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TECHNIQUES OF VALUE ANALYSIS AND ENGINEERING

by

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As the technology of Quality Control rose from economic need, so has the growing technology of Value Analysis.

As the objective, in very general terms, of the Quality Control Program has been to assure that the product accomplishes the functions the customer wants--well and reliably--so the general objective of Value Analysis is to assure that the functions which the customer wants are accomplished at appropriate costs.

In preparing for this discussion with you, I asked a sampling of people two questions:

1. What do you mean when you say a product has good quality?
2. What do you mean when you say a product has good value?

The consensus of the answers was this:

1. If a product...

"does what I expect it to
as long as I expect it to...

it has good quality."

2. If a product...

"does what I expect it to
as long as I expect it to...
and - costs what I think it should..."

it has good value."

These simple statements will confirm the more sophisticated charter which started the research work resulting in the techniques of Value Analysis a few years ago.

The objective was to develop techniques which would keep quality, safety factors and customer features but more efficiently and effectively provide appropriate costs.

LOWER COST AND BETTER QUALITY

As the special techniques were developed, it was a gratifying surprise to find that they improved value two ways -- one by lowering costs, a second by improving quality.

Before proceeding further, let's lay to rest two popular misconceptions.

These two, which are entirely too general, are:

1. "The function of value analysis is to identify and cause to be removed all costs which provide extra safety, extra quality, and extra life beyond the minimum needs. It is the aim of value analysis to remove all of the quality which can be eliminated without having the product fall apart in its customary use."

This statement is totally false in every degree of its implication. The use of the value analysis techniques identifies unnecessary cost; i. e., cost which does not add to safety, to performance, to life, or to the appearance desired by the customer and which, in fact, adds nothing whatsoever to the product under any condition.

2. "Lower cost means lower quality."

This common belief, which is often carried over from early childhood and which normally persists to control vital decisions, is also entirely false. Cost and quality have no direct relationship. Indeed, it frequently occurs that the highest cost gives the lowest quality. The reader will add greatly to his value competence if, at this point, he frees himself of any remaining tie to his childhood experience of buying small oranges for 25 cents a dozen and larger ones for 50 cents.

The reason for the existence of any product is that it accomplishes a certain function or a certain group of functions. Good quality comes with the selection of good answers to the question of how to use ideas, materials, processes, parts, and human efforts to accomplish these functions. Poor quality results from having poor answers to the questions. It is as simple as that. Cost is not part of quality determination.

Of course, as you all know too well, good quality can be lost several ways--

- inappropriate equipment
- careless workmanship
- haphazard management practices
- or perhaps trying to accomplish the job the hard--difficult or impossible way.

Professional men in quality control will recognize in the value analysis and engineering system large help in the latter area.

Often the cause of undependable quality is that the simple, practical, low-cost way for accomplishing the functions which the customer needs simply have not been learned, developed, and specified.

With the factual situation in clear focus, it will be recognized that value analysis and quality control have joint opportunities. Value analysis techniques can have an important impact on the solving of quality problems, and in turn, the quality control activity is an important means of identifying the areas in which contributions can be made by the use of value techniques. Whenever quality problems exist, it may mean that the functions involved are not being secured in a suitable manner. This provides one clear start for the effective application of value analysis.

As a good grade of quality can be lost in various operations during the life of the product--so a good grade of value may be lost at various stages in the product cycle.

Some of the most important are the following:

1. The customer understanding stage.
2. The product or service concept stage.
3. The design concept stage.
4. The design detail stage.
5. The "manufacturing decisions" stage.
6. The purchasing operation.
7. The sales methods and approach stage.

Less than the optimum actions and decisions in any of these stages outcrop as "deficient value."

What then is the system of value analysis and engineering techniques which undertakes to cope effectively with this wide range of product or process or service activity areas?

Value analysis is a philosophy implemented by the use of a specific set of techniques, a body of knowledge, and a group of learned skills. It is an organized creative approach which has for its purpose the efficient identification of unnecessary cost; i. e., cost which provides neither quality nor use nor life nor appearance nor customer features.

The focus of all value analysis and engineering is function.

What function or functions does the customer want? What is the appropriate cost (value) of these functions? What are the alternative reliable means for securing them? What is the cost of each means? What are the roadblocks or "stoppers" which prevent it from being done that way? How are they overcome in order to proceed with the low-cost simple reliable solutions?

