1. VALUE ENGINEERING AND ANALYSIS

1.1 THE VALUE CONCEPT

For the sustained growth of an organisation, it is an undisputed fact that the gap between the Price and Cost of production, i.e. the PROFIT margin should be widened as far as possible without any binding limits.

In any system

PRICE PR (N) = COST C(N) + PROFIT P(N)

Where PR(N), C(N), & P(N) are the price, cost and profit of the Nth manufacturer, such that

PR(N) = C(N) + P(N) = C(N+1)

where C(N+1) is the cost to the (N+1)th user or buyer.

If the (N+1)th end user is willing to pay C(N+1), it is in the interest of the manufacturer N to reduce C(N) so that P(N) can be increased for him, provided of course that Performance, Reliability and Quality of the item remains constant, or improved further, if possible. To achieve the above end, there are four approaches available.

(a) Keeping the Cost of Production C(N) constant, increase the selling price PR(N). This has got its own repercussions on the market demand pattern, and any price enhancement is normally linked up with a fail in demand.

(b) Keeping the Selling Price PR(N) constant, reduce the cost of production, by using various conventional methods of cost reduction, like Method Study, Material Management, Preventive Maintenance, and many other Productivity Techniques. It has been observed that more often than not, such a cost reduction approach has resulted in a substandard quality product which again had been rejected in competitive market, in favour of a better performing alternative.

(c) The third alternative is a simultaneous combination of the above two i.e., (a) and (b).

(d) Reduce the Price PR(N) and reduce the cost of Production C(N) in a higher proportion. Considering all the above four alternatives and simultaneously taking into account the behaviour of the market, one has to realise that the user wouldn't mind a higher price, if, he is satisfied that the additional performance which he will get, will more than compensate the additional price which he would pay for that product. Analysing the pattern of criteria based on which the (N+1) the user pays PRICE ,PR(N) for an item or service, it has evolved that, one pays the price for the following factors.

a) Not the immediate performance but the OVERALL LIFE PERFORMANCE.
b) Ego satisfaction
c) Salvage or resale worth of an item
d) Sentimental attachment

All the above considerations and facts indicate that a time has come when one should start thinking about the VALUE of an item and not the PRICE or COST because VALUE takes into account the above mentioned four criteria, for which the MARKET i.e. the USER is ready to pay a Price.

1.2 THE COST : PRICE & VALUE :

THE COST :

Although the term Value is used very commonly as a synonym to Cost or Price, but in the context of VAVE it is an entirely different word. To highlight the difference between the three terms, we must consider the total system. For the purpose of this chapter our system would comprise only two elements viz. the Manufacturer at one end and the User at the other end. In this system, the manufacturer produces a certain item by consuming some material, use of machinery and labour, power and by carrying certain overheads as a necessary (subject to question) part of the set up. For all these items we give a generic name viz. The INPUTS. For the inputs are

available only against a payment made or promise to pay, it becomes a commitment of the manufacturer, which sooner or later he has to pay. As this amount has got no relevance whether the product is sold or not, it is independent of the market, and this remains a fact. This part would form (and is called) the COST of the product or service.

THE PRICE :

Once the item has been produced, the MANUFACTURER adds a certain amount of profits (in some cases even at a loss) and puts the items in market for sale. This amount which he expects in return for the product is called the PRICE of the item produced or serviced. The PRICE is always a matter of policy.

THE VALUE :

Now, once the product or service is available in market, there comes the USER to purchase it. He may or may not purchase the item. His decision TO-BUY or NOT TO-BUY depends on the following criteria.

a) The Need for the Product
b) His Paying Capacity; and
c) Alternatives/Substitutes available in the Market.

Given a choice, the buyer might decide not to buy an item by spending money. The decision TO-BUY is only taken when he knows that by not having that item, he is sure to lose something else. Unless this loss is more than the price, he is paying he would never decide in favour of buying. Larger the difference between the loss and the price, more would be the saleability of the item. He knows that by spending a certain amount of money for buying it (the Price-Pr(N) he is going to save something else equivalent to W i.e. the loss, and that

$W > PR(N)$

but never when,

W < PR(N)

This notation W would be called as WORTH of that item; and the relationship between W & P is the main deciding criteria for the saleability of an item. This relationship is what we call as the VALUE of the item.

The decision to BUY an item product or service would be taken ONLY IF.

W > or = PR(N)

or

(W/PR(N)) > or = 1

and this relation W/PR(N) or WORTH to PRICE ratio is termed as VALUE. Although we are using the term PR(N) (Price) here in context of the user but that actually is his cost 'C(N + 1)' because that is what he is incurring to get the WORTH or the functional requirement achieved. Even the manufacturer, while producing the item has the same criteria for his own INPUTS (the COST which is the previous man's PRICE).

This means that the Value V can be improved. If W/Cn + 1 is improved and in turn the profitability of the organisation goes up. Of course the V can also be improved by improving the W for the item or a better combination of both so that

V1 = W1/C1 &

V2 = W2/C2

In actual situations when Value Analysis is to be carried if W/C < 1, it is a strong case for application of VA.

In a manufacturer-user system, we see that the whole system comprises very many manufacturers producing something to be used by the next man to manufacture something else and so on. The process starts with the ultimate END USER, because, he is spending his money to procure the final output.

Cost, by its very nature is a constant figure under a given set of operating conditions. The Price is changing depending on the demand and supply theory, whereas a Value changes from case to case for the same item depending upon the NEED and the WORTH of the item.

COST & PRICE are the DOMAIN of the MANUFACTURER or PRODUCER whereas VALUE is the DOMAIN of the USER or BUYER.

To differentiate between the three terms and to understand the basic difference between the three terms and to understand the basic difference between them, let us take an example under three different operating conditions.

Example : A polyester shirts

Total cost of production and distribution = 60 Rs./piece

Selling Price = 90 Rs./piece

Condition 1 : Manufactured by a local firm

Money equivalent of VALUE which you would be prepared to pay is say Rs. 75/-, which would mean that you would prefer to buy the cloth and get it stitched, for about Rs. 75/- than buying a ready made one for Rs. 90/-.

Condition 2 : Unavoidable circumstances and urgency of need, where you don't have time to give and wait for stitching : Value Rs. 90/- equivalent.

Condition 3 : Some one close to you presented this to you after buying for Rs. 90/- and one of your friends is offering you Rs. 90/- for it.

Here the question is whether you would sell it for Rs. 90/- or more or less or will not sell it at all.

This decision depends on various conditional parameters. Let us look at the following matrix :

Case	Sum offered by your friend	Your decision to sell	Consideration
1.	90/-	No	The additional amount is not compensating for the sentimental attachment with the shirt or the person who has presented it to you.
2.	100/-	No	
3.	120/-	No	
4.	150/-	May be yes	Not decided but weighing the pros and cons.
5.	175/-	Yes	Decided that the amount Rs. 175/- is equivalent or more worthy than the sentiment attached with the shirt or the person who has presented to you.

But had you yourself bought the shirt for Rs. 90/- you might have accepted to resell it for only Rs. 90/- or may be Rs. 95/- because you know that you can again replace it for the same sum as it is available readily.

This is only one of the tens of thousands of cases where you or anyone relates the money equivalent to the worth of the items, all factors considered.

AND SAME IS THE CASE WITH, AND BEHAVIOUR OF, YOUR CUSTOMER WHEN HE PREPARES HIMSELF TO PAY A RUPEE EQUIVALENT OF SUM OR SERVICES FOR YOUR PRODUCT OR SERVICES.

VALUE ANALYSIS :

VALUE ANALYSIS is a systematic approach to segregate the different parts of the VALUE, and eliminate by gradual process those parts of UNNECESSARY COSTS, which, neither.

a) increase the function,

nor

b) provide esteem or ego satisfaction

nor

c) enable the resaleability

nor

d) provide sentimental attachment or urge to possess.

At this stage we must examine the definition of FUNCTION. Function is defined as the purpose for which a material, a part, a product or a service is required. Once we come down to the purpose of which a part or a product is required, it becomes easier to suggest alternative for achieving the same purpose.

1.3 HISTORICAL DEVELOPMENT:INTRODUCTION AND DEFINITION

The first VALUE ANALYSIS (VA) program was established in the General Electric, USA by about 1947, since then the programme has received considerable attention and many successful applications have been reported. Though the technique started with analysis of purchased items it has been extended to manufactured items as well.

The idea behind Value Analysis is not new. The approach to the problem essentially differs from that of the other Cost Reduction techniques. A customer when buying a product weighs its functional and other features (appearance, attractiveness, get up) against its price and judges the VALUE of the product. Manufacturer in turn, in order to enhance the VALUE of his products must ensure that he offers all the necessary functional features at

the lowest possible price. This functional approach is the basic criteria of VALUE ANALYSIS. It tries to obtain a “FUNCTION” and “NOT” the “PART”, at a lesser COST.

This has the fundamental base, as the USER is not at all interested as to how the part looks like, or what it is made of, as long as the DESIRED FUNCTION is performed to HIS satisfaction along with the required level of Quality & Reliability.

TO THAT EFFECT, VALUE ANALYSIS IS A FUNCTION ORIENTED APPROACH AND NOT A PRODUCT ORIENTED APPROACH.

The conventional methods adopted by the industry for Cost reduction are centered around the product itself, which offers much lesser scope for Cost reduction.

Many examples can be given to illustrate this. In short a few of the causes can be summarised as :

I) Rush jobs continue to be done the same way even after emergency is over.
ii) Lack of keeping pace with progress in technology.
iii) Lack of communication between different departments (each looks from his own view point).
iv) Lack of consideration of any application information available elsewhere.
v) Value is not capable of accurate measurement - it is only comparative.
vi) Impact of new products and change in tastes and styles not being continuously taken note of.

VALUE means different things to different people.

To a Designer, Value means Reliability of Performance.

To a Financier, Value of product is the financial returns it can bring,

Whereas

To a Customer, Value is a comparative assessment between the performance, other esteem features of a product and its price.

The fundamental principle of VALUE ANALYSIS is this to analyse the functional and other features and ensure that they are acquired with the lowest possible cost.

Measurement of VALUE is not easy. It has to be evaluated only by comparison. It is the lowest cost combination of design materials, Processes which will equally reliably give Performance, Esteem, and other required functions expected from the product.

VALUE ENGINEERING is the stage where the concepts of proportionate functions and their proportionate costs are taken care of at the basic design stage.

VAVE is a generic name given to this technique of VALUE ANALYSIS and VALUE ENGINEERING.

