUE ENGINEERING SPECIALTIES

1. VALUE ENGINEERING OPERATION IN MAINTENANCE AND REPAIR ACTIVITIES

* Value Engineering is a one of the most powerful desision making techniques which depends upon various factors

* Value engineering approach is selected as a communication platform between industrial designers and engineering designers.

* Using factors comparison study between different maintenance and repair practices, the best practice will be obtained based on VE process.

* Below are the type of maintenance followed in any types of industries

- ✓ Break down maintenance (BDM)
- ✓ Preventive maintenance (PM)
- Corrective maintenance (CM)
- Condition base maintenance (CBM)
- Time base maintenance (TBM)

DECISION MAKING THROUGH VE:

★ A decision that improves quality but increases cost to a point where the product is no longer marketable is as unacceptable as one to avoid confusing the cost with value.

★ If added cost does not improve quality or the ability to perform the necessary function, then value is decreased

★ Three basic elements provide a measure of value to the user; function, quality, and cost.

★ These elements can be interpreted by the following relationship:

Value = function * quality / cost

where : function = the specific work that a design/item must perform.

Quality = the owner's or user's needs, desires, and expectations.

Cost = the life cycle cost of product.

* Therefore, we can say that ; value = the most cost - effective way to reliably accomplish a function that will meet the user's need, desires, and expectations.

* The main objective of VE is to improve value, and VE techniques can overcome many of the roadblocks to achieving good value

SELECTION PHASE BASED ON FACTORS :

The following factors have been selected for value analysis.

- COST
- SAFETY
- MTTR [Mean Time To Repair]
- QUALITY
- SEVERITY FACTOR

1. Cost

* According to cost the following points are given to the different maintenance practice for cost through comparision
* Here less cost of maintenance has more value than high cost of maintence, so low cost maintenance getting more value.
* Below table is the value point for cost.

Maintenance type	point out of 10				
	cost	safety	MTTR	quality	Severity
BDM	9	4	4	4	3
PM	8	7	5	6	5
CM	7	7	6	6	6
CBM	6	8	8	8	8
TBM	5	9	9	8	8

2. SAFETY

Here maximum point got more safe maintenance practice

Above table is the value points given for safety

3. MTTR [Mean time to repair].

* It is a ratio of repair time to frequency of failure so it should be less for best maintenance practice

* So have a less MTTR got maximum weight

* Above table is the value point given for MTTR

4. QUALITY

* It can be define as an user's needs, desires, and expectations.

* Here we give better point to good maintenance practice

* Above table is the value points given for quality.

5. SEVERITY FACTOR :

* It represents the effect level of failure on the equipment on the basis of downtime, scrap rate and safety.

* It should be less for best maintenance practice, so best maintenance practice got maximum point.

* Above table is the value point given for severity factor.

EVALUTION PHASE BASED ON VALUE POINTS:

* In this phase we have chosen factor comparison method to evaluate the maintence practice which has most value.

(@) FACTORS OF SELECTION

- ✓ Cost (A)
- ✓ SAFETY (B)
- ✓ MTTR (C)
- ✓ Quality (D)
- ✓ Severity factor (E)

(b) Degree of Importance

- ✓ major difference (3)
- ✓ Medium Difference (2)
- ✓ Minor Difference 1
- ✓ No Difference (0)

(c) Factor comparison table

Assuming one company has the following requirement while selecting maintenance practice

- * Cost - Avag
- * Safety - High
- * MTTR - very high
- * Quality - High
- * Severity factor - very high

PAIRED FACTOR COMPARISON

COST (A)	SAFETY (B)	MTTR (C)	QUALITY (D)	SEVERITY (E)	TOTAL WEIGHT	ADJUST WEIGHT
A	B1	C1	A1	E1	1	2
	B	C2	B2	E2	2	3
	C	C3	E3	E3	3	4
				E2	2	3

CRITERIA EVALUTION MATRIX

Maintenance type	Cost (A)	Safety (B)	MTTR (C)	Quality (D)	Severity (E)	Total Score
	2	3	4	3	4	
Break down maintenance	9 (18)	4 (12)	4 (16)	4 (12)	3 (12)	70
Preventive maintenance	8 (16)	7 (21)	5 (20)	6 (18)	5 (20)	95
Corrective maintenance	7 (14)	7 (21)	6 (24)	6 (18)	6 (24)	101
Condition base maintenance	6 (12)	8 (24)	8 (32)	8 (24)	8 (32)	124
Time base maintenance	5 (10)	9 (27)	9 (36)	8 (24)	8 (32)	129

* The proposed processes for maintenance practice are based on weighted points scored as shocon in evaluation matrix table.

