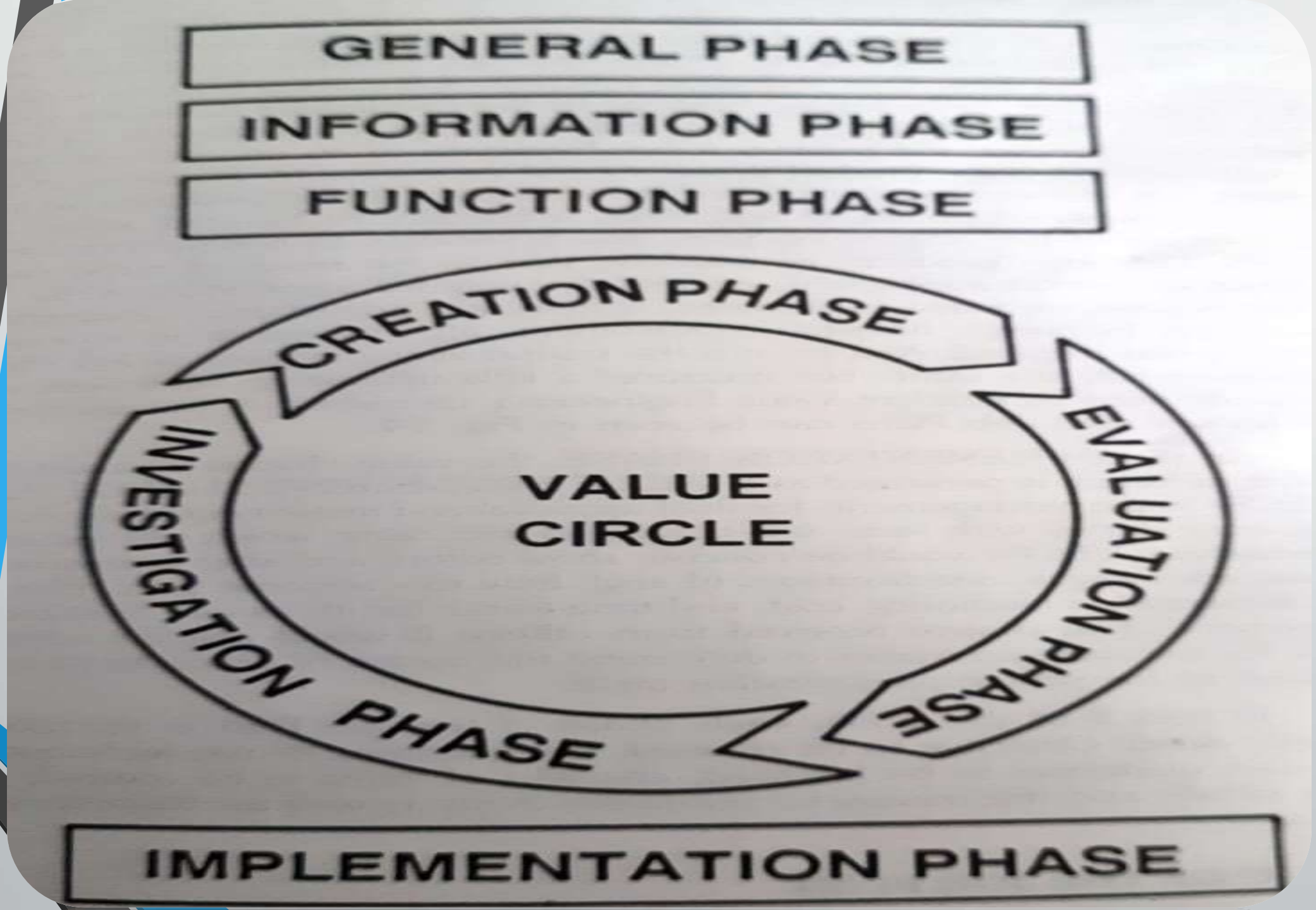
