Value Engineering / Value Analysis

Value analysis is a system for use
when better than normal
results are needed.

L. D. Miles

Value cannot be obtained by reducing quality or reliability – both are very important value features of an item or a product. R.H.Clawson.

Value is the lowest price you must pay to provide
a reliable function or service L. D. Miles

The approach is not directed at how to
make the part for less, but rather
at how to achieve the
essential function
for less.
Clawson

Value Engineering

Value Engineering developed from a necessity to provide the same performance functions at a reduced cost. This was particularly true due World War II; as Juran (1979:16-14) states …"shortages of materials drove many companies to find substitute materials or designs for the specified materials and components." Shortages therefore gave "many opportunities for improvement". In our quest for continual improvement, techniques such as value engineering / value analysis are being increasingly utilised as a systematic method to assess products and services with the objective of reducing costs while retaining or indeed increasing performance. The father of value engineering / value analysis is acknowledged as Lawrence D. Miles, who was charged with "developing substitute materials to take over the function of more costly standard materials" at General Electric. He took this role on in 1947 and produced annual savings for the company in the region of $200,000 per annum (Clawson, 1970).

Lawrence D. Miles (1904-1985) the father of value engineering / value analysis

The origins of value engineering can be traced back to the 1940's when specialist engineers were employed to work with design and purchasing departments. The value engineers went beyond pure substitution of a component or product but 'analysed' the existing design with the objective of finding cost savings without affecting the function of the item. Value analysis and value engineering are terms synonymous with finding an alternative design to perform the function of an item at a lower cost.

Miles states.. "All cost is for function." To this end he advocated value analysis techniques that blend creativity with systematic problem solving techniques to identify the primary function of a product at the lowest cost. "Unnecessary cost provides neither quality, nor appearance, nor customer features ….. mind tuning is an essential step in problem solving."

Juran (1979:16-14) states that the central theme of the concept of value analysis is:

1. to identify the necessary function to be served by a component, product, or whatever, and
2. to find the most economical way of accomplishing that function

To develop the concept, Juran (1979:16-14) identifies several categories of the term 'value'.

- Use value - which is based on those properties of the product, which enable it to perform work or service.
- Cost value - which is based on the minimum cost of achieving a useful function
- Esteem value - which is based on those properties of the product, which contribute to pride of ownership.
- Exchange value – which is based on those properties which make a product valuable for exchange purposes

Clawson (1970) however states … "the true value analyst is relatively unconcerned with cost, exchange and esteem value. For his professional purposes, any item that will deliver basic function for the lowest cost will be the item of his choice". He goes on to state … " Use value differs from all other kinds of value …. because it is:

1. determined objectively

2. the highest use value has the lowest price tag; it is the relationship between actual cost of an item and the lowest price that must be paid for the item to perform reliably."

Examples of the different categories of value

Category of 'value'	Examples	Your Examples
Use value	Nail	
Cost value	Bus fare	
Esteem value	Gold watch	
Exchange value	Antique furniture	

The importance of value engineering / value analysis is in the application of the technique rather than the deployment of specialist 'engineers'. To this extent it is useful to develop a team approach, utilising personnel from different departments to systematically assess a product or service at various stages of its 'life cycle' i.e. product launch, maturity and decline. Value analysis can therefore be utilised throughout various stages of the life of a product or service, extending from the concept design stage through to prototyping, product launch, and throughout it's commercial life until the day the product or service is withdrawn.

Can you think of a product that has undergone re-design but still performs its primary function at a lower cost? The chances are that this product has been subject to value analysis techniques.

Clawson (1970:3) states the approach to value engineering is characterised by the following five questions:

1. What is it?
2. What does it do?
3. What does it cost?
4. What else will do the job?
5. What does that cost?

Both Juran and Clawson advocate that value engineering / value analysis as an organised approach to improvement studies of the product, service etc. Juran (1979:16-14,15) identifies the following approach to organising the way in which a product is analysed.

1. Define the nature of the term value – to distinguish more clearly the multiple objectives to be met.

2. Prepare a plan consisting of:

    a. Item selection, i.e., the product elements to be chosen for study
    b. Determine the essential function and cost of the item selected
    c. Develop alternatives to perform the essential function
    d. Analyse cost of alternatives
    e. Test and verify alternatives
    f. Submit proposal and follow-up

3. Prepare checklists as countdowns in studying problems.

4. Utilise tools such as Pareto Analysis for concentrating on high cost items, data books / software programs of quantified costs and related information.