* And finally Time base maintenance practice get highes point, and alternately it should be selected as a best maintenance.

BENEFITS OF VE IN MAINTENANCE

This is very helpful for new industry or small scale industry for selecting the best maintenance practice for economic point of view it is new concept for selection of maintenance practice and enhance the moral of

2. VALUE ENGINEERING IN NON HARDWARE PROJECTS

* Non hardware projects refers to software projects
* Value Engineering and Software Engineering are both "people" business.
* Both disciplines require exceptional thought processes in order to be successful
* However, there is little evidence to suggest that the methodologies of value engineering actually support the acquisition and development of Software
* Software is define by webster's dictionary as "Written or printed data, as programs, routines, and symbolic languages, requisite to computer operations. 2, Documents containing information on computer operations and maintenance

VE in Software Development :

* Each software development project begins with a review of available techniques and processes that are used to develop software.

* To ensure quality software is produced, appropriate management attention must be directed in the areas with the potential to generate challenges beyond origin expectations.

* Software development is extremely complex and can be compared to the construction of aircraft.

* Aircraft manufactures use a variety of tools, materials, and processes to develop an aircraft consistent with contract requirements.

* Both software and aeronatical engineers constantly look for new technique and process to improve their products.

a) The plurality of goals

* In software engineering, an honorable goal for a software developer would be to provide software products that fulfill the needs of a customer in a uniform manner.

* In other words, if a customer specifies that he desires a software product to exhibit certain characteristics, such as program efficiency or program clarity, then the customer would normally not expect other characteristics to suffer as a result of preferring one over others.

* This software engineering concept is known as "The plurality goals"

* The plurality of goals means that different software goals conflict with each other in software development. This means that if one particular software goal receives special emphasis, then other software goals will most likely suffer as a result.

* From a value Engineering standpoint, one would question and challenge every aspect of the plurality of goals in order to achieve the highest levels of value

* Some useful questions that should be asked would include:

- ✓ why is memory our most important software goal?
- ✓ How important is program clarity to our organization. why should output clarity be considered?
- ✓ would other software goals better suit our heads and why?
- ✓ who can provide the best answers; the software engineer or the customer?
- ✓ what are our real requirements, will something else suffice?

b) Goldplating

* Any product, whether it is hardware or software can "nice to have items" that do not add value to the customer.
* In software engineering, "goldplating" makes the job larger and adds costs which are disproportionate to original software requirements.
* One common method to make the software job larger and increase the cost significantly, is to succumb to the temptation to add additional software engineering to a software project.

* Two of his examples include:

1) Instant Response Time: overloading processing system with rapid response times for all transaction that exceed users requirements.

2) pinpoint accuracy: Requiring systems to produce mathematical calculations to A digit accuracy versus 2 digit accuracy.

* In value Engineering "Using industry specialists to extend Specialized knowledge;" could be used to challenge to tendency to "goldplate" software products:

* Appropriate questions to ask inthis category should includes:

✓ what is exact function the software must perform and why?

✓ who is in the best position to define the unique requirements of the software and why?

✓ what software cost are associated with identified functional requirements and why?

✓ what other software solutions will satisfy indentified requirements and what are their relative costs?

VE in software maintenance!.

* Software maintenance represents a Significant portion of Software life-cycle costs.

* The cost associated with maintaining software is approaching 70% of the total software cost.

* Maintaining Software is not the same as maintaining hardware

* Hardware requires maintenance because components eventually break down over time

* when hardware components are replaced, the items Original configuration remains intact.

* Software maintenance is classified into two main categories

1) software update: which result in a changed functional Specification for the software product

2) Software repair: which leaves the functional specification intact."

* A value analysis checklist can also be generated using brainstorming techniques which can focus on potential maintenance areas that impact future value.

* Again, questions that could be evaluated to analyze future value include:

✓ what are the performance capabilities of the system and how might they grow?

✓ which areas of requirement might become unnecessary and removable?

✓ Is there the possibility of a need to have different version of the system with different capabilities?

✓ what are the implication on manpower and computer resources if the identified changes come about?

✓ which areas of function have the greatest chance of requiring change in light of experience with the system?