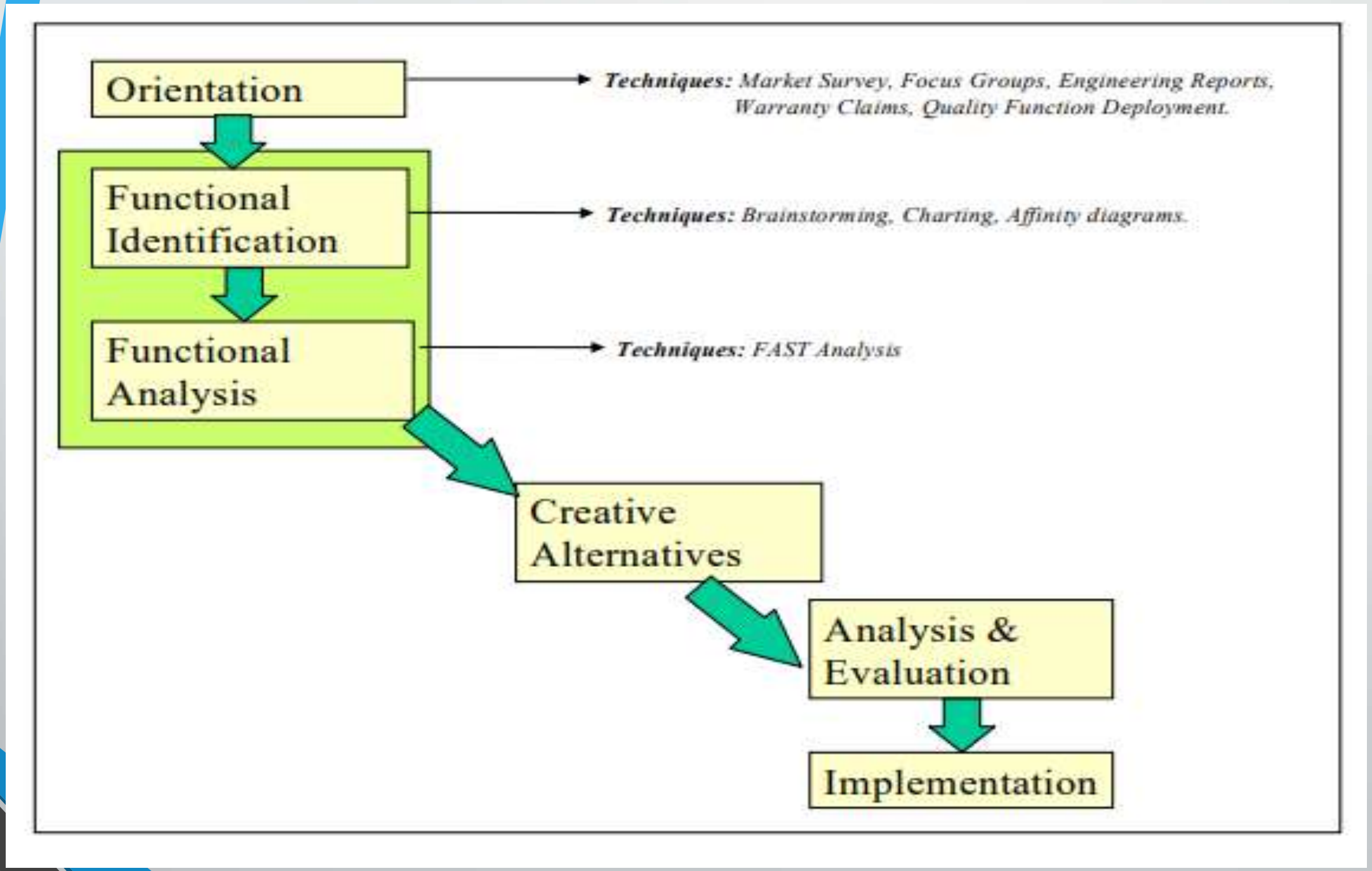
UNIT –II