5. Initiate training in the use of value analysis tools and techniques.

6. Set-up cross-functional teams to adopt value analysis tools and techniques.

Value Engineering

Value engineering is not a cost cutting exercise in which labour, materials, overheads etc. are systematically slashed. This approach often leads to important resources, skills and capabilities being cut to the extent that the end result leads to inferior product and service quality. Value engineering is focussed purely on identifying the function that will perform the job at the lowest cost. Other collateral gains include improved reliability, maintainability and produceability. What value engineering is not (Clawson, 1970) is "improving the part *as is*, rather than evaluating the function of the part. ….Value engineering does not accept the designed product and its component parts, but stresses cost reduction by defining the function of the product and redesigning accordingly to perform the function at the lowest possible cost."

> Value engineering challenges the very specification, design requirements and design itself.
>
> Clawson (1970)

The adoption of value engineering as a policy enables the organisation to develop a culture of cost and value consciousness. To maximise the benefits derived, the organisation must ensure it has created a framework that places the value engineering function at a sufficiently high level for it to be taken seriously but close enough to the operations level for it to be effective. "Management must be living and practising the value engineering concept, showing through their actions that value engineering is both desirable and attainable." Clawson (1970). The danger for many organisations is complacency, especially when sales and profit's are up.

Clawson (1970) states “The principal reason for poor value is the lack of an organised effort to obtain high value. Poor value develops in the following ways:

1. Temporary decisions – made under the pressure of meeting tight schedules.
2. Lack of essential information – leads to decisions based on honest but wrong beliefs.
3. Non-generation of ideas – high costs of items because of the lack of ideas that would produce the items at lower cost.
4. Personal inertia – built on old tradition and the way things have always been.
5. Non-troublesome items – result in hidden high costs.
6. Predetermined reactions – based on habit. Why change, ‘don’t rock the boat’ syndrome.
7. Reluctance to seek advice – ‘management know best’

To create an organised approach and derive the benefits of value engineering, goals, policy, communication and training need to be initiated. Clawson (1970) suggests the following goals should be set. He however leaves the quantification of these goals with the individual organisation:

A Goals

1. Train __ employees in the techniques of value engineering.
2. Place __ employees in industrial/professional committees.
3. Conduct __ presentations to suppliers and subcontractors.
4. Deliver __ value engineering presentations to management.
5. Staff __ areas of the organisation with named value personnel.
6. Organise __ task forces to identify high-cost areas.
7. Attend __ seminars given by other companies and invite them back.
8. Motivate the practice of value engineering by news letters, posters, lectures, displays and videos.
9. Develop new techniques in value engineering.

B Value Engineering Policy

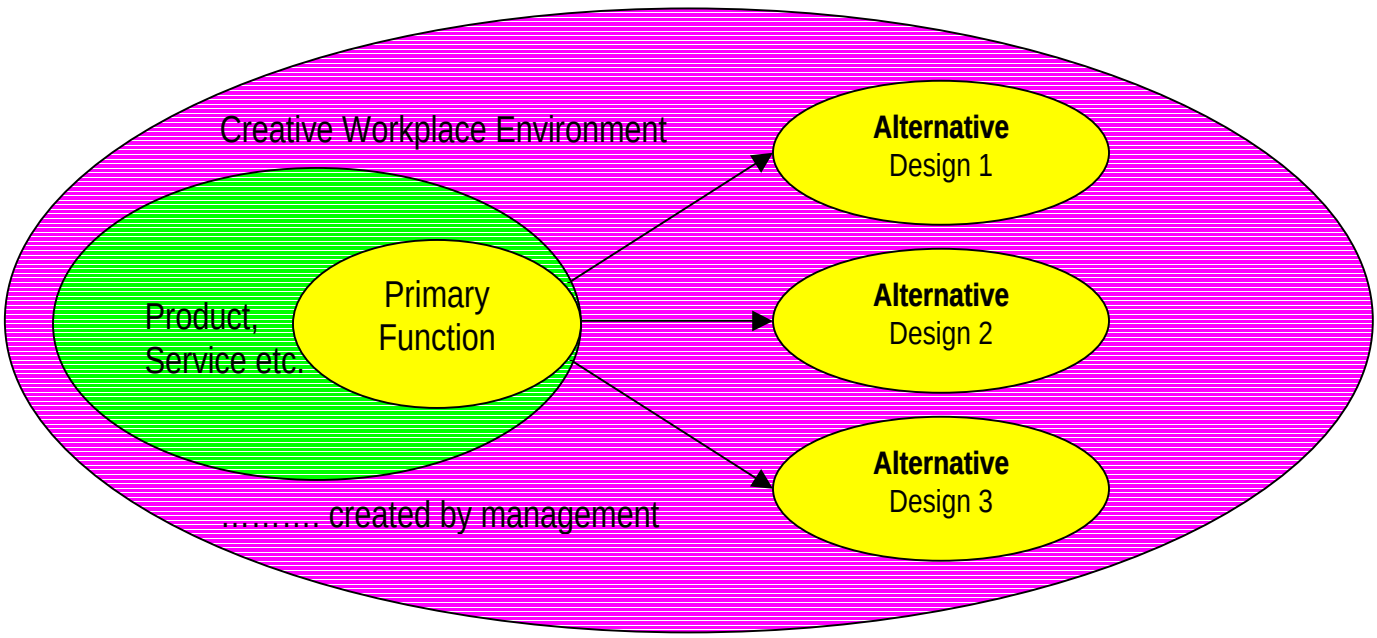
1. Publish a value engineering policy as a means of communicating the aims of value engineering. Management must however be seen as well as heard. “There is nothing that will so convince the lower echelons of the decision-maker’s true intent than to actually see top management participating in value engineering activities.”

