

Conference Paper



VALUE ENGINEERING

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Industries grow through giving consumers more of what they want per dollar. To do so while providing satisfactory dividends takes some doing.

As new approaches to accomplish functions in the product have been developed, so have new approaches for enhancing the cost value in the product.

One such approach is value engineering.

NEW TECHNOLOGY

This is not a new name for an existing technology but rather a new technology. It represents a new approach to the two-headed task of increasing value to the customer and increasing dividends to the manufacturer.

The engineer or manager who notes some familiar techniques in the value engineering system and might be thus induced to, in error, feel "old-but-good stuff" may well review that the new usually consists largely of re-arrangement of the familiar, with some different emphasis and usually with one or two new elements added.

Consider the automobile, for instance. It was created largely through a re-arrangement of known components such as iron, copper, paint, fabric, wheels, and engines.

The same components, with a few others added, were again in later years re-arranged into the airplane, creating a new product and increasing efficiency--if transporting people over long distances with comfort, safety, and speed is the purpose--five to ten times.

Similarly, value engineering is a creation born largely through the rearrangement of known concepts, plus the addition of a few new ones. It is used with knowledge from many technologies for the specific purpose of efficiently identifying unnecessary costs.

The engineer who wishes to delve deeper than our time will permit, may do so by securing the new McGraw-Hill Book, "Techniques of Value Analysis and Engineering."

UNDERSTANDING "VALUE"

Although the term "Value" is one of our colorful multi-meaning English words--as applied to a product or service--it is generally considered that value exists if appropriate performance and appropriate costs have been secured.

For the sake of contrast, it may well be considered that...

...the field of performance engineering has for its objective the reliable achievement of overall performance, service, maintenance, life, and other factors which the customer has learned to want.

...the field of value engineering has for its objective the achievement of these established performance factors at costs sufficiently competitive to provide the reasonable dividends so aptly brought into focus by our chairman so that the business can continue to live and contribute to mankind.

The techniques, tools and approaches used in each of these two essential areas may be very different.

It is our objective to identify and describe some of the new techniques and areas of higher emphasis.

The manager may well recognize the matter of timing as having highest significance.

TIMING*

In general, the production of a product involves three cycles. First is the research and development stage in which knowledge is extended toward innovation to create new functions, to provide additional functions, and to accomplish existing functions more reliably or efficiently. The resultant products are awaited with anticipation, and, if successful, they are sold in sufficient numbers to support continued performance studies.

Then comes the second cycle, the growth stage. The product, having proved that it fills a need, gains in customer demand, competition enters the field, and it becomes evident that the product must be produced at lower costs in order to sell competitively in sufficient quantities.

The third cycle, the maturity stage, is reached when the product has matured fully. Research and development are no longer making large contributions to the efficiency with which functions are accomplished, to the life of the product, or to the addition of new functions. Thus the prime task of the manufacturer becomes one of tackling the value part of the job so well that product leadership will be maintained primarily by having performance equality and value leadership.

Whether in the maturity cycle a business continues to increase in profitable sales volume or starts to decrease, then drops out of the field, is normally governed by the degree to which it recognizes this shift from performance engineering to value engineering emphasis at the right time, and by the effectiveness with which it shifts its use of resources and competence, as compared with its competitors.

Most appliances are in the maturity stage now, thus the value engineering emphasis is most appropriate.

CUSTOMER FUNCTIONS - USE AND ESTEEM

It is a basic concept of value engineering that each cost element must add commensurate customer function; i. e. , each element of cost, taken individually is justified only if it adds customer function.

Customer function is divided into two classes...

...functions which perform the use or service the customer wants.
These are called "use" functions.

...functions which provide the appearance or features which the customer wants.
These are called "esteem" functions.

Both are equally important. The engineering challenge is to provide them in proper proportion and at appropriate costs.

Use value or function consists of the properties and qualities which accomplish a use, work or service. Long life, ease of maintenance and similar factors are a part of use value.

Esteem value or function consists of those properties, or features, or appearance items which cause the customer to want to secure the product or service.