VALUE ENGINEERING JOB PLAN

VALUE ENGINEERING JOB PLAN

- It is the systematic approach which is more important to achieve the desired objectives like cost effective methodology of producing a product maintaining it's other features like reliability, maintainability, quality etc.
- A well planned and systematic procedure yields better results compared to an unplanned and undisciplined one.
- VE includes following phases (According to Arthur Mudge)
  - ✓ Orientation
  - ✓ Information
  - ✓ Function
  - ✓ Speculation
  - ✓ Evaluation or Analysis
  - ✓ Investigation
  - ✓ Implementation


GENERAL PHASE
INFORMATION PHASE
FUNCTION PHASE
CREATION PHASE
EVALUATION PHASE
INVESTIGATION PHASE
VALUE
CIRCLE
IMPLEMENTATION PHASE


Orientation
Techniques: Market Survey, Focus Groups, Engineering Reports, Warranty Claims, Quality Function Deployment.
Functional Identification
Techniques: Brainstorming, Charting, Affinity diagrams.
Functional Analysis
Techniques: FAST Analysis
Creative Alternatives
Analysis & Evaluation
Implementation

ORIENTATION PHASE

- The orientation phase begins with appointment of the value engineering team.
- One of the most experienced and responsible team members appointed as team leader.
- The number of members selected in a value engineering team is dependent on the quantum of the work to be pursued by value engineering team.
- The value engineering team members are explained about the aims and objectives of value engineering job plan.
- They are informed about different phases through which the value engineering job plan would pass through.
- Different potential areas for value engineering are identified.
- The team members are informed about the importance of value engineering and inspired to work cohesively to achieve the organizational goal.

The ***Orientation Phase*** may be summarized as accomplishment of the following

(1) Selection of value engineering team

(2) Organizing value engineering team

(3) Inspiring value engineering team members

(4)Informing team members about the methodology and importance of VE.

(5) Dissemination of information to value engineering team members

(6) Selection of area of value engineering effort

The success of value engineering job plan is largely dependent on the attitude and contribution of the value engineering team members.

Some of the guidelines for team members are:

- ✓ Maintain good relationship amongst the team members
- ✓ Team members showing personal prominence may adversely affect the efficiency of work
- ✓ Due weightage to be given to suggestions of each team members
- ✓ Present the ideas in clear words supported by photographs/ drawings/ sketches and facts
- ✓ Work responsibility should be allocated based on the expertise of the team members
- ✓ Lessons learnt from previous and others' experience to be implemented
- ✓ As a rule of thumb, a team work results in better reward then individual
- ✓ Accept new ideas
- ✓ Do not act as the infallible judge

The outcome of the orientation phase is the identification of the product assembly/component which would be the focus for the value engineering study.

INFORMATION PHASE

The objective of information phase is to gather all relevant information about the project / product which is selected for value engineering study.

The information phase is expected to conclude by obtaining the answers to the following questions.

- What is the product / project? (Name of product)
- What does it do? (Basic function(s) performed)
- What does customer need?
- What is the problem?
- What is the cost? (of existing product)
- What are the secondary functions?
- Whether the function performed by the product meets all customer needs?
- What is the worth?
- Which functions can be eliminated?
- Whether the functions performed by the product meets the customer requirements?

- All the pertinent facts about the product/project must be pooled together.
- It is important to get all the facts and getting them from the best resource is necessary.
- All information is important regardless of how disorganized or irrelevant it may when collected.
- The data collected should be supported by evidence in the form of appropriate documents.
- Opinions are sought from experts and experienced persons regarding customer needs.
- More exhaustive and diligent the search is, the better the information will be, so better value is attained.
- The information can collected from customers' interview, market research, suppliers, distributors, financial reports, hand books, industrial magazines, management information system, previous design etc.,
- Basic function of the product is identified and is compared with customer needs. Any mismatch between the two is carefully recorded.
- Technical data related to similar product mfd. by the competitors is also collected.
- A sample of such an item if available is obtained and its performance is evaluated in terms of customer needs.
- Technical specifications, drawings, sketches, photographs and performance test reports related to such products are also procured.