3. INITIATING A VALUE ENGINEERING PROGRAMME – INTRODUCTION

Value Engineering program:

A typical VE program includes an organized set definitive tasks which applies the VE discipline to all major elements of an organization. An effective and sustained VE program will have:

* Periodic top management attention to ensure implementation and continuing support by the entire organization.
* A key individual to manage the VE program. This individual should be well trained in VE principles, techniques, and contractual aspect. It is recommended that an individual with an engineering background hold this position. Communication, Oversight, and involvement in engineering studies are routine activities of successful VE managers.
* A "master plan" to ensure that action which will effectively contribute to a successful VE program are considered and acted upon

* VE objectives, policies, responsibilities and reporting requirements firmly established and implemented.

[BELOW SAME CONTENTN IN UNIT 1, Q. NO. 23, 8)

4. TRAINING PLAN

VALUE ENGINEERING TRAINING

* Training is the most important element of a comprehensive VE program.

* Continual emphasis must be placed on training if VE is to reach its full potential.

* An overall program, to include both formal and informal training, should be set up for top management operational management. operating personnel and value engineers.

ESTABLISHING A VE TRAINING PROGRAM:

In establishing a VE training program, there are three important elements that must be initially formulated:

1. Training Responsibilities
2. Training plan
3. Training capability Development

1. Training Responsibilities:

* Because a VE training program will require participation by many organization elements, coordination by a central source which are desirable in order to avoid conflict, duplication, and dilution of the primary effort.

2. Training plan:

* Normally prepared under guidelines of the overall VE program plan, a training plan should be developed to include annual training schedules, procedures for assessing the effectiveness of the training provided, and a method for developing in-house training capabilities.

3. Training capability Development

* The establishment of in-house training capabilities reflects the need of the organization.

* Where no VE program exists, an in-house training capability may be achieved by obtaining VE training outside the organization.

TYPES OF VE TRAINING:

1. Workshop seminars
2. Orientation session
3. Informal VE Training

1. Workshop Seminar:

* Workshop seminars are the main source of formal VE training for operating personnel.

* These seminars provide an opportunity for an individual to sample value work before being committed to it.

(a) Duration and session schedule.

✓ A 40 hours workshop seminar is common.

(b) Participants.

✓ The size of the class will vary according to the organizational needs and the availability of experienced personnel to serve as team project leaders.

c) Curriculum

✓ The seminar lecture schedule, prepared in advance, should include a curriculum covering all

aspects of the VE methodology.

d) Team organization and responsibility.

✓ Team should consist of three to five training candidates for project portion.

e) Vendors.

✓ vendors should also be included in workshop seminars to provide information on new ideas and innovation in production, materials, or processes relative to the projects.

2. Orientation session:

* This type of VE training is normally conducted by staff value engineers and generally runs 1 to 8 hours duration to introduce the fundamentals, goal and operation of the VE program.

3. Informal VE Training

* Some organizations may chose to train personnel in VE through less formal methods or to supplement other programs with informal training devices

* Some of these informal training approaches are :

a) Handbooks and manuals
b) Bulletins and newsletters, distributed periodically
c) Technical meetings
d) Displays of succesful VE case histories

TRAINING PLAN

SCHEDULE ONE : understanding value Engineering and its application

1) Course Introduction and post-course Assesment
2) What is value? what is value Engineering (VE). why is it important?
3) Defining value Engineering concepts and principles
4) VE Study definition, scope and project phase
5) VE team and stakeholders analysis and management
6) Introducing the case study.

SCHEDULE TWO: The Information and function Analysis phase - Expressing project needs and constraint

1) The VE Job plan
2) The Information phase - steps and procedures
3) The need for function Analysis in projects
4) Identifying function and selecting function Diagrams
5. function Analysis System Technique (FAST)
6. Workshop : FAST Diagram.

SCHEDULE THREE : The Creative phase - Inspiring creativity in your Team

1) function cost and worth
2) Finding value mismatches
3. Facilitation skills and overcoming creativity blockers
4) Creativity and Creative thinking within the project environment
5. Data collection and creativity output
6. Workshop : Brainstorm case study Alternatives.

SCHEDULE FOUR : The Evaluation phase - Making Informed Project Decision

1) Effective Decision - making in project environment
2) project evaluation methods : Subjective evaluation and quantitative evaluation
3) Project life-cycle costing and net present valu
4) Output of the Evaluation phase
5. Workshop: Cost estimating Techniques

SCHEDULE FIVE : The presentation and Reporting phase- Getting Results through Effective Communicat

1) Selection of alternatives and action planning
2) Reporting VE findings to senior management and project Stakeholders
3) Oral presentation techniques & interpersonal skill
4) Review of VE Case study Reports and wrap-up discussions.
5. post - Course Assessment

5. CAREER DEVELOPMENT FOR VALUE ENGINEERING SPECIALTIES

VALUE ENGINEER:

* value engineers create plan for engineering activities devising design criteria and product specifications for component and equipments in any projects.