1.4 AREAS FOR APPLICATION OF VAVE

Although it is believed that VAVE can be applied in all spheres of activities of an organisation and of course, it is a fact but the difficulties faced in application phase have to be realised. Looking into the Artistotle's classification of seven types of values, we can realise that excepting in the case of ECONOMIC VALUE, all others are highly subjective and fully individual oriented rather than group or society oriented. The seven classes of values propounded by Artistotle are :

1) Economic Value
2) Political Value
3) Social Value
4) Aesthetic Value
5) Ethical Value

6) Religious Value

7) Judicial Value

The following table shows a comparative analysis and applicability of these different classes

VALUE CLASS	TYPE OF ACTIONS (EXAMPLES	EXPLANATIONS & ANALYSIS	CAN VAVE BE APPLIED?
ECONOMIC	A Product or Service bought at a given Price.	Within a given framework and conditions alternative products or services can be found so as to serve the required function at a much lesser cost.	YES.
POLITICAL	People are normally wedded to a particular philosophy thereby have a certain political following and way of thinking.	People have been to be changing their alliances and philosophies so as to join others in some cases even with a diagonally opposite view point, just to gain power. The price one pays in such manners depends on his or her own standing and influences. Under the same circumstances, two individuals from the same political wing have compromised at two different prices. (Need not necessarily be in the cash form but even in kind form).	Subjectivity is involved to a large extent and exact VALUE cannot be ascertained.
SOCIAL	Spending a certain amount to attend own brother's marriage (which is a major social function)	If one is close by, he might take leave from work and join the occasion with family. If the distance is far (but within the country) he decides to join the occasion along because of travel cost and other expenses. If the person is in America and the	High subjectivity is involved and the VALUE of not joining the function cannot be evaluated.

		marriage is in India, he might as well decide not to join the occasion because of very high cost involved. Also in the same circumstances one brother might join the group whereas other might decide not to join	
AESTHETIC	Hobbies of individuals are involved. a Picasso painting is purchased at astronomical Price one, whereas a diamond studded gold ring is bought by the other	For the other person the painting may not be worth that amount and he feels that the decision was foolish. in the second case other person might feel that instead of spending money in diamond studded ring he could have as well bought deluxe Maruti Car and Colour TV with a VCR attachment.	Value cannot be judged as the functional requirement cannot be qualified in general. The individual has spent his money and that is his lookout.
ETHICAL	Secret information not to be revealed : An employee of one organisation should not work simultaneously for competitor, etc.	It has been observed that there is a class of patriots who can lay their life for the nation, but at the same time there are others who pass on secret security information to other countries, etc.,	Highly subjective criteria hence VALUE of ethics cannot be judged.

RELIGIOUS	Communalism and values prevailing, A person following a particular religion forces other to convert to his own religion but he does not want to change his own religion.	For gains some people change over to a particular religion (both for cash & kind in return). It is easy to convert some but a bit difficult to convert some other.	Purely based on individual's own look and his own value system.
JUDICIAL	Judges lay a certain penalty for given	For the same type of cases the penalty	From case to case the

	crime like Rs. 50,000/- or 3 months. R.I.	amount and the equivalent R.I. period changes. The same person committing the same crime a second time will have a more severe punishment.	details are different and hence no fixed amount.

A FEW MORE CAN BE ADDED TO THE ABOVE LIST WITH EQUALITY AMBIGUOUS SITUATIONS : LIKE

SENTIMENTAL VALUE
HOBBY BASED VALUE
CRAZE OR FASHION VALUE etc.

From the above table, it can be clearly seen that Value Analysis effort can be very effectively made when it concerns the Economic Value. In other cases it should be left to the individuals, who are the best judges in their own cases. The only scope in these cases is that when it concerns an organisation's need, a better approach would be that a team of experts decide about the VALUE of these decisions, wherever possible, so that the subjectivity can be reduced, if not completely eliminated.

2. THE ECONOMIC VALUE

The Economic Value of a product or service can be broadly divided into six basic values :

a) The USE VALUE :

To the extent that the money spent just justified the usefulness of the product or service. This has main reference to the specific

FUNCTIONAL REQUIREMENT. For example a James Clip in place of a Tie Pin.

b) EXCHANGE VALUE :

To the extent that the additional amount paid guarantees the resale or exchange at any point of time. Although in most cases the item is never exchanged, but this factor helps by way of insurance against crises. Example of this is the purchase of a particular brand of scooter by paying 3 to 4 thousand rupees more than it's face VALUE. Also we know that most of the people buying that particular brand never really sell it off. But they are sure that as and when conditions warrant, they can easily sell it off, as compared to other brands. It is perhaps, that feeling of safety which forces one to spend extra amount.

c) ESTEEM VALUE :

To the extent that it meets a particular satisfaction and ego need. Normally this is the most difficult item to assess and hence the main aim is to eliminate it, as it does not contribute anything towards satisfactory performance of the function. The concept of APPEARANCE ENGINEERING is fast picking up now. However in case of packing and a deadly medicine in a nice package will not enthuse the buyer to go get it unless it has been prescribed by the doctor. In this case, packaging should aim at only preserving the medicine, and nothing more than that. On the other hand, a consumer good can be packed in an appealing package as it would definitely add to the decision making of the buyer. In case of Government sponsored and highly subsidised items like Bio-Gas Stoves, Gasifiers etc., they need not be made costlier by way of esteem features, as they are supposed to meet the use function more than good looks. (The person who wants to spend his money may be left free to even get a gold plating done on his gas stove, provided he spends his own money.)

d) COST VALUE :

To the extent that it is a fact and expense to produce the item or service have already been incurred.

e) PLACE VALUE :

To the extent that in a given place the item would have a specific VALUE where is in another place it will not have the same VALUE. A glass of water in a desert, can be an example.

f) TIME VALUE :

To the extent that at a given time only the VALUE of an item is important. Once the time has passed, the item loses its VALUE. Example is Blood Transfusion to a patient during operation, or a stepney in a car on long journey.

While talking about VA/VE the normal interaction of a member is with industry, although VA/VE can be equally applied in other fields. When we are dealing with a product or service in an industry, very often one faces the situation where many criteria are considered and one finds it difficult to allocate part of the total cost to a certain type of functional need. For the ease of handling such situations, it is suggested to broadly classify all products or services into four major class of products and then allocate a weightage to various type of values so as to split and analyse the total cost. Table below gives the Matrix.

S. No.	CATEGORY OF PRODUCT / SERVICE	USE VALUE	ESTEEM VALUE	PLACE VALUE	TIME VALUE	REMARKS
1.	Industrial Product	80	5	8	7	Because Reliable performance is the main criteria
2.	Consumer Product (competitive market)	80	15	5	-	Competitive
3.	Consumer Product Monopolist	70	5	5	20	Monopolistic
		10	70	20	-	External Components

4.	Fancy Goods	70	20	10	-	Hidden or internal Components
5.	Critical Items	90	-	5	5	Where performance is the only criteria

3. BASIC PLAN :

The basic plan for VALUE ANALYSIS is :

1. Identify the function - As far as possible one Verb and one Noun only should be used to define the function. In most cases it is possible to do this. This is in order to ensure that we approach nearest to the Basic Function and not get lost in Verbose description.
2. Prepare a Functional Relationship Chart.
3. Allocate Proportional Cost to the Functions in relation to their relative importance.
4. Compare the Actual Functional Costs vis-a-vis the norms thus fixed and establish the Gaps between the Actuals and the Norms.
5. Identify those Sub-Systems with higher gaps in the Actual v/s ideal, and Create alternatives to achieve the functions at the ideal costs.

VALUE ENGINEERING JOB PLAN

Several versions of the VE Job Plan can be found in current VE literature. Some give five, others six and yet many others seven phases. It is the systematic approach which is more important to achieve the desired objectives.

The phases of the Value Engineering Job Plan are as follows :

- Selection
- Orientation
- Information
- Speculation
- Evaluation
- Planning
- Implementation
- Summary

3.1 SELECTION OF A PROBLEM

To get a real benefit from the technique, it is very much necessary that the problem is rightly understood and selected. Normally, any problem that comes ones way is taken up and a quick study is carried out as regards the functional analysis and alternatives are suggested. This is followed because of the urge for showing glaring results in terms of high percentage savings; but in fact it might be a very meagre sum as far as the absolute money VALUE is concerned. What need to be done is to select those problem areas where a potential for net higher savings is expected, although the percentage scope may be very low, because it is the Rupees saved that matter and not the percentage figures. For ensuring this the easiest and surest way is to use the Pareto's Analysis, more commonly and universally known as ABC analysis and used in any problem selection. But ironically the only potential use of this analysis made is in the area of Materials Management. Here, it is taken for granted again, that the reader is aware of the methodology of ABC Analysis, and hence only a reference is made.

SELECTION CRITERIA :

The main important Factors to be considered for the selection of a problem area are :

1. Products with poor profit margin
2. Comparison with competitive products
3. Modification (Market demand)
4. High Service Cost
5. High tooling cost
6. Import problems
7. Availability
8. Maintenance and Operational Complexities
9. Obsolescence of the Technology, etc.

The Pareto analysis, more commonly known as A B C analysis can be used for initial selection of a problem in the organisation. At this stage it would

suffice to say that this analysis works on the principle of 'VITAL FEW AND TRIVIAL MANY'. In any given setup, there are very few areas which contribute to most of the cost of the system, and a proportionately large portion of items contribute for a lesser portion of the cost. The Fig. 3 depicts the basic features of the ABC Curve. As has been said earlier selection is made first of areas which gives maximum advantages. The amount of information assembled will depend on this decision. For example the weight and cost of individual components will probably be unnecessary if an alternative to the whole product is sought.

It is useful to establish the amount of time which should reasonably be expanded, taking into account activities, costs, other work, etc. and to establish a rough target of the savings which is hoped to be achieved.

In case of VAVE since the approach is to reduce the cost, while at the same item retaining the quality and performance intact, the analysis has to be based on the cost distribution among various Main and Sub-functional levels.

Stated in simple terms, the ABC Analysis as applicable to VAVE is : In a given assembly, there would be very few components accounting for the major cost (A class items), and very many components accounting for a very meagre portion of the total cost. (C Class items). Other items would range some where in the middle of these, and would be termed as B Class items. It can be seen very clearly as shown in the following tables in case of an Automobile Door Handle, an Air Breather of a Transformer, a Powerloom, and indicator Tube Assembly of a Tap Changer of a Transformer.

TABLE - 1 : AUTOMOBILE DOOR HANDLE

S. NO.	ITEMS	NO. OFF	COST	CUMULATIVE		CLASS
				COST	%	
1.	Handly Body	1	9.60	9.60	54.60	A
2.	Lock Body	1	2.90	12.50	71.00	
3.	Lock Barrel	1	1.70	14.20	80.70	
4.	Bracket	1	1.40	15.60	88.70	
5.	Circlip	1	0.60	61.20	92.10	
6.	Return Spring	1	0.40	16.60	94.40	
7.	Levers	8	0.40	17.00	98.30	
8.	Screw	1	0.10	17.50	99.50	
9.	Lever Springs	8	0.10	17.40	98.90	
10	Screw	1	0.10	17.50	99.50	
11.	Spring Washer	1	0.05	17.55	99.80	
12	Plate Washer	1	0.04	17.59	100.00	

This analysis of cost shows that only about 33% of the components are accounting for about 89% of the cost and remaining 76% components account for only about 11% of cost. The efforts should be concentrated on attacking the top four items only where the potential effect lies.