Three basic steps are carried out by the aid of a job plan and thirteen special techniques--

The basic steps are:

1. Identify the function.
2. Evaluate it by comparison in terms of dollars.
3. Cause value alternatives to be developed.

Step 1: IDENTIFY THE FUNCTION.

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

In addition, there may be secondary functions involved. A light source may be required to resist shock, a pump for domestic use to operate at a low noise level, a clock or watch to provide attractiveness, an umbrella to be useful as a cane, a dust enclosure to allow access to interiors, and a handle support to provide for locking.

Step 2: EVALUATE THE FUNCTION BY COMPARISON.

The functions are evaluated in terms of dollars. Value being a relative rather than an absolute measure, the comparison approach must be used in evaluating functions. The basic question, "Is the function accomplished reliably at the best cost?" can be answered only by comparing with other ingeniously created alternatives which would accomplish the functions.

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.

Step 3: CAUSE VALUE ALTERNATIVES TO BE DEVELOPED.

Realistic situations must be faced, objections overcome, and effective engineering, manufacturing, and other alternatives developed.

In the search for, and selection of, alternatives, attention must be constantly focused on functions and not merely on a material, part, or device as such. Unless this is done, it is easy to fall into the trap of considering an alternative that may impair the designed-in function and thus fail to meet the fundamental requirement of value analysis that the needed function must be accomplished reliably at the lowest cost.

PHASES OF THE JOB PLAN

Phase 1: ORIENTATION.

The stage is set by establishing:

What is to be accomplished?

What is it that the customer really needs or wants?

What are the desirable characteristics with respect to size, weight, appearance, durability, etc.?

Phase 2: INFORMATION.

Here, the concern is to:

Secure all pertinent information.

Phase 3: SPECULATION.

Having acquired understanding and information, we have laid the foundation for the application of various techniques to generate every possible solution to the over-all problems involved, to the parts of problems, and to the individual problems---to derive the fullest benefit from creative power.

Phase 4: ANALYSIS.

Estimate the dollar value of each exposed idea.

Develop the ideas.

Select the ideas and approaches which have the most promise.

Phase 5: PROGRAM PLANNING.

Break the job down into a progression of functional areas.

Select the best specialists for consultation.

Select the best vendors for consultation.

Establish a program of investigation.

Phase 6: PROGRAM EXECUTION.

Pursue constantly, regularly, thoroughly, and intensively each of the avenues set up in the program-planning phase.

Stay with each promising suggestion and help to overcome difficulties until definite, tangible, and usable results are secured.

Phase 7: STATUS SUMMARY AND CONCLUSION.

Prepare suitable summary of alternatives and conclusions.

SPECIAL TECHNIQUES

The special techniques are:

First... means for establishing proper value--appropriate cost--function by function.

Second... means for identifying the deterring factors or roadblocks.

Third... means useful in overcoming them.

Space will not allow a discussion of them here. Some of them are:

Avoid generalities--get down to specifics.

Get and understand all available meaningful costs.

Use information only from the best source.

Blast, create, refine.

Identify and overcome roadblocks.

Utilize high creativity.

Utilize industry specialists to extend specialized knowledge.

Etc.

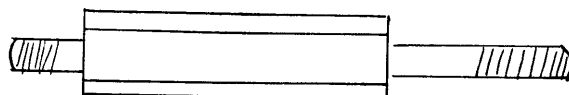
A specially arranged system of knowledge used in conjunction with the techniques accelerates results.

The following example will add understanding and clarity.

PRECISELY WHAT IS MOST SIGNIFICANTLY NEW AND DIFFERENT IN THE APPROACH AND TECHNIQUE?

This will be illustrated by comparison with a more traditional approach.

A spacer stud is required to fasten a timer to an appliance. Naturally quantities are large. Steel is acceptable.



The Conventional Approach

(It is not intended to down-rate the conventional approach, but rather to highlight differences.)

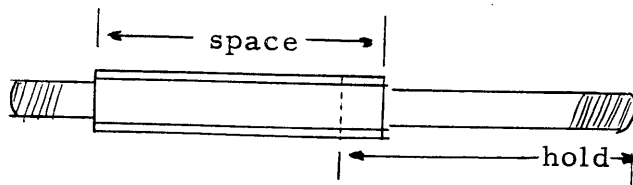
The engineer, with his manufacturing methods and processes man and his draftsman, if such exist as separate people, considers different types of machines and of manufacturing processes for making this spacer stud, or one which would accomplish its function. The company has a well-equipped screw machine department and it seems obviously a screw machine part. Design proceeds along the line of securing standard steel stock for economy of purchase and ease of procurement, arranging to buy it in the largest practical economical lot sizes, buying hex stock since it is the same cost as round stock and provides for the use of a wrench at assembly, selecting proper tooling for the screw machines, developing maximum efficient cutting speed, planning the most efficient screw machine cycle, developing appropriate time standards, making arrangements for automatic deburring, automatic cleaning, a minimum of handling, etc. Often a study will be made of suppliers providing attachments for the screw machine which might accelerate the work.