* They function as a mediator between engineering and other departments involved in the work

* value engineers has to research product design to make sure proposals match standard design criteria.

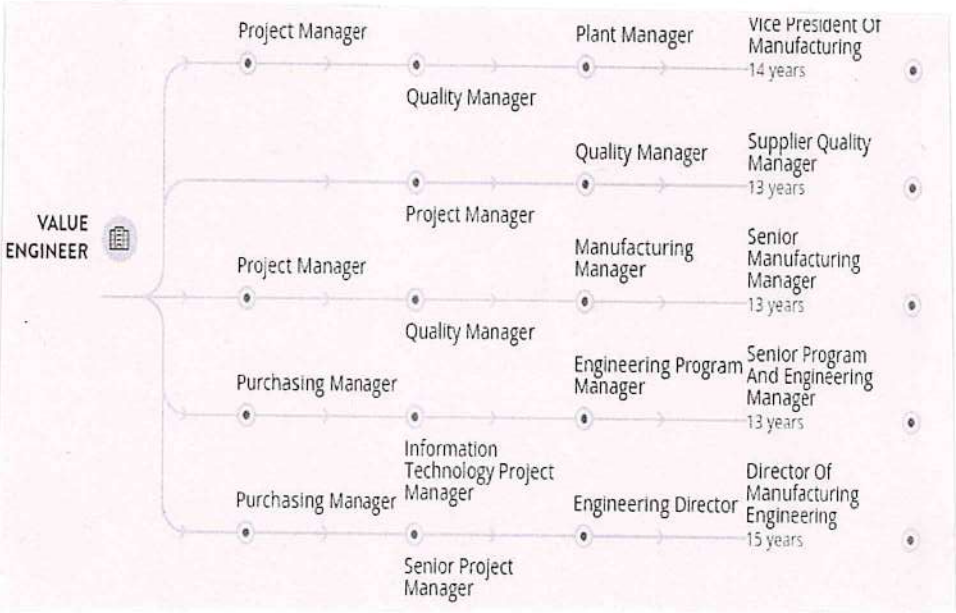
* They will make sure the design costs are reasonable and approve plans or suggest improvements in design proposal based on various factors such as practicality, costs, and component technology.

VALVE ENGINEER RESPONSIBILITIES:

* Lead and assist maintenance in resolving equipment malfunctions, troubleshoot process problems, and organize and implement preventive maintenance procedures
* Use solidworks to design machine parts and sheet metal enclosures for use on industrial gas instrumentation
* Own and write user-requirement specifications for error recovery, new equipment / technology and ISO Compliance
* conduct engine fit and function tests with prototype electrical hardware to ensure product meets customer requirements in performance and durability
* Develop and implement processes and procedures for ISO certification program and execute internal ISO auditing

VALVE ENGINEER CAREER PROGRESSION

* Career paths for value engineering diverse and wide ranging
* With experience and proven success, value engineers can progress to more senior roles or even executive-level positions, such as vice president of manufacturing or supplier quality manager.



15 ESSENTIAL SKILLS FOR VALUE ENGINEER CAREER:

1. project management
2. CAD
3. Sigma
4. product design
5. Lean manufacturing
6. Lean six sigma
7. value steam
8. value Analysis
9. continuous improvement
10. solidworks
11. Cost models
12. Brain storming
13. Data analysis
14. Technical support
15. Cost analysis

VALUE ENGINEER REQUIRMENTS:

1. Bachelor is degree in engineering, mathematics, or related field
2. 5+ years of experience in value engineering
3. Proficiency in utilizing CAD, FEA, and other analysis software
4. Ability to interpret and analyze technical drawings.
5. Through understanding of production methods and processes

VALUE ENGINEER SKILLS SUMMARY:

* Below are the most important value engineer skills.
* The top value engineer skills based on the percentage of value engineer resumes they appeared on

✓ The most common value engineer hard skill is project management. 12.0% of value engineers have this skill on their resume.

✓ The second most common hard skill for a value engineer is CAD appearing on 9.1% of resumes.

✓ The third most common value engineer skill is Sigma on 7.1% of resumes.

✓ Three common value engineer soft skills are Speaking skills writing skills and creativity