Potential Components = 4/12 = 33%

(Covering about 90% of the Total Cost)

TABLE - 2 : THE TRANSFORMER AIR BREATHER ASSEMBLY

S. NO.	ITEMS	NO. OFF	COST	CUMULATIVE		CLASS
				COST	%	
1.	Cylinder (Perspex)	1	86.87	86.87	41.90	A
2.	Brass Plug	1	53.00	119.67	57.80	
3.	Top Cover (Die-cast)	1	30.18	149.85	72.40	
4.	Intermediate Plate	1	25.14	174.99	84.50	
5.	Oil Cup (Perspex)	1	22.62	197.61	95.50	
6.	Bolt	1	3.21	200.82	97.00	
7.	Clamp (Phosphor Bronze)	1	1.95	202.77	98.00	
8.	Ring (Rubber)	2	1.02	203.79	98.50	
9.	Hexnut M-12*8.4	1	0.69	204.48	98.80	
10.	Round Cap (Plastic)	1	0.69	204.48	98.80	
11.	Perforated Plate	1	0.66	205.83	99.40	
12.	Spring Dowell Sleeve (4 x 24)	1	0.54	206.37	99.70	
13.	S1 PHD Tapping Screw (N 1.4 x 1/2")	1	0.24	202.61	99.80	
14.	Caution (Transfer Label)	1	0.18	206.79	99.90	
15.	Spring Washer B-12	1	0.15	206.94	100.00	

This analysis shows that only about 33% of the components account for 95% of the cost and the rest 67% account for only 5% cost. . The efforts should be concentrated on the top five items only.

Potential Components = 5/15 = 33%

(Covering about 90% of the Total Cost)

Please ref. Fig. 1 for details of the assembly

TABLE - 3 : POWERLOOM FOR TEXTILE MILLS

S. NO.	ITEMS	NO. OFF	COST	CUMULATIVE		CLASS
				COST	%	
1.	Side Frame	2	248.00	248.00	16.90	A
2.	Crank Shaft	1	204.25	452.25	30.80	
3.	Emery Pipe	1	177.01	629.26	42.80	
4.	Sley (Wooden)	1	114.40	743.66	50.60	
5.	Rail Breast	1	95.77	839.43	57.10	
6.	Bracing Top	1	91.05	930.48	63.30	
7.	Tapper Shaft	1	88.40	1018.88	69.30	
8.	Spur Wheel (10 T)	1	85.87	1104.75	5.10	
9.	Back Rail	1	83.25	1188.00	80.80	
10	Swing Rail	1	54.79	1242.79	84.60	
11.	Front Rail	1	53.00	1295.79	88.20	
12.	Whip Roller bar (Long)	1	50.07	1345.86	91.66	
13.	Angle for Central Rail	1	48.87	1394.73	94.80	
14.	Whip Roller bar (Short) End for Central rail	1	41.15	1485.88	97.70	
15.	Binder bearing brush	2	28.57	1464.45	99.60	
16.		2	4.79	1469.24	100.00	

This analysis of cost shows that only about 33% of the components account for 60% of the total cost and the remaining 67% account for the rest 40% cost only. In this case most of the components are C.I. castings and machined.

Potential Components = 8/16 = 50%

(Covering about 75% of the Total Cost)

TABLE - 4 : INDICATOR TUBE ASSEMBLY FOR M.R. TAPCHANGER

S. NO.	ITEMS	NO. OFF	COST	% CUMULATIVE	CLASS
1.	Indicator Tube	447.61	447.61	37.5	A
2.	Gear	196.97	644.28	54.0	
3.	Coupling Dog	110.78	755.06	63.3	
4.	Geneva Wheel Operator	85.00	840.06	70.4	
5.	Gear	74.00	914.06	76.6	
6.	General Wheel	36.00	950.06	79.6	
7.	Gear	33.00	983.06	82.4	
8.	Indicator Tube Sub Assembly	31.74	1014.80	85.0	
9.	Supporting Plate	28.02	1042.82	87.3	
10.	Coupling Shaft	20.72	1063.54	89.1	
11.	Roller Pin	18.54	1082.08	90.6	
12.	Guiding Pin	16.01	1098.09	92.0	
12A	(Other Item)	(15.62)	1113.71	93.3	
13.	Rivet Bolt	15.39	1129.10	94.6	
14.	Rivet Bolt	14.90	1144.00	95.8	
15.	Geneva Wheel Sub Assembly	7.56	1151.56	96.4	
16.	Washer	6.99	1158.55	97.0	
17.	Geneva Wheel Operator (sub assembly)	6.96	1165.51	97.6	
18.	Locking cam	6.79	1172.30	98.2	
19.	Driving Dog	6.20	1178.50	98.7	
20.	Position indicator plate	5.35	1183.85	99.1	
21.	Supporting plate	5.04	1188.89	99.5	
22.	Washer	1.33	1190.20	99.7	
23.	Spring pin	1.00	1191.20	99.8	
24.	Spring pin	0.75	1191.97	99.9	
25.	Hex screw steel	0.40	1192.37	99.9	
26.	Spring washers	0.30	1192.97	99.9	
27.	Snap head rivet (steel)	0.30	1192.97	99.9	
28.	Circlip light	0.25	1193.22	99.9	
29.	Snap head rivet (steel)	0.15	1193.37	100.0	
	TOTAL		**Rs.1193.37**	**100.0**	

Potential Components = 10/29 = 3%

(Covering about 90% of the Total Cost)

Please Ref. Fig. 2 for details of the assembly

A good approach to the overall sales is to determine a total profit factor for each product. This can be derived by multiplying unit profit by sales volume

for each product. The product should then be ranked by this total profit factor. A secondary ranking could be make by the two criteria described above viz., (I) Low volume low profit, (ii) low volume high profit. This product ranking may be further subjected to the following ground rules.

1. Rule out items with very limited production life or those with spasmodic production requirement.
2. Rule out those low volume items which might require costly changes such as in engineering or tooling where these change might offset any improvement in profits.

One area which should always be considered is new products. Value improvement in this area not only result in maximum profits, but will increase the potential market penetration through more competitive pricing. The products can be ranked with established products by estimating the volume and profits.

In some industries product analysis is not feasible because the output consists of large and complex products. Value Engineering would in such cases be applied to specific operations or components. This approach here should be through preliminary in process analysis. This analysis would rank operations by their percentage of total operation cost. The selection for VALUE ENGINEERING study could be made on high-cost-operation first.

For selection of a problem for Value Analysis applications, as in any other approach, we musts take the cost of production or operation as the starting point and start with the ABC Classification of cost factors like Materials, Labour and Overheads. Once the prime area is selected, say Materials, then a further analysis of Materials at organisational level can be made for selecting 'A' items for control purpose. As the nature of organisations and their operations differs from one another, following table explains how the areas can be selected.

S.	TYPE OF ORGANISATION	AREAS AND SUGGESTED

NO.		APPROACH
1.	General Engineering Manufacturing Organisation	Select product groups in 'A' class by material contribution. Then within the selected groups; go far an in depth analysis of specific component in 'A' category of this selected group.
2.	Service Organisation 2.1 Electricity	Generation - Transmission or Distribution. Once selected the A item there, then go far ABC ANALYSIS of the particular item, say for example, Transmission Cost is the 'A' area, then a further classification might show the Transmission towers and conductors are the main cost.

Studies in this area could give increased total profits by increasing the volume through lower costs and pricing.

Once the area for attack has been selected, we need to form a team of members who would be working on the problem solving sessions. As any problem solving session calls for multi-disciplinary dimensions, it is necessary to form the team with members from each of the functional disciplines. While every discipline can be represented in the team, it is advisable to have people from.

Engineering & Design
Process Planning & Manufacturing Engineering
Materials Management
Costing & Finance

Once the working team has been formed, we proceed on to Orientation of the team, to the given problem.

3.2 ORIENTATION :

In the preliminary selection phase, the projects to be studied are identified or selected from the range of work carried out by the organisation concerned. The general scope, restrictions and aims of the study may be defined at this stage.

Select areas with High Savings Potentials first and then come down to areas with low savings potentials.

In this phase it is also necessary to decide on the approach to be used. The scope of the study should be defined clearly in terms of, whether we want :

To study the whole product (or system)

To divide into assemblies or functional areas and study each in turn :
OR
To study individual parts in turn.

The scope & potential can be understood from Fig. 3.

3.3 THE INFORMATION PHASE :

Most of the exercises carried out during any VAVE training programme or exercise sessions are treated as more of an academic exercise, and most of the time is spent on creativity sessions for ideas generation. People find it very interesting because of the games, puzzles, quiz and brain teasers used for opening up the mind and crossing the halo barriers. But things don't proceed beyond this. It is mainly because neither before, not after the exercise, the full information regarding the problem is collected.

The inadequacy of information is due to two main reasons :

a) Because of the limited time allowed for such exercises, the participants or team members do not find the source of the required information. Even if the source is known, there are procedural road blocks in providing the information. To overcome this, the team members, more often than not, either guess the figures or collect from any other source which they think fit.

b) Cost is the main important information for VAVE. Most of the financial managers and other departmental heads keep it as a confidential item and there is a resistance to divulge them to the team members, on the plea that it is secret.

Although it is accepted that cost details must be confidential in an organisation, but the question is

CONFIDENTIAL FOR WHOM?
WHAT IS CONFIDENTIAL ? AND
WHEN IS IT CONFIDENTIAL?

Definitely, not for the VAVE team. Nothing should be concealed from the team, otherwise the results cannot be ensured. Afterall the team members are part and parcel of the organisation.

It must be realised by one and all that without the ACTUAL Cost details, no VAVE exercise can be fruitful. It would be better not to attempt VAVE, than doing it with the use of assumed figures and thereby drawing wrong conclusions.

The total information regarding a product or service can be classified into seven classes.

1. Design :
    - 1.1 Basic parameters
    - 1.2 Materials Specifications and their capabilities.
    - 1.3 Manufacturing Methods
    - 1.4 Performance, Quality and Reliability.
2. R & D
3. Production (Demand)
4. Services (Operation)
5. Marketing
6. Material Recovery
7. Finance

- Purchase
- Store

While collecting information, one should try to collect the information relevant to following three questions :

- What is it?
- What does it do?
- What does it cost?

The cost should be separately available for the following items.

* Materials
* Labour
* Process
* Packaging
* Other Overheads

What to Collect ?

When one gets on to the job of information collection, he should to be able to find trees from the woods. Too much of information does lead to unnecessary information being collected and therefore more confusion.