Through policy and objectives the organisation can begin to attain major cost reduction benefits based on identifying ‘a better way’.

> “There’s a way to do it better …….find it”
>
> “Genius is ten percent inspiration and ninety percent perspiration”
>
> Thomas Edison

A value engineering policy enable the organisation to design products and services that cost less, work better and are produced quicker. Clawson (1970) suggests that value engineering enables the management team to create a ‘creative atmosphere’ one in which alternative designs can be generated that focus on fundamentals – the function of the product. By creating an environment in which the disciplines of value analysis and blended with the creativity of looking outside of the box, “average people working together, accomplish more than average results”. The disciplined approach to value engineering demands a methodology that harnesses creative problem solving. Clawson (1970) states that value is related to function. This relationship can be brought together through creative thinking and teamworking.

Before value engineering is introduced, it must be internally marketed – sold to employees so that concerns and issues are discussed and the benefits of value engineering communicated.



There are two root causes to inferior design according to Clawson (1970) :

- Time – to get the job done in a hurry, regardless
- Tradition – the voice of the past. In other words if it isn't broken, don't fix it

Changing attitude is as much a problem as is to convince the management team that there is an alternative to traditional cost cutting exercises.

Value engineering demands complete objectivity, an open mind and consideration of all possible effects.
Clawson 1970

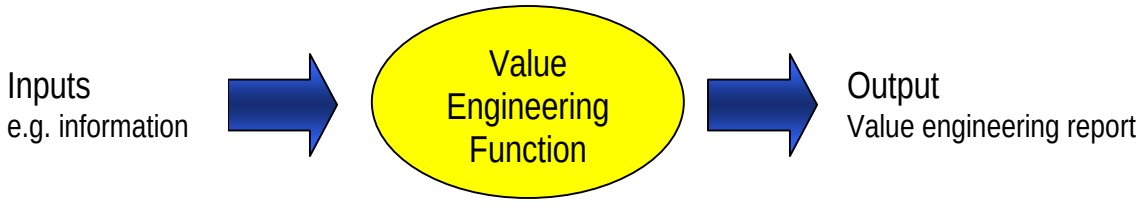
Value engineering demands a training programme that is focused on two important aspects:

1. Technical – cost alternatives
2. Human – the decision making process

The later demands management to create creativity and encourage communication and team working – not the easiest of objectives, but ones that are common to many other 'management initiatives'.

Whether the organization crates a centralised on decentralised value engineering function will depend on the size of the organization and the type of product or service offered. Clawson (1970) suggests where the product or service is primarily using purchased parts with little design change from year to year … value engineering could be the responsibility of the purchasing department. On the other hand when the product is complex or highly technical with frequent design changes the value engineering function could be located in the technical engineering department.

Having established the potential benefits of value engineering, the task for the value engineering team is to realise those benefits. Clawson (1970) has once again something to say on this issue. "The value engineer can be brilliant, creative, handle people, reduce costs, improve products endlessly, but unless you can sell your ideas through live-on-your-feet presentations, and through effective written communication, forget it."



Effective communication is critical at both the input and output stages of the value engineering study.

To achieve the value engineering objective of finding an alternative solution to the original design may encounter resistance. To overcome the 'human' resistance, relationships need to be established and confidence gained by providing services that are not contentious. Offering to provide information, supporting other department initiatives and 'bringing to the table' expertise that would otherwise be time consuming for the other party may be ways of gaining this confidence and showing the sceptics the value engineer's credentials. Once barriers are removed it may become easier to gain support for value engineering projects that need to step outside of the box.

Clawson (1970) states … "In the selection of projects there are three general areas to watch:

1. Yourself
2. The item itself
3. The item in the marketplace

Yourself

- Sixth sense for the successful project
- Availability of data (if not don't start)
- Create balance between short and long term projects
- Match between the project and your skills
- Estimate potential savings early
- Equate resources (the budget) to projects

The item

- Is the item old – if so, plenty of potential
- If it is complex – plenty of potential
- Are there procurement problems – potential
- Does cost appear high – high priority qualifier
- Are materials exotic, is there waste – potential for reductions
- Complicated tooling and equipment required – could be simplified
- Over designed – look for tight tolerances
- Volume or usage high – saving pennies could reap high returns

- Support costs high – improve reliability and maintainability
- Interchangeability – very careful study required before changes are made

Performance of item in market place

- High profit margin – priority to maximise savings
- Poor competitive position –assess balance between primary, secondary and tertiary functions
- High levels of customer complaints – A1 priority
- Future potential – can value engineering restore poor sales performance?