- If the product under consideration is already manufactured by the organization then following pertinent details about the product are collected in specific and concrete terms.
  - ✓ Customer complaints / feedback
  - ✓ Feedback from sales and marketing department
  - ✓ Customer segment
  - ✓ Problems related to design, production and inspection of components / assemblies
  - ✓ Rejection and rework
  - ✓ Equipment used to manufacture the components
  - ✓ Operation sequencing
  - ✓ Assembly techniques and related problems
  - ✓ Tools, dies, moulds, jigs and fixtures used
  - ✓ Special treatment / process like heat treatment, coating etc.
  - ✓ Degree of accuracy required to manufacture each component (tolerance and fits)
  - ✓ Raw materials.
- Based on above data app. Cost of production is calculated and compared with the price of similar product in the market.
- Analyse the secondary functions whether the customers needs them or not.
- Establish the worth of each basic function and secondary function desired by the customer.

FUNCTION PHASE

- Many times it is taken granted that the functions performed by a product are required function by customer.
- But this may not be always true.
- Thus, it is necessary to precisely define the function and classify all the functions into two categories as follows
  - (1) Basic function
  - (2) Secondary function
    - (i) Desirable (required) secondary function and
    - (ii) Un-desirable (not required) secondary function.
- There are four questions to be asked:
  - What does it do?
  - What else does it do?
  - What does customer need?
  - Is the customer willing to pay for function(s) performed by the product

EVALUATION OF FUNCTION

Guidelines for evaluation of function are as follows:

1. Express function in two words:

- State the function in two words a verb and a 'noun. However, in certain cases an adjective added to the function may help to reduce ambiguity.
- Ex: function of lathe may be Collectively written as 'machine work piece' and At the same time the function of milling machine can also be written as 'machine work piece. To avoid ambiguity the function of lathe may be written as machine work piece (cylindrical) and that of milling machine as machine work piece (flat).
- The two word abridgement offers two advantages:
  - The description pin points the function.
  - Possible alternative solutions for providing the function are not underestricted.

2. Quantify noun:

- The nouns should be preferably quantifiable, for example circulate air (in m^3/sec), low weight (in kg), high strength on N/m^2, increase mechanical advantage (in Newton) But there may be many cases where the quantification may not be possible, ex: machine work piece, pan metal, indicate presence etc.,

3. Choose broad verbs:

- Keep the function definition simple and choose verbs as broad as possible.
- For example function of refrigerator would be written as ‘preserve food' not 'chill food' or 'chill water. The design methodology to preserve food in broad sense is by chilling food below certain temperature such that the growth of bacteria be suppressed and there by preserve food. This is the reason why a user gets chilled food or chilled water to drink. If there would be methodology to suppress bacterial growth without chilling of food, then that equipment would not provide chilled food or chilled drinking water.

4. Categorize function:

- Divide all to the functions into two categories- i) Basic function ii) Secondary Function
- To ascertain whether the function is basic or secondary, value engineering team members must ask a question "Will the customer purchase this product if the function under consideration is not accomplished? If the answer is "No". then the function is basic.

5. Emphasize on aesthetics:

- Give due emphasis to aesthetic function. Different Products are expected to perform different degree of aesthetic function.
- Industrial products like gears, tools, sprocket, chain, machine has hardly any aesthetic function perform, but domestic products like wrist watch, television, refrigerator, toaster, king stove, travelling bag, utensils perform aesthetic functions to varying degree.
- Wrist watch with Rexene belt may cost Rs. 100 to Rs. 200, whereas same watch with gold plated chain may cost in the range of Rs. 1000 to Rs. 2000; and same watch when studded with diamond may cost Rs. 10,000 to Rs. 1,00,000. Different customer segments are available for different wrist watches.