By using the above clauses, the team should concentrate on collecting the details about

* Specification
* Drawings/materials/Finishes/Tolerances
* Desired Life
* Aesthetics and esteem requirements
* Desired Reliability
* Area of Operations/Working conditions
* Technical Manuals
* Others using same Product or Service.
* Past history of the function fulfillment
* Problems Specified (if any)
* Special requirements of the users
* and above all
* the costs there of

By getting the answers to the above items, one would be in a position to consolidate information.

COLLECTION OF INFORMATION

Although very important, but COST is not the only information to be collected. in addition there are many more things to be collected, and they can be ensured only by

CONSULTING EVERY BODY WHO HAS GOT ANYTHING TO DO WITH THE ITEM/SERVICE.
THE SUGGESTIONS ALWAYS LIE WITHIN THE ORGANISATION:
OUTSIDERS CAN ONLY HELP AS CATALYSTS.

3.3.1 THE FUNCTIONAL REQUIREMENT ESTABLISHMENT

The nerve center of Value Engineering approach is the understanding of the FUNCTION of an item, Product or Service. The following are important:

FUNCTIONAL ANALYSIS

INTRODUCTION :

An item is purchased only because it performs some specific function. A customer need, to be fulfilled by performance of functions is initially established. This may come from the customer's awareness or a need or the development of a need in the customer by industry. For example the customer may want some way to heat bread. The customer recognises a function he would like to have fulfilled. Now industry, which in itself has a function to fulfill (make profit) searches for and recognises this customer desire. Industry, to fulfill its function of making profit, develops an item to satisfy the desired customer function of heat bread. During development, industry may add certain features to the product which do not relate to the function of heating bread but which they feel will contribute to the saleability of the product. They may add (what they hope to be) esteem VALUE, through an additional process and cost, such as chrome plating.

Normally then, out of the functions that a part performs, some are related to use VALUE and others to esteem VALUE. The ratio between Functional values can vary from item to item. For example a mink coat manufacturer places high weightage on use VALUE, i.e. to keep the body warm through thermal insulation characteristics of the mink. However by using a superior lining and attractive diamond studded gold buttons and other attachments, the saleability if the mink would increase.

Thus, in every case, a product or operation will include Primary (Basic Function) and Secondary Functions. As related to Value Engineering, functions are described with only two words, a VERB form and a Noun form

e.g. Provide Light, Cut Paper, Provide Energy etc. The two word description offers two major advantages.

1. The description pinpoints the function. The description is not cluttered with superfluous information. This enables concentration on the exact requirement when alternatives for providing the function are developed during the speculative phase of the job plan.

2. Possible alternative solutions for providing the function are not unduly restricted. This is helpful in the creative phase of the job plan, when a full range of possible alternatives is desired. The longer the list of ideas for providing the required functions, the greater the probability that the list will contain the lowest cost method.

THE FUNCTION

Functions are the natural or characteristic actions performed by an item, or can be thought of as the properties of an item which enable it to perform the requirements placed on it, in terms of USE, QUALITY, & RELIABILITY.

THE FUNCTIONAL HEIRARCHIAL TREE :

Every product or service used is meant to serve some functional requirement or fulfill an established need. This is termed as the PRIMARY FUNCTION. While fulfilling this requirement it also does something more than that. This some thing more is a secondary requirement which becomes necessary for meeting the main requirement with a better effect. To this extent the SECONDARY FUNCTION becomes subservient to the PRIMARY FUNCTION. In actual practice we come across regular cases where the product has one additional feature whose function cannot be explained in the given set up.

RELATIVE EVALUATION OF FUNCTIONS :

When all the Basic and Secondary Functions of the product or operation have been listed, the next problem is to evaluate each function. The technique of evaluating a function is primarily one of skill, and in VE, as with any skill, practice, makes one perfect. The analyst must never operate under the impression that these techniques include hard and fast rules or formulae. Value is a relative term, and therefore, may be different with each analyst. This is why it is so important to evaluate the function rather than the item. This keeps the study aimed at the need for this item. The techniques set forth in this section are only some of many. As the VALUE ENGINEER becomes skilled in evaluating functions, he will no doubt develop some of his own.

EVALUATE BY COMPARISON :

Placing VALUE on a function by using the VALUE of something readily known. If we consider a lamp, the function can be expressed as 'Provide Light'. This could be evaluated by using the cost of a match or an incandescent lamp. Another example might be a special fastener where we can define the function as 'fasten assembly' . Quick reference to hardware catalogue would show the cost of a standard bolt to perform the basic function. The VALUE of the secondary function might also be required, so, if the fastener also 'transmits force', the cost of a tie rod should be listed.

Fig. 4 shows a Flanged Bush which is used to hold a shift and provide friction less drive on high voltage equipment Trip Free Mechanism. It offers no appearance or esteem VALUE to the customer. It is having a use function only. Cost of part Rs. 95.00.

The part can be analysed as below.

PRIMARY FUNCTION :

1) PROVIDE FRICTIONLESS SURFACE

The cost of the function “PROVIDE FRICTIONLESS SURFACE” can be compared with that of a BUSH of similar dimension as shown above, and would cost about Rs. 12.00.

SECONDARY FUNCTION :

Arrest Rotation of Bush
Arrest Axial movement of Bush
Facilitate replacement

From Fig. 4 it can be seen that the above mentioned two functions are being met by the flange.

Once the functional requirement is established clearly, it becomes easier for one to find out various alternatives for fulfilling the function, like,
A Keyway with a key,
Threaded Bush
Woodruff key
Araidite Joint
Lug screws
and many of such devices which would ensure that the secondary functions are achieved.

The moment it is defined that the replaceability of the bush is a must, some of the options like welding, pasting etc. would be dropped.

However it may be seen that in the above design, while the flange serves the secondary functions only, it does form the major chunk of the cost of the item. A careful analysis of the same would lead us to one alternative, as depicted in Fig. 5, which can be one of the many others that may be possible.

This arrangement could be possible at an additional cost of Rs. 4 to 5.

Thus the total functions could be met in a total amount of about Rs. 16 to 17, as compared to the present cost of Rs. 95.

EVALUATING FUNCTIONAL AREAS :

Often in analysing a product, it is easier to determine functional areas rather than specific functions. This is done by first dividing the product or assembly into the portion which makes it work (performance) and that proportion which makes it sell (features, attractiveness). The performance portion can be broken into Mechanical, Electrical, Chemical, Magnetic, etc., Mechanical components may be divided into Translating, Rotating, etc., while attractiveness may cover such things as machine finish, surface coatings, shape or form, safety of user, etc.

These functions would then be evaluated by relative worth (percentage) or by using known of predetermined values for basic functions. In evaluating the functional areas by relative worth, percentages are assigned to each areas listed depending on relative worth, including both performance and features. This will highlight those areas of cost which might be out of line.

Based on this, the total functional requirements of a product or service are basically divided into three parts :

A - The BASIC or PRIMARY Function
B - The SECONDARY Function, and
C - The UNNECESSARY or REDUNDANT Functions.

BASIC or PRIMARY FUNCTION :

A basic function is defined as the specific purpose for which the item was designed. There can be one or more basic functions depending on a particular individual or organisational viewpoint. For example, one person might say that the basic function of a women's wrist watch costing Rs. 100/- is to indicate time. Another person may state that the basic function is to 'Provide status', while still another concludes that the function of the watch is to 'indicate time' and 'provide status'. The important thing is that within an organisation there should be agreement between the decision and policy makers as to what the functions of the products are. The primary or basic function of a product or operation can be identified by asking the following questions :

1) What is it's purpose?
2) What does it do?
3) What is it required?
4) What makes it work?
5) What makes it sell? and finally, perhaps,
6) What would happen if it is not there at all?

SECONDARY FUNCTIONS :

A secondary function can be defined as anything that makes the product or operation work better or sell better and can be identified by asking the following questions :

1) What makes it work better?
2) What makes it sell better?
3) What else can it do?
4) How does it support the basic function?
5) Can the secondary function eliminate basic function?

UNNECESSARY OR REDUNDANT FUNCTION :

Unnecessary functions are those characteristics of an item which are not required either as a basic function or as a secondary function. In other words, a function might have been provided that is not required at all. The VALUE ENGINEER must be on the look out for unnecessary functions and eliminate them.

To understand the implications of defining the functions, let us take an example of a common product - THE PAINT.

In the normal sense a paint is expected to protect surface, however depending on specific applications, the additional functional requirements would become necessary.

APPLICATION	**FUNCTIONAL REQUIREMENTS**
-On a Water Drum	- Protect from corrosion - Add esteem
-On a Refrigerator	- Add esteem - Provide thermal insulation - Protect from corrosion
-On a Transformer	- Protect from Atmospheric Condition - Ensure resistance against high abrasive winds - Provide thermal conduction
-On a Gasifier -a) In the Oxidation zone	- Withstand upto 1400 degree centigrade - Resist oxidising atmosphere - Resist Wear from flowing mass - Resist Reducing atmosphere - Resist Wear from flowing mass - Withstand upto 1000 degree centigrade - Withstand upto 200 degree centigrade

From the above it may be clear that though each one is a paint, however, depending on specific applications, we have to add specific ingredients in the paint to fulfill the different functional requirements.

The following suggestion should be considered when VALUE ENGINEERING is applied :

The real skill of Value Analyst lies in the fact as to how exactly and accurately he defines these functions both in terms of ideal requirements and actuals provided. Then the effort would be to attack the gap between the ACTUAL and the IDEAL The rule : Vital few and Trivial many, holds good for the FUNCTIONS also.

Though definition and understanding of actual function is the nerve of Value Analysis, however understanding the function has been observed to be the weakest area in designing a product.

A DEMONSTRATION :

A very common and universally known example is dealt here to highlight the relevance of establishing the functional requirement and how normally one is mislead by the Perceptual, Cultural and Habitual block.

This example pertains to the playing cards. The author has tried this on about 1000 subjects spread over about 50 programmes/assignment and the pattern of responses is summarised here. To start with, show a set of playing cards specially printed in one single colour. Fig.6 to any person supposed to be an expert in cards, and ask him to recognise the cards as displayed. He will read them as Dice Nine, Spade ten, Spade Jack, Clubs Queen and Hearts Kings. After a close look and on a further careful examination he will come up with a statement that the cards are wrong. (Caution : Players please stop here and try it and then proceed further). Reason - The Hearts King and Diamond Ten are black in colour. So far so good. Quite an expected answer. THIS IS WHERE THE PERCEPTUAL BLOCK WORKS.

Now similarly proceed with by showing him another card as per Fig. 7 and he would say Hearts Jack! Right the first time! Sorry! Not right.

With these two examples, proceed with simple questioning shown below, and the answers would naturally follow :

Q.1 Why do you say they are wrong?