Clawson (1970) identifies six value engineering phases:

1. Information phase
2. Functional analysis phase
3. Speculative phase
4. Evaluation phase
5. Implementation phase
6. Presentation phase

He stresses the importance of documentation at all stages, as the objective is to produce a credible report that communicates with the decision makers. The documentation should be in the form of worksheets for each of the six stages. A title page detailing the item under study, value engineering team, value engineering study number etc. should be raised prior to the commencement of the study.

Clawson (1970) suggests that a data package should be assembled prior to the study. For a product or manufactured item the package should include:

- Detail of assembly drawings
- Specification and performance requirements
- Operation sheets /manufacturing plans
- Cost data
- A model, assembly or parts
- Production quantity forecast

For a service or process:

- Chart of description of organisation responsibilities
- Information flowchart
- Sequence of events
- Flow time
- Frequency of activity
- Equipment capability and utilization
- Present capital investment
- Material and supply costs
- Maintenance costs
- Recurring labour costs and overhead

Worksheets for each of the phases should be designed to collect information that answers the following questions:

1. INFORMATION PHASE

1. What is it?
2. What does it cost?

2. FUNCTIONAL ANALYSIS PHASE

1. What does it do?
2. What is that worth?
3. What does that cost?

- Identify and analyse function
- Determine worth
- Know your costs

3. SPECULATIVE PHASE

1. What else will do the job?

4. EVALUATION PHASE

1. Will it work?
2. What does it cost?

5. IMPLEMENTATION PHASE

1. Can we get approval?

6. PRESENTATION PHASE

1. Why am I writing this report?
2. Who will read it?
3. Will I need detailed support for ideas?
4. What are my specific ideas?
5. Can I group my ideas?

Before value engineering function begins to undertake its goals the following questions should be answered?

- Has the concept of value engineering been sold to the management team?
- Has a value engineering policy been established?
- Have value engineering personnel been trained?
- Has a value engineering team been formed?

When conducting the functional analysis Clawson (1970) states ….. “The approach is not directed at how to make the part for less, but rather at how to achieve the essential function for less.”

When conducting value analysis, care should be taken not to make presumptions about the function of an item because of its design description. This could lead to unnecessary costs being incurred. Clawson (1970) states “Value engineering concentrates on the true identification of function leading to the door being opened to a wider variety of possible alternatives that would do the required job.” Describing the function using two words, a verb followed by a noun enables the value engineering team to focus on the true function under evaluation. Clawson (1970) gives the following examples of verbs and nouns:

Action Verb	State of Being Verb
transmit	facilitate
support	increase
stop	provide
conduct	control
store	limit

Noun
torque
current
corrosion
esteem

In the following examples Clawson (1970) the verb-noun combination is used to describe the function of the item:

Subject of study	Function	
	Verb	Noun
shaft	transmits	torque *
wire	conducts	current*
paint	prevents	corrosion
colour	provides	esteem

* By using a measurable noun, the function can be quantified.

Worth

When calculating worth Clawson (1970) suggests the following approaches:

"The (value) worth of the function is the lowest price we must pay to reliably accomplish a given function. Estimates depend on:

- The state of the art
- The thoroughness of the value engineering study
- The accuracy of the available information

Calculation of worth

- Worth by judgement and experience – consider it to be your money that you are spending – what would you consider the item be worth to perform a given function.

- Worth by experience – searching mentally for other existing products or services that would do the same function.

- Worth by 'blast and refine' – pursues a concept to 'blast' away all the features of the design of an item to the simple item that could perform the function. Then by relating the cost of the simple object to the cost of the design, it is possible to determine whether or not there is room for value improvement.

- Worth by comparison to existing standards – no need to design the wheel. The secret here being knowing where and how to access appropriate standards.

- Worth by value factors – arbitrary scale say from 1 to 10. Position the item on the scale, suggest alternatives and estimate relative positions. Ideas falling below are developed.

- Worth by establishment of cost targets – say reduce by 30% and working at the problem until the target is achieved.

- Worth by value standards – develop standards for function that recur frequently.

The systematic approach of value engineering suggested by Clawson (1970) will allow the organisation to accrue cost benefits that achieve better than average results. Can you think of an item that might result in cost reductions through value engineering techniques?

References:

Juran, J.M. (1979) Quality Control Handbook. McGraw Hill

Clawson,R.H. (1970) Value Engineering for Managers. Auerbach

Lawrence D. Miles
http://www.valuefoundation.org/whois.htm