SPECULATION (CREATION) PHASE

- The objective of this phase is to generate a large number of new ideas in a conceptual form for accomplishing the identified basic function(s).
- Accomplishing this phase should result in the answering the questions like
  - (1) What else would perform the function(s)?
  - (2) How else can the function be performed?
- The completeness and comprehensiveness of the answer to these questions determine, to a great extent the calibre and effectiveness of value work.
- The success of this phase depends on the adoption of ‘Free Thinking- Lateral Approach’ by all Members of VE Team.
- The ideas generated during this phase are recorded before proceeding to the next phase.
- Larger the number of alternatives identified and higher the quality of identified alternatives, the greater would be chances of developing an outstanding solution.
- However, additional alternatives which have not been considered will exists regardless of the skill and proficiency of the value team.

Techniques for evolving new Ideas:

1. Brain Storming
2. Blast, Create and Refine
3. Check list
4. Morphological Analysis
5. Delphi Method
6. Attribute Listing
7. FAST Diagram.

Guidelines to be followed by value engineering team members during create phase are as follows:

(i) Inculcate habit of creative thinking by imagination power

(ii) Ideas may strike even when the person is not on duty. Keep a record of ideas whenever it strikes

(iii) Evolve an atmosphere conducive for team work

(iv) Appreciate the ideas of fellow team members, rather than criticizing

(v) Closely observe the problem and judicially analyze in light of laws of nature.

(vi) Ensure that all members participate with enthusiasm

(vii) Gather as many ideas as possible.

(viii) Set the goals of the team in clear and tangible exercise if possible.

(ix) Keep a record of all the ideas presented by each team member.

(x) Keep the product in near vicinity during the discussion.

(xi) Make a list of possible technologies that can be applied to each function

(x) Think positive, there is always scope of improvement.

EVALUATION PHASE OR ANALYSIS PHASE

- The purpose of this phase is to select for further analysis and refinement the most promising alternatives from among those generated during the previous phase.
- During the speculation phase there is a conscious effort to prohibit any judicial thinking so as to not inhibit the creative process.
- In this phase all the alternatives must be critically evaluated since many of them may not be feasible.
- The alternatives are studied individually and grouped for the best solution.
- The following questions must be answered during this phase:
- (1) What does each alternative cost?
- (2) Will each alternative perform the basic functions?
- All the ideas developed in the creation phase are evaluated using systematic method or procedure.
- The evaluation is meant to assess which alternative is the best in given situation considering several important parameters like cost of manufacturing, saving potential, existing infrastructure like machine equipment, personnel, technology, maintaining the aesthetics, quality, reliability, maintainability etc.

- Comparisons can be made between the various features of similar alternatives under consideration.
- Advantages and disadvantages of each alternative can be listed and then the ideas sorted according to their relative advantages and disadvantages.
- The value engineering team evaluates the feasibility of each idea by identifying its advantages and disadvantages.
- The ideas are judged, refined and combined to determine how each of these ideas can be utilized to accomplish needed cost function.
- Each idea can perform the basic function to different degree and cost of manufacturing is different for each idea.
- Secondary function performed by product designed using different concepts may be different.
- Some of the secondary functions may be preferable for some customers and some secondary functions might have no value to customers.

PROCEDURE

1. Evaluation criteria-
   - ✓ The first step is to develop a set of evaluation criteria-standards by which to judge the ideas.
2. Screening process-
   - ✓ the actual ranking of ideas according to the criteria developed.
3. Establishing costs of alternatives-
   - ✓ The remaining alternatives are then ranked according to an estimate of their relative cost reduction potential.
4. Final selection-
   - ✓ the alternative with the greatest savings potential will be selected. if several alternatives are not decisively different at this point, they should all be developed further.