A.1 Because Hearts and Diamonds “SHOULD” be in red colour

Q.2 Why do you think it SHOULD be in red?

A.2 Because THAT IS THE WAY THEY HAVE BEEN EVER.

Q.3 No, but can’t you recognise the card even if it is black?

A.3 Of course yes.

Q.4 Now how do you recognise the card?

A.4 By the shape of the figure of print.

Q.5 Now imagine that the cards are printed only in one colour - BLACK; can you recognise them or not?

A.5 Yes, of course

Q.6 Doesn’t it mean that your purpose is served just by the shape and not the colour?

A.6 I think - yes.

Q.7 Well now have you had a look at the second card?

A.7 Yes, Please

Q.8 What was it?

A.8 Hearts Jack

Q.9 How do you know it?

A.9 Just by the letter, the shape and the figure on the card.

Q.10 Do you think that all these are required by you to recognise the card?

A.10 Yes.

Q.11 Supposing the card didn’t contain the photograph of the Jack and only the letter and symbol are there.

A.11 Yes, I can recognise it even without a photograph, but then it makes it lot easier if you have a photograph.

Q.12 Do you really think so?

A.12 Well - I don’t think there are two opinions about it.

Q.13 O.K. then let us come back to the arranged cards as in Fig. 6. Did you have any trouble or difficulty in recognising the Jack, & Queen and the King, because the photographs were not visible?

A.13 I didn’t have any difficulty.

Q.14 Well then does it mean that most of the time we recognise the cards just by looking at the corners ONLY and not looking at the card by counting or something.

A.14 Yes, perhaps we can have cards with only the corners printed, so that we can save on the cost of additional printing.

Q.15 Suggestion : By the way for your information the second card that you saw had J-Hearts in the corners but actually had a King and a Queen's figure on the face, and no additional symbols inside the block?

A.15 Oh my God, really ! Well I can't really make out how a jack or King looks like.

This exercise will be a clear indicator of our thinking blocks and also highlights the basic minimum requirements for fulfilling a functional requirement. Beyond this, if sometimes this solution is not possible because of the constraints of the problem, probably Fig. 7(b) can be used as via media solution with much lesser cost of production in terms of ink and block making.

Various other examples of functional fulfillments are :

- Abbreviations like viz., e.g., i.e., Admn., etc.
- Codes like MAS for Madras, BPL for Bhopal, NDLS for New Delhi and DLI for Delhi, Symbols like RED Triangle for Family Planning, Monograms etc.

The approach of defining the primary and secondary functions of components and their design features and identifying the redundancy of functions resulted into reduction of material in many cases. Fig. 8 to 15 depict some of such results which have been achieved by the author during his interaction with very many project groups guided by him.

3.4.1 EVOLUTION OF ALTERNATIVES

In any situation, whenever a problem is faced, there can be a standard approach of solving it. In industrial set up, every day thousands of problems are faced by the management and as routine they are solved more on the basis of experience and hunches than a systematic approach.

More often than not these problems are taken as a matter of routine and they are not termed or defined as problems unless it creates a situation of crisis. This results in management crisis. Whenever a crisis errupts, a task force is created together with as time bound action plan, for solving the problem. This is exactly how the concepts of VAVE also have been treated.

From the abundant experience available in industry in problem solving, perhaps we can take a clue. If a problem can be solved in a crisis, why cannot the same be done even when crisis is not there. That means, as a routine and planned activity, rather than based on crisis. Instead of waiting for a crisis and then attacking the problems, if the same problem is diagnosed on a voluntary basis, the efforts required would be very much less. This would mean creating a problem and then solving it, rather than letting the problem becoming a crisis and then trying to solve it.

As has been already said, we face many problems every day, which means problems are there. The only thing required is which of the problems need be tackled on a priority and which ones can be left free.

It must be very clearly understood that,
IT IS THE PROBLEM OF THE ORGANISATION. THE ORGANISATION MUST IMPLEMENT IT. WE ARE THE ORGANISATION.

Because an Organisation is not the moot building and furniture and brickwork, BUT THE PEOPLE WORKING THERE. To this extent a few of the following questions would definitely help us in arriving at a solution.

- Has the problem been recognised by people at the helm of affairs?
- Do they REALLY want a solution?

- How has the creativity team been formed?
- Are the top executives committed to implement the final outcomes?

Have the Designers, Materials Managers and Financial Executives and concerned been taken into confidence and do they feel a part of the team?

It has been generally seen that very many good and beautiful problem solving suggestions die down their own natural death, because;

a) Either they have been organised at a very low level in the organisation structure; OR

b) The creativity sessions have been treated as a routine organisation matter without much importance.

3.4.2 THE THREE STEPS FOR PROBLEM SOLVING

To solve any problem, we must resort to the following in that Order.

1. ELIMINATE the NEED for the FUNCTION or the PURPOSE.
2. IF NOT POSSIBLE, COMBINE many functions into one component/part.
3. If this also is not possible, then MODIFY the function into a modified component or part.

ROADBLOCKS :

All too frequently a good idea or proposition is swept aside by a good sounding excuse generally such as :

- Every detail of the design of this device has had a thorough review by a special, high competence review team.
- The best manufacturing specialists in India have reviewed this and agreed that these manufacturing methods are the best and most economical.
- It is not practical to build dies for drop forging when quantities are less than 25,000 per order.
- It is not practical to build moulds for casting in quantities of less than 5,000
- We had to make these parts by hand because we cannot pay for the tools for the quantities involved.
- We have made a thorough study of every conceivable way of doing this, and what we have is the only it can be accomplished.
- There is no better material.
- This is the best process, considering the quantities involved.
- There is probably no better way of doing it and we are short of time anyway.
- This has been proved to work. We won't change it.
- Underwriters wouldn't approve any other arrangement.
- This the result of a lot of study. It will be far better than competition.

- We changed that a few years ago and got into an epidemic of trouble.

- We are not changing it again.
- We had to maintain interchangeability.
- You can't beat an automatic screw machine for any part that it can make.
- We have ten turrent lathes; we certainly make money by designing to keep them busy.
- There is no other source of supply.
- We cannot pay for the tools.
- It does not make sense, but it is our policy.
- We know more about this than any one else.
- There is no material with those properties
- It is impractical to make casting that small.
- It costs too much to change the drawings.
- The customers like this way.

Such general statements stop buyers, investigation and changes. To combat these generalised assumptions, one must deeply analyse the specific situation at hand.

- Please remember that :
- Nothing is static
- Technology moves in leaps and bounds
- What is not feasible at one point of time not only becomes feasible but economical as well, as the time changes.
- Functional needs change constantly.
- No two problems are alike in toto.

GROUP DYNAMICS IN VALUE MANAGEMENT

Value Management primarily deals with the processes of making innovations and implementing changes. As a result, it is influenced by, and has to adapt to, certain human factors which operate through individual and group agencies. Since these factors have a determining influence on the success of VM, an awareness of their existence is necessary for the Manager to enable him to function effectively.

Factors Operating at the Individual Level :

These factors arise from the idiosyncrasies of the individuals psychological functioning and often hamper with the process of creativity, and change. A few such tendencies are described below :

- Rigidity of thought process, which makes the individual inflexible in his functioning, so that he believes that there is only one working or solving a problem.
- Fear of Novelty and defensiveness, which makes the individual stick to the old familiar routine, finding a personal threat.
- Lack of risk-taking capacity, which makes the individual cautions sin trying our new ideas and unwilling to consider alternatives which look wild and extreme.
- Judgmental attitude, which makes the individual jump at conclusions, too quickly without considering other possibilities.
- Dichotomised thinking, which makes the individual evaluate everything in terms of GOOD or BAD, WORKABLE-NON WORKABLE, POSSIBLE-IMPOSSIBLE e.g. if one method of working is functional all the rest would be necessarily disfunctional.
- Short-term Perspective, which makes the individual consider everything in terms of immediate goals and gains, unable to visualise the gains possible in the distant future.

Most of these tendencies can be countered by initiating the process of Value Management to a group, rather than on individual. The environment of the

group helps the individual in overcoming the inhibitions of his thinking process and gives him support in thinking out and considering ideas which are extreme and unconventional. Similarly in implementing the change, if the group is taken into confidence, it provides pressure and support to it's members towards change.

Factors operating at the Group level :

As noted earlier, group has facilitating effect on both the generation and the implementation of new ideas. The following points summarise the other benefits of the group, functioning:

- A group pools diverse information, thus clarifying different aspects of a problem.
- In a group, each individual contributes his way of looking at the problem and its alternative solutions, thus generating wider total spectrum of alternatives to choose from.
- If a decision is reached at by a group, the resistance is low during its implementation.
- In the group-discussion about proposed decision, all the aspects come into light and are clarified. in this way, the problem of communication is lesser during implementation.

However, working with a group has its own difficulties and obstacles. They are :

- There is a social pressure to conform to the dominant party. This dominant party may be an individual within the group, or may be outside it.
- People show a tendency to agree with the very first idea. Better ideas generally emerge only late during the discussion.

- People with different backgrounds and with different ideas, coming together in the group, may disagree with each other and create

conflicts. Thus instead of solving the problem, the group may create new ones.

- Members of the group often have hidden or secondary goals, and tend to use the group as an opportunity to satisfy personal aids. e.g. to gain sympathy or recognition, to pulling someone, to please or to humiliate someone, etc.
- Unless, sufficient time is given to the group for warming up, a set of few people tend to monopolise the discussions and render the remaining others to the role of “Silent Majority”.
- Group-discussions require more time than a decision taken by an individual.

Though the group has these demerits, they are not impossible to eliminate. The effectiveness of groups functioning depends on the leader’s ability to coordinate the groups activities and discussions. The total range of activities and alternatives generated by team can be grouped into five phases or levels.

Conceptualisation:

- Concept of new ideas (non-existent as far as the group is concerned). This may be attributed to the fact that a group member does not have knowledge in relevant fields and the works that have been already done elsewhere.

Design:

- Putting into design an idea that has already been sold in the past, and the Management acceptance has already been there.

Development :

- Development of a design already working, but mainly with a view to solving a crisis and not a deliberate effort to evolve alternatives.

Modification :

- Modification of an already existing design. This decision might have been forced by circumstances (crisis) or a threat to the survival of the product and in turn the company.

Criticism :

- Criticism of the existing features of the product or service (normally concentrated on a part to part basis), just enough to make a local compromise which may sometimes create a problem some where else.

3.5 EVALUATION OF ALTERNATIVES AND SELECTION OF THE MOST OPTIMUM :

Normally and generally it has been observed that the groups and the individuals have a built in tendency to consider one or two overriding criteria for selecting an alternative.

In the course of generation of alternatives and selection of the best, it is just natural that the selection can not be made on a single factor. There can be menu criteria for taking this decision. The set of criteria selected would squarely depend on the nature and conditions of the product/service under consideration, and therefore it is just not possible to establish a list of criteria to be used universally by all the organisations. Even within an organisation the set of criteria could change depending upon the problem being handled.