These steps were, in fact, carried out in connection with this part. The manufacturing cost--material, labor, and overhead--were 8¢ each.

The Approach of the Value Engineering and Analysis System

Identifying The Functions.

What is the function which the part must perform ?



There are two functions--to hold, and to space.

Evaluating The Functions.

By comparison, what is the appropriate cost (value) for the holding function?
what is the appropriate cost (value) for the spacing function ?

Value is now determined for each function separately by comparison. The holding function could be reliably accomplished by a steel screw, for example, which costs $1/2\text{¢}$. Therefore, the value of the holding function is not over $1/2\text{¢}$

The spacing function could in general be accomplished by a cut-off length of tubing or a rolled spacer which would cost about $1/4\text{¢}$

Adding, we have a value for the two functions of $3/4\text{¢}$

Causing Alternatives To Be Developed.

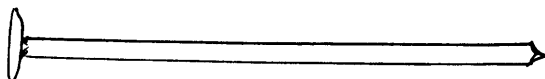
Our work from now on is directed in several respects:

1. We will not expend time developing the details of any approach which will not accomplish this entire function for in the order of 1¢ .
2. We will overcome sufficient lacks of idea, of information, of appropriate design concept so that we will provide a material, design, and product which will accomplish the functions reliably and in this area of cost.

But, how do we get started?

Use Special Technique. . . "Blast--Create--Refine".

We know we cannot use the screw machine approach because we must arrive at costs approximately $1/10$ of those which would result. Help in getting started is sought from every source. Much help is found in the specific value analysis techniques. The one which formed a mechanism for this item was. . . "Blast--Create--Refine." Thinking started with an eight-penny nail which was approximately the appropriate size, contained a head and cost $1/10\text{¢}$. Of course, it would not perform the function.



Creating and refining, the answers are developed to the question. . .

What must be done to the nail so that it will accomplish both functions reliably?

What will be the added cost of each added operation?

First, the head must be moved down slightly on the shank.

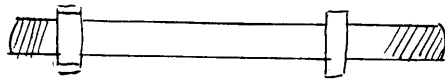
Second, it must be made hexagon.

Third, another head must be made in the middle of the nail to provide the necessary spacing action.

Fourth, threads must be rolled on each end of the modified nail.

Suppliers in this type of business said they could do it and, in fact, did so--the cost becoming .8¢.

The result--because the value engineering technique of "evaluate the function in dollars" before starting any type of work upon it was employed and because other appropriate techniques were employed to produce the necessary new ideas and approaches, the functions were reliably secured for their value which was 1/10 of the cost which resulted in the absence of the original function evaluation.



In conclusion, one key technique in the value analysis and engineering system, and which is a contribution of these techniques to technology, is this preliminary EVALUATION OF FUNCTION.

For a military example recall one of the first jobs in which the Bureau of Ships used value engineering techniques--a procurement of 1000 landing craft. One of the items of cost was the special specification, specially fabricated steel tank for containing 200 gallons of gasoline which was quoted at \$520 each--\$520,000 for the procurement. The Bureau of Ships value engineers evaluated this function by comparison to four 50-gallon drums costing \$28. Now, with this approximate value of the function in mind, which did not include the necessary characteristic of resisting certain environmental conditions, they secured suggestions and quotations for providing the environmental treatment and coatings to the tanks. The result was that the function of containing the gasoline was provided for \$80 and, because this approach was used, the taxpayers paid only \$80,000 instead of \$520,000 for the function on that one procurement.

SUMMARY

The technology of value analysis and value engineering consists of a system of function-based techniques and of special knowledge which are used in the design concept stage, the design stage, the purchasing stage or the manufacturing stage to efficiently identify unnecessary costs so that they may be prevented or removed.

This technology operates to create alternative means for reliably accomplishing functions by providing better answers. Not only costs, but also quality and reliability are improved.

Quality control makes its major contribution to value by aiding the customer to secure appropriate, reliable and continuing performance.

Value analysis and engineering make their major contribution by aiding the manufacturer to secure appropriate costs.