ANALYSIS CHECKLIST

- ✓ What ideas seem feasible?
- ✓ Have all alternatives been evaluated? (Figure 1)
- ✓ Can any be modified or combined with another?
- ✓ Have all feasible alternatives been retained?
- ✓ What are their savings potential?
- ✓ What are the chances for implementation?
- ✓ What might be affected?
- ✓ Will it be relatively difficult or easy to make a change?
- ✓ Will each idea satisfy user needs?
- ✓ Has a list of the most feasible of ideas been compiled? (Figure 2)
- ✓ Is there an existing inventory of parts that must be used prior to implementation?
- ✓ Has a "Draft" VE proposal been presented to affected parties? (Figure 3)

Figure 1

ANALYSIS PHASE	FEASIBILITY RANKING
STUDY NO.	
FUNCTION	

List the ideas that have, in your judgment, ability to meet the required criteria. Rank each idea from 1 to 10 for these factors:

							TOTAL RANKING
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							

NOW IS THE TIME TO JUDGE

Figure 2

ANALYSIS PHASE STUDY NO.	**IDEA COMPARISON**

Select the most feasible ideas or combination of ideas. List them below. List both the advantages and disadvantages of each idea to determine where additional work must be done.

IDEA	ADVANTAGES	DISADVANTAGES	RANK

KEEP AN OPEN MIND

Figure 3

DRAFT VALUE ENGINEERING PROPOSAL

NAME OF PART OR ASSEMBLY:	DWG. NO.
USED BY:	QUANTITY PER: UNIT _____ CONTRACT _____ OTHER YEAR _____
FUNCTION:	TOTAL REQ'D

PRESENT

PROPOSED

UNIT MANUFACTURING COST	MATERIAL	LABOR	BURDEN	TOTAL
PRESENT	$	$	$	$
PROPOSED	$	$	$	$

% PROPOSED REDUCTION _____ SAVINGS PER UNIT $

TOTAL UNITS X SAVINGS/UNIT = GROSS SAVINGS $ _____

COST OF CHANGE		-LESS-
	ENGR. & DRAFT. _____ TEST _____	
TOOLING & PATTERNS _____ OTHER _____	TOTAL COST OF CHANGE	$
	NET SAVINGS	$

COMMENTS AND ADDITIONAL RECOMMENDATIONS: _____

PROJECT TEAM _____ PROPOSAL NO. _____ DATE _____

INVESTIGATION PHASE (DEVELOPMENT PHASE)

- Depending upon the ranking established and the parameters recommended in the previous phase, one or two most suitable design alternatives are selected for further detailed technical and economical evaluation.
- The alternatives must be investigated in sufficient depth to permit the development of specific recommendations
- A detailed technical specification sheet and detailed cost estimate for the selected alternative design is worked out.
- It is checked that following will be achieved to the required level or not:

(1) Functional requirement

(2) Cost

(3) Quality

(4) Reliability

(5) Safety

(6) Maintainability.

The cost of product also includes the following costs:

(1)New equipment

(2) New tools and tooling

(3)Changes in plant layout

(4) Additional space

(5)Cost of designing, manufacturing and testing prototype

- These costs are collectively named as overheads.
- The investigation phase results with proposal of one or two detailed designs with complete drawing, specifications, cost analysis, relevant capabilities and limitations of each design alternative.

RECOMMENDATION (PRESENTATION) AND IMPLEMENTATION PHASE

- The objective of recommendation phase of value engineering job plan is to present the recommendation before the decision makers in such convincing way that they accept the recommendation.
- Decision makers are usually Managing Director/Chairman of the company.
- During this phase the presentation skill of the designer becomes very important beyond the technical abilities.
- However, it is frequently necessary to consult experts, or vendors to obtain additional information before developing value engineering recommendation.