WHILE ONE CAN HAVE A REPRESENTATIVE SET OF CRITERIA MINOR CHANGES WOULD BE NECESSARY ON A CASE TO CASE BASIS.

THE FACTOR WEIGHTAGE :

Given more than one factor to be considered for evaluation, it is necessary that the relative importance of these should also be established. Also it is not sufficient just to rank the factors in one order, but they must also be given a quantitative figure which would assess the real relative importance of one factor as compared to the other. This QUANTITATIVE RELATIVE POSITIONING is termed as the 'WEIGHTAGE" of the factor.

CRITERIA WEIGHTAGE EVALUATION MATRIX

THE PRACTICE IN VOGUE :

In general practice, the team members would sit in a group and establish the weightage of the individual factor more on a consensus basis. While normally this would serve the purpose, but the subjectivity involved is of a very high degree, because the initial bias of the group members and universal feelings play an important role. To take care of this situation, a modified system has been evolved based on a factor comparison and grading them on a scale, which is normally chosen on an adhoc basis e.g. 0-5 or 0-10. Each of the factors is compared with every other factor and the relative grading is done, as shown in the criteria weightage matrix shown in Table - 3.5.1 and 3.5.2.

Table - 3.5.1

Q	R	P	M	Pr	C1	A	PLT	W	PCK	TOTAL
Q	R-4	P-5	M-3	Pr-2	Q-2	Q-2	Q-2	W-4	Q-CK	6
	R	R-P	R-M	P-3	R-5	A-3	R-3	R-2	R=PCK	17
		P	P-2	P-3	P-5	A-2	P-2	W-4	P-2	19
			M	M-2	M-3	M-A	W-2	W-3	M-1	11
				Pr	Pr-4	R-A	Pr-PLT	W-2	PCK-2	4
					C1	A-2	PLT-2	W-3	PCK-2	-
						A	A-4	W-4	PLT-PLT	14
							PLT	W-4	PLT-PLT	2
								W	W-3	27
									PCK	4

Q = Quality

R = Reliability

P = Performance

M = Maintainability

Pr = Productivity

C1 = Capital Cost

A = Availability

PLT = Production Lead Time

W = Weight

PCK = Packaging

Table - 3.5.2

CRITERIA WEIGHTAGE FOR GROUND EQUIPMENT

Q	R	P	M	Pr	C1	A	W	PCK	TOTAL
Q	R-3	P-2	M-2	Q-1	Q-2	Q-1	W-3	PCK	24
	R	R-P	R	R-3	R-2	R-2	R-2	R-1	17
		P	R-P	P-2	P-3	A-4	P-2	P-3	15
			M	M-4	M-4	M-3	W-4	M-3	16
				Pr	C-4	Pr-3	Pr-4	PCK-4	7
					C	C-4	C-4	C-4	16
						A	A-4	A-3	15
							W	W-3	10
								PCK	6

The matrices clearly indicate that while the organistion remains same. (in this case an aircraft manufacturing organisation) the criteria weightage have changed depending upon the particular project selected. In case of an airborne component the criteria weightage are shown in Table 3.5.1 whereas in case of a ground equipment the weightage are quite different. Although in this approach the subjectivity referred earlier is reduced to a great extent, still the approach has a basic lacuna that it looks on to only one side of the comparison. If initial cost and Maintainability are compared, then the matrix only shows that either C has weightage of 3 (or any other figure) above Maintainability or vice-versa (or may be that C = M). It however, does not give any consideration to the other factors. in very critical cases it results into a typical situation which shows that the Initial Cost has a zero value because everywhere it has been overlooked by the other factors as far as airborne components are concerned. But we very well realise that cost is one of the important criteria in evaluation.

PROPOSED EVALUATION CRITERIA :

To take care of this phenomenon a modified criteria weightage matrix is suggested which takes a 0-100% scale to avoid the problems as envisaged in a 0-5 or 0-10 or 0-20 scale. In this scheme of establishing the criteria, both the factors under consideration would share the scale in proportion of their relative importance, and hence every criteria would have some quantitative VALUE which would be the complimentary of the other factor's weightage. For example, when we say that Cv/s Maintainability; M = 3, it would mean that on a 0-5 scale M has acquired a position of only 3 and hence the remaining 2 have been considered for C, in this proposed scale. M would acquire a weightage of 5 + 3 = 8 and C would have value of 5 - 3 = 2. This is explained below :

THE LOGIC & APPROACH :

In order to understand the allocation of weightage, let us assume that A and B are the two factors being compared at any point of time. The three alternatives possible are :

a) A > B

b) A = B

c) A < B

The same can be represented on a scale as below :

a) <.....A.....> <.....B.....>

b) <.....A.....> <.....B.....>

c) <.....A.....> <.....B.....>

if A + B = X then

B = X - A

The maximum could be A = X or B = X

and in case of A = B;

A = B = X/2

Extension of Table 3.5.1 to Table 3.5.3 :

Supposing in Table 3.5.1, when compared to C, M = 3, which means that M is having a proportionately higher weightage of the third order on a 0 - 5 scale. This would mean that M>C by 3 degree on a 0 - 5 scale. So we add 3 to 5 (5 corresponding to C = M condition). So the final figures would be

C = 5 + 3 = 8 and M = 5 - 3 = 2 and so on.

Table - 3.5.3

PROPOSED CRITERIA WEIGHTAGE MATRIX

(for Airborne Components)

Q	R	P	M	Pr	C	A	PLT	W	PCK	TOTAL	%
Q	R-9 Q-1	P-10 Q-0	M-8 Q-2	Pr-7 Q-3	C-3 Q-7	A-3 Q-7	PLT-3 Q-7	W-9 Q-1	PCK-5 Q-5	33	7.3
		P-5 R-5	M-5 R-5	Pr-2 R-8	C-0 R-10	C-0 R-2	PLT-2 R-8	W-3 R-7	PCK-5 R-5	59	13.0
	R		M-3 P-7	Pr-2 P-8	C-0 P-10	A-7 P-3	PLT-3 P-7	W-9 P-1	PCK-3 P-7	58	12.8
		P		Pr-3 M-7	C-2 M-8	A-5 M-5	PLT-3 M-7	W-8 Pr-3	PCK-4 M-6	51	11.2
			M		C-1 Pr-9	A-5 Pr-5	PLT-5 Pr-5	W-7 Pr-3	PCK-7 Pr-3	39	8.6
				Pr		A-7 C-3	PLT-7 C-3	W-8 C-2	PCK-7 C-3	17	3.8
					C		PLT-1 A-9	W-9 A-1	PCK-2 A-8	53	11.7
						A		W-9 LT-1	PCK-5 PLT-5	30	6.6
							PLT		PCK-5 PLT-5	70	15.5
								W			
									PCK	40	9.5
										450	100

In this approach also we do see that factor C is played at the lowest level however it does have a VALUE of its own, because of which in some cases it might as well offset the weightages accruing out of other factors.

GRADING THE FACTORS :

DEGREES:

Once the factor weightages have been decided, it becomes necessary that they be further graded into various degrees of impacts. For example let us say that in a given criteria 'Capital Cost' - C, we have 5 alternative suggestions. It is but natural that each alternative, because of the inherent designs would require a different level of capital investment and VARIABLE COST for the change to be implemented. If their capital requirements are of the order of say.

C1 = Rs. 5,000

C2 = Rs. 15,000

C3 = Rs. 50,000

C4 = Rs. 1,00,000 and

C5 = Rs. 20,00,000

Then naturally first alternative with the lowest cost would be most preferred as compared to fifth, which requires a very high initial cost of implementation. Hence alternative one should get much more consideration as compared to fifth. In such a case we should have some scale by which this relativity can be either inflated or deflated for the purposes of inter-factor comparison. This is ensured by defining each factor in terms of different degrees. While the basic weightage of the factor C remains same as 17 (in table - 3). The net consideration would be that of 17x5 = 85 for C1 and 17 x 1 = 17 for C5. (Supposing we have only five degrees). thus splitting each factor into the degrees, the final points gained by a particular alternative under each factor can be assessed.

EVALUATE THE FUNCTION BY COMPARISON :

After the functions have been identified and classified, evaluation is performed reasonably enough and a lowest cost is by comparison.

Taking the case of the squirrel cage rotor, we can compare aluminum for copper, carbon steel stampings heat treated, instead of silicon steel stampings. Die casting instead of riveting and brazing. We can compare style of one refrigerator with that of other and create low cost alternatives. Here it is necessary that the functional reliability must not be forgotten, otherwise we may impair the performance of the product.

CAUSE VALUE ALTERNATIVES TO BE DEVELOPED :

The alternative caused earlier may be in a crude form and at this stage it is necessary to analyse the objections that may exist for these alternatives and make refinements, technical and others, to make the alternatives workable. Here it may be necessary to consult experts in respective fields or from outside and seek their advice. The effect of alternatives on other spheres too, will have to be taken into account.

3.6 RESULT ACCELERATORS

Successful VALUE ANALYSIS effort, culminating in the elimination of unnecessary cost, depends a great deal upon skillful application of techniques that will identify unnecessary cost, remove obstacles, and provide a course of action that will ensure the development of VALUE alternative of merit. A series of accelerators has been developed and has proved capable of meeting real life situations.

The VALUE ANALYSIS techniques are :

1. Avoid generalities.
2. Get all available costs
3. Use information from only the best source.
4. Blast, create, refine
5. Use real creativity
6. Identify and overcome roadlocks
7. Use industry specialists to extend specialised knowledge
8. Get a RUPEE sign on key tolerance
9. Utilise vendors available functional products
10. Utilise and pay for vendors skills and knowledge
11. Utilise applicable standards
12. Utilise speciality processes
13. Use the criterion “Would I spend my money this way”
14. Establish clearly in the mind exactly what is to be accomplished.
15. Precisely what functions are desired.
16. Place better alternatives before the decision makers.
17. Get an action pattern established so that the information on the best alternatives will be promptly used in decision making.

BLAST, CREATE, REFINE :

In the technique, the function or functions are first brought into very clear focus. Then the possible means of providing the functions are reduced to simple terms. The necessary complexity comes next. Where good grade VALUE is required, this procedure is necessary to eliminate the causes of why

things are done as they are. The common controlling factors are the habits and knowledge of the people at the time the particular thing whatever it be, was first done and when it later was modified as different processes and materials and other people came into the picture.

This situation raises the following vital questions in the search for better VALUE: How can this chain of influence be periodically stopped? How can a function needed today, in the light of today's knowledge, be looked at objectively?