In the technology of value engineering, costs of each are separately identified and evaluated.

BASIC STEPS OF VALUE ENGINEERING

Basic steps include...

...identify the function or functions.

This includes dividing between "use" and "esteem".

...evaluate each function--and each group of functions in terms of dollars--by comparison.

This again includes careful division between "use" and "esteem" functions.

...cause value alternatives to be developed.

IDENTIFY THE FUNCTION

Any useful product or service has a prime use function. That function can usually be described by a two-word definition such as, provide light, pump water, indicate time, exclude dust, support handle.

An electric refrigerator has the prime function of preserving food by electrical means. The added features of revolving shelves, storage space in the door, shape and color of cabinet, may be esteem functions.

Clear identification and separation of functions is one of the value engineer's initial steps.

Evaluation of each in dollars becomes the second act.

EVALUATE THE FUNCTION

Evaluate the function by comparison. Value at present being more a relative than an absolute measure, the comparison approach must be used in evaluating functions. The basic question, "Is the function accomplished reliably at good cost?" can be answered only by comparison.

It can be said almost without fear of contradiction that, if there is no comparison, there is no evaluation. All evaluation results from comparison of some kind: in some instances, comparison with standards; in other instances, comparison with similar items; and in still others, comparison with partially similar items. If, in the pursuit of better value, functions have not been identified and these functions have not been evaluated by comparison, then the process has not been value analysis but cost analysis.

The technique of function evaluation in dollars is one of the new elements of value engineering.

Evaluating a function--i. e., assigning a dollar and cents figure to it which is the lowest cost to reliably accomplish the required function--will be determined by a creative search for engineering, manufacturing, and other value alternatives which would reliably accomplish the total function together with the overall costs involved. Obviously, this evaluation will be just as good as the tools and knowledge and effectiveness of the evaluator; for example--evaluate the function of containing 200 gallons of gasoline in a landing craft which has a useful life of eight years. What is the value? Four 50-gallon drums might cost a total of \$25. But probably they wouldn't meet environment conditions. They would require some coatings. As a first guess, it is estimated that the coatings would slightly more than double the cost. Estimate--\$60. Now the function has been temporarily evaluated at \$60.

Evaluation is always completed before the item is planned or decisions made. It often leads to new and startlingly simple, reliable, and low-cost solutions. In this example, the specification actually called for specially-fabricated, special alloy tanks costing \$520 each. The result was that in this procurement of tanks for 1000 ships, the cost to the taxpayers, instead of being the expected \$520,000 was \$80,000... and the function was indeed accomplished by using four drums with appropriate coatings just as on the preliminary evaluations, excepting that the actual costs were \$80.

For another example, consider the steel stud spacer used to hold the timer onto an appliance. It was 2" long--the spacer part being 1/4" diameter and the fastener part being 1/8". Its manufacturing cost on the available automatic screw machine equipment would be 8¢.

But what is the value of the function?

First, what is the function?

There are two precise functions...

1st - a spacing function.

2nd - a holding function.

Each is evaluated separately.

They are use functions.

The spacing function would be accomplished by a rolled spacer at 1/2¢.

The holding function, by a steel screw at 1/2¢.

Thus the entire function of the part has a value of approximately 1¢ - not 8¢.

CAUSE ALTERNATIVES TO BE DEVELOPED

A different design and manufacturing approach is mandatory. As a result, a supplier of specialties is searched out who would use steel wire as base material, coin two heads, roll two threads and provide the totally functional part for .8¢ in lieu of the originally-planned 8¢.

The evaluation of the function by comparison provided criteria which forced the decisions of design approach--material, process, manufacturing set-up, etc.--into areas which resulted in 1/10 of the cost for identical quality.

Blast, Create, Refine - This is a special technique usually helpful in reaching value objectives. First, it serves to eliminate what is in immediate view so that the mind is no longer channeled and so that thinking in totally different, more effective directions is not stifled. Second, it directs thinking to basic considerations. Third, it provides a mechanism for building that which is needed on basic considerations.