The presentation of a recommendation includes following major information:

- Description of product
- Description of function(s) (Basic and secondary)
- Description of original design with sketch
- Description of alternative design(s) with sketch
- Comparison of original design with alternative design with respect to function performed and changes in design.
- Capabilities and limitations of original design and alternative design
- Presenting cost benefit
- Presenting the increase in profit margin
- Requirement of additional infrastructure (design, manufacturing, etc.) for proposed new design

- *The presentation of the recommendation must be concise, factual, accurate and in such a manner as to create a desire on the part of those responsible to implement the recommendations.*
- *In case, more than one idea is to be presented, it is advisable, that each alternative idea should be presented as a single independent value engineering proposal, in a clear and concise manner to avoid its chances of rejection due to lack of understanding.*

PROJECT SELECTION

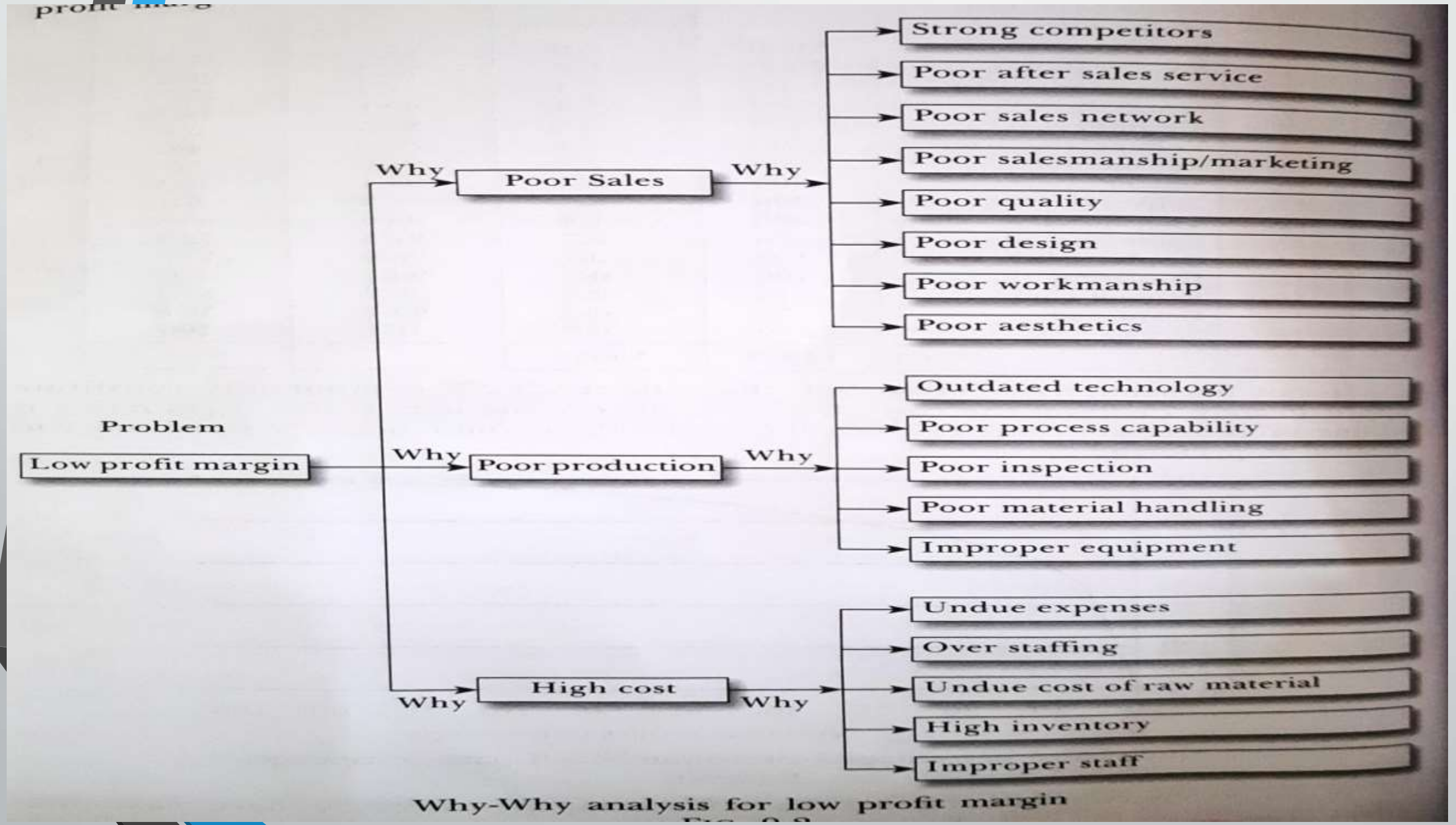
- Before a value study can be made, a project must be selected for the study.
- If any product is subjected to value study at any point of time in its life cycle it is likely to yield an average minimum of 10% return on investment.