The techniques of blasting creating and then refining is specifically directed toward accomplishing these objectives. The aim of the three steps in the use of the technique are :

BLAST : In this stage (keeping in mind the basic functions to be accomplished, but not expecting necessarily to entirely accomplish them) alternative products, materials, process, or ideas are generated. These alternatives should, first of all, qualify for accomplishing some important part of the function in a very economical manner or, at least, serve as an economical base for modifications that are likely to accomplish an important part of function. At the same time. the precise amount of the function which would be accomplished and the specific cost which would result are brought into clear focus.

CREATE : Using creativity, as described earlier, this step should serve to generate alternative means by which the concepts revealed by the blasting can be modified to accomplish large part of the function with pertinent decrease in cost. In this creative part of the technique, definite integers of increased function are associated with definite integers of increased cost.

REFINE : In this final step, the already created alternatives as above are further shifted and refined, adding additional integers of function with additional integers of cost until the refined, product fully accomplished the

total function. It is not uncommon for the resultant newly constructed product concept to accomplish the total functions with the same reliability and over all benefits for a cost of on-half to one-tenth of the original.

UTILISE VENDOR'S AVAILABLE FUNCTIONAL PRODUCTS :

a) Understand the function
b) Search directories of manufacturers, catalogues, etc.
c) Contact associations and institutions
d) Search in trade shows
e) Search Magazines
f) Contact competent men in clubs, etc,
g) Make enquires

Once suitable sources of special functional products have been located, do not neglect to :

1) assist the functional product vendor;
2) interpret the needed functions to him;
3) provide him with a broad and deep feeling for the importance of the various functions, for the various operating situations, etc.
4) help him to develop practical suggestions for using his product or combinations of his product:
5) secure tangible suggestions from him.

UTILISE SPECIALITY PROCESSES :

Generally speaking, all process serve one of the two purposes:

1. They accomplish functions that can be performed in another way.
2. They accomplish performed function equally well but at much lower cost.

The second group takes in an extremely large number of process, which are of vital interest in VALUE oriented work and which will be the group for further study in this section.

All processes might further be divided into two classes.

1. Processes that are known and are reasonably well understood by those who are making decisions.
2. Processes that are not known to the decision maker but which would be applicable and would accomplish the desired ends at very much lower cost.

Again, it is this second class that we shall deal with. Let us first see how processes which will accomplish functions reliably at very much lower cost but are now known to the decision makers at the particular time may be brought into view and how their benefits may be utilised in VALUE work. Of course, what is a special process today commonly becomes the standard process of tomorrow.

Use the Criterion, “WOULD I SPEND MY MONEY THIS WAY/”

Most certainly, any successful individual in the competitive economy has learned to use common sense in applying the criterion ‘would I spend my money this way?’

The average person, while evaluating his own expenditure, is governed by the following typical condition :

He has a limited amount to spend.

He strives to secure maximum use function and appearance function from his expenditure.

He knows that he cannot get reasonable VALUE in exchange for his resources unless he has VALUE alternatives clearly established and uses corresponding information as criteria in the decision making.

Before he spends his money, he will have clearly in view the relative costs.

Fig. 17 indicates the present process of machining a hydraulic pump piston used on lifting trolley, it was observed that about 70% of the costly and imported forged material was removed by the machine operation to get the piston and the piston rod. The design was split and the component could be made in about 40% of the earlier cost.

In case of complex product or system, consider the function of the entire system first. Do not become involved, at the beginning of the analysis, with the functions of individual assemblies and or components that make up the item. If the VALUE engineer begins by analysing components or sub assembly, he has automatically committed himself to use the original concept.

The indicator tube assembly as referred in fig. 2 earlier, was analysed on these lines and it turned out that the only final function of all these components was to indicate the angular position of the tap changer shaft in case of a failure. In the existing design an assembly of 30 components was used to meet this requirement. A critical look at the function of the total assembly gave an idea that the angular position and also be measured at the top end of the shaft, instead at the bottom end. Once this was established the group could develop an alternative assembly which needed only seven components as against the 30 presently used. this costed only Rs. 176 instead of the present cost of Rs. 1200. In addition the modified design had the added advantage of reduced no. of components thereby increasing the reliability of the system, due to reduced no. of components. (Ref. Fig. 18).

At each level of application (item, assembly component) determine if the function being performed is necessary to meet requirements. If the function is unnecessary, eliminate the item, assembly, or component involved. Do not waste time developing a low cost method to provide function which is unnecessary.

Evaluation :

Each idea should be reviewed and if necessary, simple freehand sketch made to explain basic principles, etc. A rough estimate of the relative cost of each idea is required (assuming at this stage, that it would work).

Taking the lowest cost idea, or group of ideas, an assessment must be made of, first the good and then the bad features. The bad features should include

any major item of the specification not satisfied by the idea. Attempts should be made to overcome or minimise the features and any action necessary to do this, recorded.

Having taken both cost and performance into consideration, the best VALUE ideas are selected for further development.

3.7 INVESTIGATION & PLANNING :

It is necessary to develop a plan of action for each idea and accommodate this in the overall plan.

As in any development work, the correct sequence of action can save time and money.

Produce scale drawings
Obtain a decision on customer's reaction
Obtain samples and test new materials and method
Make and test new models of prototype
Produce an accurate estimate of the expected cost and savings.

A target date for implementation should also be estimated and in this connection there should be adequate planned overlap in the availability of stocks of existing and new parts to avoid any production delay due to faulty parts or late delivery.

Implementation :

The overall plan must be followed and conclusion reached. Action must be simulated by progressing the work in hand and participants encouraged to hold speculative sessions to overcome any problems.

The purpose of the exercise is to save money. If results are not being obtained, it is useless to add more work, but instead, the programme should be either re-examined and altered or additional facilities provided.

The phase is concluded when a better VALUE alternative is in production. Without this all of the previous work has been wasted.

SUMMARY

In the summary phase, the VALUE ANALYSIS coordinator will check that the change has been implemented as intended and that the estimated savings are, in fact, being achieved. Also that performance and quality of the project has not deteriorated.

In addition, he should examine all of the information collected during the study with a view to collecting useful cost and other information for future reference.

In all the stage mentioned above, Group Dynamics plays a very important underlying role.

4. ORGANISING A VAVE FUNCTION

The end result or final goal of a VAVE activity is that it should be developed as a philosophy or way of life in the organisation. Just like the productivity or cost consciousness. The most ideal situation would be when everyone starts talking in terms of function and cost and behave accordingly. It has to be as necessary a part of employees' life, as is good house keeping, discipline and knowing duties and responsibilities.

Exposing everybody to this concept and approach is sure a herculean task and cannot be effected overnight. Even if serious and sincere efforts are made, it would take scores of years to build up to that stage. The only choice left then is to start the activity is selected areas, let the people start realising its role and necessity, and then slowly extend it to all spheres of life in the organisation. This requires the formulation of the VAVE activities.

A phased programme for developing VAVE culture in the organisation.

A full-fledged VAVE function should have to go through the following phases for effective implementation. Ref. Fig. 19.

Phase - 1 :	Value Engineering Cell	VEC Phase
Phase - 2 :	Value Engineering Department	VED Phase
Phase - 3 :	Value Engineering Teams (Product-wise or Department-wise)	VET Phase
Phase - 4 :	Value Engineering Circles	VEnCi Phase
Phase - 5 :	Value Engineering Culture	VEnCul Phase

DIFFERENT VAVE APPROACHES

S. NO.	APPROACH	METHODOLOGY	ANALYSIS & REMARKS
1.	Value Engineering Cell (VEC)	Normally a centralised cell under the Management Services function, comprises 2 to 4 members. This cell organises Training Programmes and appreciation courses for the executives and middle level management	It is treated as routine activity under training departments of the organisation. Apart from attending training programmes the members normally do not contribute any thing concrete. However, this cell definitely helps in generating an awareness of the technique in the employees. It has been seen that it does create an additional interest in the participants. The urge to do something generated, and few of the enthusiastic members do start spending more time to know more about the technique and its application.
2.	Value Engineering Department (VED)	A centralised function established more like any other function. This is headed by a full time Manager and supporting Engineers and Value Analysts. A target performance is established and the department is expected to fulfill the target by undertaking various studies.	Although a function, it operates more like a staff function and not as a line function. In most cases the acceptability of VED by the users is of a low order, because it is looked at either as an unavoidable evil or as a spying or auditing activity. There is generally a resistance from the designers and manufactures. VED is normally a step further of VEC, and the fact that a particular organisation has a VED does indicate the realisation of the management and the need for VAVE. If organisational backing is provided. VED will give much better and more concrete results than the VEC approach.

3.	Value Engineering Teams (VET)	In large size organisations there can be Value Engineering teams in each of the product groups or departments. Each of the groups can be exposed to a detailed application oriented training programme. This group normally can comprise the designers; manufacturing, and materials functions.	The acceptability of this team and its work is of a much higher degree because of the fact that they are considered to be inside people are known to the sections/departments. As quite a few members are from design or R&D, their suggestions are quickly accepted and implemented.
4.	Value Engineering Circles (VEnC)	Through the VEnCi activities and by exposing enmasse the employees to the VAVE programmes and through use of audiovisual aids, a mass recognition can be established. This would result into everybody taking care of the optimum VALUE in his sphere of activities	Mostly this would be very broad approach. It would work effectively like the Quality Circles programmes or Zero defects movements in Japan.
5.	Value Engineering Culture (VEnCul)		The ultimate can be achieved through this approach. Once an organisation has developed this culture it would automatically take care of the new entrants thinking process and this a full fledged VALUE culture can be established.

5. ORGANISATION FOR VAVE

The four Tier Approach

AS has been seen in the above chapter. VAVE is a multi-disciplinary approach involving various stages of decision making and different specialised disciplines and subjects. No VAVE exercises can be effective unless these multi agencies are grouped into one entity, supporting each other and contributing to the exercise. The main theme of the whole exercise is DECISION MAKING and IMPLEMENTING the RECOMMENDED ALTERNATIVES after a through EVALUATION.

The following table depicts various stages and phases of VAVE exercise and the levels of the management which would have to be involved at that stage of the exercise.

Level - 1: Top Management	-	Managing Director and All General Managers, Chief Executives and Heads of the Divisions or Departments
Level - 2: Senior Management	-	Senior Managers & Departmental Heads
Level - 3: Middle Management	-	Managers - Dy. Managers
Level - 4: Shop Floor Management	-	Foremen; Supervisors, etc.

As the exercise is applicable across the activities of any organisation the appropriate agencies equivalent to the above functional level should be involved.