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 over-simple terms.

The aims of the steps in the use of this 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, processes, 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 the function.

Create. Using intense creativity, this step should serve to generate alternative means by which the concepts revealed by the blasting can be modified to accomplish a large part of the function with pertinent increases 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 necessary created alternatives are added to the functions which would be accomplished by the blasted product. These are further sifted and refined, adding additional integers of function with additional integers of cost, until the refined product fully accomplishes the total function. It is not uncommon for the resultant newly constructed product concept to accomplish the total functions with the same reliability and overall benefits for a cost of one-half to one-tenth of the original.

For example, this approach was also applied in each of the two foregoing examples of evaluating function. The \$520 specification gasoline tank was "blasted" mentally to four 50-gallon drums at \$28 which would not accomplish the entire function . . . then after creativity developed suitable coating . . . the product was refined to bring the total cost with all functions reliably accomplished to \$80. In the second example, the spacer stud was "blasted" to a piece of wire; then, through creative alternatives, refined by adding two heads and two threads so that all functions were fully accomplished.

Twelve other techniques complete the formal techniques of value engineering.

EFFECTIVE ORGANIZATION FOR VALUE ENGINEERING WORK

Performance orientation having been of maximum importance in the industrial development of the United States, management people have learned quite precisely how to effectively accomplish performance-oriented assignments. It has been expected that appropriate value actions will normally be taken in addition to carrying out the performance-oriented assignment.

This means that getting value has been considered to be somewhat similar to breathing. As the individual takes his bath, has his breakfast, and drives his car to work, he just continues breathing, and he does a reasonable job of it at all times. Care is taken that air is provided for breathing, and that nothing obstructs ability to breathe.

Under that traditional system, value is everyone's business, whether his specific assignment is to design the product, to handle its drafting, to engineer its tooling, or to lay out the factory. Periodically, emphasis is placed upon it. Periodic drives are made.

That method of handling value is, in fact, satisfactory as long as competitors use the same method.

Industry is learning that there is a vast difference between the "everyone-does-it" result and the result which is achieved by specially trained men using an appropriate set of techniques and a specialized universe of knowledge. So managements of competitive businesses--businesses in which value is important--are learning that it is efficient to provide value consultation to aid their decision makers at the right times and to the right extent.

The value engineer is not a specialist in any sensitive area, but an "extreme generalist." He does not know steels in depth, electronic circuits in depth, vacuum castings in depth or any other specific traditional technology. What he knows and uses in depth is a system for identifying function, for evaluating functions in dollars, and for starting a chain of activity which will produce, from vast and diverse resources, the economic solutions to the problem, often "ready to use."

Is he a crutch? Is an advanced mathematician a crutch--is a specialist in servo-mechanisms a crutch--or is he the efficient way to accomplish the objective?

The company which is well organized to render stewardship to its owners in the area of dividend building through value engineering will provide suitable orientation and indoctrination to all levels of company decision-making personnel. This will vary from a few hours for top management to several days for engineering, drafting and buying personnel who have the double opportunity of directly contributing more in the area and of utilizing the contribution of their available professional value engineering consultants.

As management sets challenging economic goals to parallel the challenging technical goals of their engineers, management work must also include...

planning the economic or cost results expected of each value engineering man or group;

providing to them the tools their technology requires;

pacings them;

directing changes as new influences arise;

progressively measuring their work, progress and results;

suitable periodic reporting to upper levels relating to them.

I was thrilled last week to open one of the current engineering magazines and to find an editorial entitled, "Growing Up Gracefully" followed by an article on "Value Engineering." "Growing Up Gracefully" is the purpose of all of us in this new profession.

The time has come for all of us in manufacturing and engineering not only in the appliance but in all industrial and military business to set for ourselves economic specifications which are as severe as the technical specifications we have always set and through the new technology of value engineering to meet them.

*Some items are quoted from "Techniques of Value Analysis and Engineering" McGraw-Hill Publishing Company, 300 W. 42nd Street, New York, New York
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