Few important parameters affecting the selection of product for value engineering are as follows:

1. High cost of item
2. Highly competitive item
3. Product manufactured in bulk
4. Item with stringent quality requirements
5. Annoying problems for manufacturing
6. Changes in market demand
7. Warranties
8. Vendor problem
9. Product with high degree of complexity
10. Product involving large man power
11. Import problem
12. Bottle neck in production
13. Heavy rejections and rework
14. Customer complaints
15. Product with poor profit margin
16. High tooling cost

METHODS USED FOR VE PROJECT SELECTION

1) Felt need
2) Review by steering committee
3) Suggestion schemes
4) Seminars / brain storming
5) Relative ranking
6) Why-Why analysis
7) Assessment of Value index.



Why-Why analysis for low profit margin

Assessment of Value index:

$$\boldsymbol{Value\ Index = \frac{Worth}{Cost}}$$

- By definition, Worth is the least cost for performing the function.
- The worth of all secondary functions is ZERO for value engines purposes.
- And, worth is associated with the necessary function(s) and t with the present design of the item.
- Experience has shown that low value indices (or COST to WORTH ratios greater than 2) will usually indicate good potential for value efforts.

$$\boldsymbol{Value\ Gap = Cost - Worth}$$

Index of Savings Potential

$$Index\ of\ Cost\ Savings\ potential = \frac{Estimated\ study\ savings}{Estimated\ costs\ of\ study}\ X\ Probability\ of\ Implementation$$

Where,

- ✓ Estimated Savings = Present Cost (before VE)-Estimated Cost (after VE)
- ✓ Present Cost (before VE)= Quantity x Present Cost Per unit
- ✓ Estimated Cost (after VE)= Quantity x Estimated Cost of proposed, per unit.
- ✓ Estimated Cost of study = Estimate of Cost of VE Study +Estimate of Cost of Implementation
- ✓ Probability of Implementation= 0.0 for no chance of implementation. 1.0 for certainty, with no chance for not being implemented. Interpolate for the range.
- ➢ The item with highest index should be considered for the value study, first

VALUE STANDARD

- The Value Standard, originally drafted in May 1997, has been through a process of periodic updates to address changes in the business environment and technology and to meet future integration with the International Standards Organization.
- Value Standard establishes the specific six-phase sequential Job Plan process and outlines the objectives of each of those phases.
- It does not standardize the specie activities that are used to accomplish each phase.
- Purpose and Scope of the Standard

(1) Define the steps and components that constitute a valid Value Stud

(2) Document supporting information that defines a generic methodology, common terminology and standard practice to guide practitioners a managers in effectively applying value methodology to improve the vale of their projects.

(3) Guide the practitioner and manager in determining at what point apply value methodology to a project in order to maximize:

(i) the benefits of team innovation skills and

(ii) implementation of alternative(s) that add value to the project.

(4) This document may be used by both practitioners and managers a guide for applying value methodology.

(5)The Value Standard allows for the tailored application of value method and related practices to suit the intended application.