VAVE a systematic approach

STAGE/PHASE OF VAVE	MANAGEMENT LEVELS	I	II	III	IV
VA Organisation Project Identification		Y	Y	Y	-
Project Potential & Selection		Y	Y	-	-
VAVE Team Formation		-	-	Y	-
Orientation of the Team		-	Y	Y	-
Evolving Alternatives		Y	Y	Y	Y
VA ACTION PLAN					
Orientation Phase		-	Y	Y	-
Information Phase		-	-	Y	Y
Speculation Phase		-	-	Y	Y
Evaluation Phase		-	Y	Y	-
Consolidation Phase		-	-	Y	-
Submission & Planning		-	-	Y	-
Wetting & Analysis of Recommendation		-	Y	-	-
Decision for Change (Financial & Technical)		Y	Y	-	-
Implementation Phase		-	-	Y	Y
Result Summarised Phase		-	-	Y	-
Re-evaluation Phase		-	Y	-	Y

Although the VAVE wave has caught up in Indian context, and also, through various exercises it has been established that VAVE does give results, already a frustration at the working levels has founded its roots and is fast growing into a small plant size, to be soon staking the shape of a big tree when it would become very difficult (if not impossible) to uproot it. The frustration has emerged basically from the fact that while the individuals working on VAVE projects are sure of the results, they are finding a cold shoulder from the management in implementation stage. In most of the cases the exercises remain on paper and serve as a mere academic interest rather than as a cost reduction tool. There is no dearth of individuals who are slowly withdrawing from this field and started relaxing back on the chairs. because of the frustration thus developed by not seeing the results implemented. The main reasons are that :

a) Either the suggestions have originated at a very low level in the organisation structure (This is the level which mainly does the detailed work, and is the back bone of change process)

OR

b) The creativity sessions (and for that matter the VAVE activities) are treated as a routine organisation matter without giving due importance.

Before an organisation gets into a full-time VAVE activity, there are certain questions to be answered. And unless the answer to all these questions (without any exception) is 'YES', there is perhaps not much fun in embarking upon this crusade.

a) HAS THE PROBLEM BEEN RECOGNISED BY THE PEOPLE AT THE HELM OF AFFAIRS?
b) DOES THE MANAGEMENT REALLY WANT A SOLUTION TO THE PROBLEM?
c) IS THERE ANY ESTABLISHED 'WILL TO IMPLEMENT SUGGESTIONS and WHETHER THE TOP IS COMMITTED TO EFFECT IMPROVEMENTS?
d) HAVE THE DESIGNERS, MANAGERS, FINANCIAL EXECUTIVES AND ALL OTHERS CONCERNED BEEN TAKEN INTO CONFIDENCE AND WHETHER THEY DO FEEL A PART OF THE TEAM?

VALUE MANAGEMENT

Implemented examples - Indian and Foreign

Type of Industry	Before VA	After VA	Benefits
(1)	(2)	(3)	(4)
1. INDIA **Chemical Factory**	a raw-material purchased at Rs. 15 per kutcha amount in western India	A similar raw-material of a some what different specification available at Rs. 9.50 per maund locally.	Approximate saving Rs. 80,000 to Rs. 1 Lakh per annum; less inventory cost as material is available locally.
Cigarette Company	Cardboard cartons Wooden boxes of a certain thickness and hoop iron for packing cigarettes	After analysing the methods of transportation and the possibility of damage in handling the thickness of timber for wooden boxes was reduced. The use of hoop iron and protective case sector were discontinued for road transport. Dwelling was not found necessary. Hoop iron width for shipments by rail was reduced and length of lap cut. Waterproof paper size was reduced and so on.	
Automobile Factory	Polished metal	Eliminated altogether as this cap merely covered a hole for insertion of automatic cigarette lighter; As the latter were not being provided at all in India, there was no point in even providing holes for them. Drilling of these holes was stopped too.	Saving in Production cost as drilling of holes was eliminated savings of purchase cost as caps were no longer required.

(1)	(2)	(3)	(4)
Automobile Factory	Rolled steel hollow section for windshield frame for automobile	Solid Aluminum extrusions	The former was imported, the latter is obtainable indigenously; saving of foreign exchange Rs. 1,60,000/- net saving Rs. 80,000/-
Railways	Laminated springs for railways to IRSS M-11 grades 1 & 2	Laminated springs to IRSS 10-49	Laminated spring of the former specification had to be imported or would have required 2 1/2 years to produce in India. By changing the specification it was possible to buy the entire quantity from India sources within a reasonable time.
Refrigerator Company	Proprietary brand of refrigerant	Different brand of refrigerant from a different source which served equally well	The former costs Rs. 2.50 per lb. A saving of 40%
Cement Factory	Standard and for cement testing Light on Buzzard sand imported from U.K.	Standard sand according to ISI specification issued in 1955 available indigenously from Madras	The imported sand cost Rs. 1000/- per ton. The Indian standard sand is available at Rs. 300 per ton from Madras. Saving of costs as well as foreign exchange.

(1)	(2)	(3)	(4)
Transformer & Switchgear (small industry)	a) Brass plug fastened by brass chain to prevent dust entering valve.	Chain eliminated & plug replaced by G.I. one.	
	b) LT Bush Button ends fastened to wooden piece with brass screws c) Gunmetal petcock for oil testing and checking	Replaced by G.I. Screws G.I. plugs to be used	Rs. 6249/- per annum savings doubles from next year as rate of production doubled
2. UNITED STATES **2.1**	5" Steel pin 5/16" diameter with deep conical impression at one end	The same pin with only half as deep conical impression price reduced from 20 cents a piece to 11 1/2 cents on the new design	Saving of 38%
2.2	A special type 1/10 the H.P. motor to fit a cramped	Newly designed motor 90% standard features	Price reduced from $ 59 to $ 27 or saving of 50%
2.3	An impregnated value body at $ 310 per thousand	The same made of superior material at $ 390 per thousand	Higher price was paid for lower ultimate cost. The former had 44% scrap in part processing whereas the latter had virtually no scrap. savings $ 204 per thousand even after paying higher price of $ 80 per piece.

(1)	(2)	(3)	(4)
2.4	Cover of menu card used for special airlines flight was embossed with silver to give high quality appearance	Silver embossing was replaced by two-color (blue and silver) design that maintained desired effect	Saving of 64%
2.5	Metal electrical component rack was chromium plated with a .0005 inch thick coating	Attractive but unnecessary finish was replaced with anodized coating covered with a dry film lub.	Saving of 41%
2.6	Heating element was coated with expensive layer of silver to protect surface and to protect surface & allow good heat transmission	Coating was switched to less expensive nickel which still gives the necessary protection	Saving of 55%
2.7	Carrying handle for portable fire extinguisher was made of an aluminum casting. Finishing were required	Design was switched to a plastic diecasting with color moulded in to the handle, size was reduced.	Saving of 67%
2.8	'Seat Occupied' Card for international airline was printed in two colors on both sides-English on one, Spanish on the other	Card was redesigned to contain both English, Spanish on one side of card. Second colour was eliminated as non-functional	Saving of 46%

(1)	(2)	(3)	(4)
2.9	Bolt for electric switch board was machined to order from solid bar stock.	Bolt was assembled by combining a standard rib-naked carriage belt with a simple screw machine product	Saving of 69%
2.10	Handsome and study latch was specified in original design of sheet metal coupling guard	Study revealed that appearance of latch was unimportant and high precision unnecessary	Saving of 98%
2.11	Nuclear power station guidance feature and lifting grab head	Funnel like guidance feature eliminated	47% cost reduction and also more robust.
3. BRITAIN 3.1	Sheets and strips	Bought in multiple sizes	Saving of 40%
3.2	Starter dog of diesel engine machined from hexagonal bar stock	Hexagon nut used as function 'turn crankshaft was redundant'	60% reduction in cost.
4. AUSTRALIA 4.1	Special machined bolt with hexagon head random-slotted	Some with rolled thread.	Saving of 75%
5. SWEDEN 5.1	A ceramic item	The same manufactured by a different process obtained from a new source of supply	Saving of 70%
6. WEST GERMANY 6.1	Water pump of washing machine	Redesign with change of materials replacement of bolts by rivets etc.,	Cost reduced from DM 4.70 to IM 1.86 with an annual production of 100000 machines, annual saving DM 2,84,000.

NPC STUDIES IN VALUE ANALYSIS - A BIRD's EYE-VIEW

	THE PROBLEM	FUNCTIONAL ANALYSIS AND FINDINGS	RESULTS
1.	Electrical Equipments-Production Capacity Limitation for Heavy Duty Motors	Capacity limitation for magnet frames of motors an analysis of the machinery of various surfaces was carried out with specific effects of the machined surfaces on the performance and reliability of the motors working.	18% of the total machinery was established as reduced out i.e. not serving any functional requirements and also not adding any thing to the esteem of the product. This effect in creation of about 22% additional capacity for production.
2.	Trip free mechanism used in switchgears No problem was faced because the supplies abound out and no crisis situation was created	The problem was undertaken on voluntary basis and the mechanism for manual tripping was analysed, with a view to attaining the purpose while getting rid of components in assembly.	Nine components were established to be redundant just by making a change in the location of a hole for push button on the cubic outside.
3.	Rotor end plate for D.C.motor. The production being time consuming and complicated	The functional requirements of end plate were established and a set of standard stamping already existing was selected to serve the function	Although the material cost went up, the total processing cost came down in a much higher proportion.
4.	Door handles for automobiles. No problems faced as a routine matter.	On voluntary basis the product was selected and functional analysis of various components was carried out. It was noticed that with each of the locking handle three non-locking handles were provided as a complete set. But the components used in both types were the same excepting that in the non-locking type they were blanked by using a cap.	A modification was made for the non-locking handle and seven components could be eliminated. Thus effecting an overall savings of about 25%.

5.	Heavy down time of the primary crushers of a copper concentration plant due to boulders blocking the passage	The system was analysed with a view to stopping the large size boulders being fed to the crushers. The analysis revealed that only in case of a particular combination of the material handling systems this phenomenon is prominent. The shovel bucket was recommended to be componentailsed so that during filling, the large size boulders are automatically segregated and do not come to the crusher at all.	No more incidents of crusher downtime and cost savings of about Rs. 7,00,000 per annum were effected.
6.	High consumption Ferromanagagese in Steel Making	The function requirement of Ferromanaganese in steel melting process was analysed. Compared with the idea, it seemed to be very much on higher side. An analysis of present practice and the areas of consumptions portion of the FeMn is burnt in the process because of addition in the melting furnace stage. It was established by the technology wing that the same effect could be achieved even by adding the pouring stage	Experimental runs had shown that the present norm of 22 Kgs/Mt can be brought down to almost 10 Kgs Mt.

7.	High consumption of grate bars in sintering furnace	The operating requirements and characteristics of the grate bars, with specific requirements of material competition, chemical contribution and heat resisting characteristics was established. It was found that the present grate bars are ordinary C-1 supplied by local suppliers. A high content was required, thereby raising the cost about 5 times.	The total down time cost of the furnace and the resulting production was more than offsetting the additional cost.
8.	Pickstick in a Power-loom		Redesigned to give double the life at an additional 20% cost.
9.	Picker in a Power-loom		Redesigned to give double the life with an additional 30% cost.