UNIVERSITY OF CALIFORNIA...

FOURTEENTH ANNUAL INDUSTRIAL ENGINEERING INSTITUTE

"Value Analysis and Engineering"

by

L. D. Miles, February 1962

Isn't Value Analysis another name for Industrial Engineering? This question is so often asked by industrial engineers that we will start with it today.

OBJECTIVES ARE THE SAME

The basic objectives of both might be approximated as, "To prevent or eliminate unnecessary costs." For comparison, the objective in transportation might be to transport substance between Los Angeles and San Francisco. The means used might be an airplane, a freight train, an automobile, or a bicycle. But the results would be very different. Similarly, for the objective, "to prevent or eliminate unnecessary costs," different means will exist. Success will result from choosing the most appropriate means for each specific situation. A similarity of objective does not in the slightest degree indicate similarity of approach, of technique, of emphasis, of resources used, or of results accomplished in specific situations.

MANY OF THE "TOOLS" ARE THE SAME

Wheels are found on the airplane, train, automobile, bicycle; engines in the airplane, train, and automobile; and steel, copper, aluminum, fabric in all. Still, they are entirely different products. They do not accomplish the same results in any given situation, nor is any one best for all situations. Similarly, in industrial engineering and value analysis common parts will be found, sometimes used identically, sometimes used differently, sometimes providing different emphasis.

BUT THERE ARE MANY DIFFERENCES

Together, let us clearly see that different technologies, like different products, have much in common. The automobile and the airplane have wheels, engines, generators; yet, the airplane also has wings, emphasizes lightness, emphasizes streamlining, etc. As a result, it is a totally different product, worthless as a substitute for the automobile in some situations, far exceeding its performance in others.

Similarly, radar equipment and television equipment have much in common--electric components, oscillator circuits, filter circuits, antennas, and so on. Still, each has the addition to its system of a vital few differing parts so that the over-all is a different product bringing about very different end results.

The difference in products and in product capabilities in specific situations is created by the difference in some of the parts included in the product system. The difference in technologies and in technology capabilities in specific situations is created by the difference in some of the parts, techniques and special knowledge, included in the technology.

DIFFERENT PRODUCTS OR TECHNOLOGIES ARE IDENTIFIED BY THEIR DIFFERENC

To be most helpful, I would like to discuss:

Areas of "newness"
The approach of Value Analysis and Engineering
The techniques
The emphasis

Areas of Newness

Dividing all expenditures into costs of: use values, esteem values, no values.
Using function as the only true base for the determination of appropriate costs.
Evaluating functions in dollars and cents.

The Approach

The basic approach is entirely from the customer's viewpoint. What does the customer want? He wants: suitable performance and suitable cost. Suitable performance includes two classes of items: suitable use values--which include quality, life, safety factors, etc.; and suitable esteem values--which include attractiveness, shapes, colors, features.

When translated into the manufacturer's language, these "values" become "functions" Use values become product use functions; esteem values become product esteem functions. The use functions cause the product to "perfofm" and the esteem functions cause the product to sell.

With functions only as basic considerations, the approach and techniques promote good answers to the question of how to provide reliably and at lowest cost the functions which the customer wants.

Work does not start with such self-oriented considerations as: How do we want to design it? What tooling do we have in place? What in-place know-how should be used? What materials do we want to use? Do we want to buy it or make it?

These and similar considerations limit original thinking, prevent the creation of the best value alternatives, and often result in lost business and closed factories. These considerations are important after appropriate values of functions have been determined and are factored into decision-making in the implementation of value alternatives.

The evaluation of groups of functions and of individual functions in dollars and cents saves large amounts of design time and expense. Such evaluation at once rules out many design and manufacturing approaches as being too costly, so that effort is at once channeled into approaches which have the potential not only of achieving suitable performance, but suitable costs as well.

The Techniques

Three basic steps are carried out by the aid of a job plan and thirteen special techniques. The basic steps are: identify the function; evaluate it by comparison in terms of dollars; 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. To minimize unproductive or disappointing design time and expense, manufacturing methods time and expense, and purchasing time and expense, establish the value in dollars for each group of functions collectively, then each function individually by comparison.

"Value" used in this sense is the "lowest cost to accomplish reliably a function or a group of functions." This will be determined by a creative search for engineering, manufacturing, and other value alternatives which would reliably accomplish the total function together with the over-all costs involved. Obviously, this evaluation will be just as good as the skill and knowledge and effectiveness of the evaluator.

For example, for 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-gallong drums would cost a total of $28, but they wouldn't stand the environment. They need environmental coating. Estimate that the coatings would about double the cost. Function value is estimated at $60. The specification called for specially-fabricated, special alloy tanks costing $520 each. But alternatives were developed in harmony with the value of the function. 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.

The fact that the function had been evaluated in dollars adds a new valuable dimension. Had this been done before the original design work and previous procurements, the savings would have been: large amounts of design time saved; large quantity of special alloy steel critical during emergencies -- not needed; special cutting and welding equipment -- not needed; five-sixths of the cost available for other needed weapons.

The importance of the technique of evaluating the function cannot be over-estimat

Step 3: Cause Practical Alternatives To Be Developed. The value analysis and engineering technology utilizes a 7-phase job plan, thirteen special techniques, and a system of special knowledge to promote the evaluations of the function, the development of practical alternatives, and the overcoming of "stoppers" or roadblocks which always exist to impede both the development of and implementation of practical alternatives.

The job plan contains the following phases which will be listed but not here expanded to include procedures:

1. Orientation
2. Information
3. Speculation
4. Analysis
5. Program planning
6. Program execution
7. Appropriate summarizing

Of the thirteen special techniques in the technology, two will be listed and expanded by explanation and example. Some of the techniques have for their principal objective the development of new and better alternatives, while others have been found essential to overcome to a reasonable degree the "roadblocks" which exist.

One techniques designed basically for the formation of alternatives is

BLAST--CREATE--THEN REFINE

In this technique, after the creation of the function "value" by comparison, the value engineer mentally very "cruelly" blasts or "dismembers" previous approaches. His thinking now starts with simple and different solutions--which would not perform the function but which have something in common--and which are very economical to accomplish. This is followed by intense practical creativity, then by refinement to produce totally functional alternatives. An example will best illustrate.

> A spacer stud is required to fasten a timer to an appliance. Naturally, quantities are large. Steel is acceptable. Cost--automatically produced on screw machines--is 8¢.
>
> What is the function which the part must perform?
>
> There are two functions--to hold, and to space.
>
> 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¢. Therefore, the value of the holding function is not over . . . . 1/2¢

The spacing function could in general be acoomplished by a cut-off length of tubing or a rolled spacer which would cost about . . . . 1/4¢

Value for the two functions . . . . 3/4¢

But, how to get a practical alternative? The technique:

BLAST--CREATE--REFINE

The screw machine approach cannot be used because costs 1/10 must result. Help in getting started is sought from every source. Thinking starts with an eight-penny nail of approximately the appropriate size, contairing a head, and costing 1/10¢.

Creating and refining, the answers are developed to the question: What must be done to the nail so that it will accompdish both functions reliably, and what will be the added cost of each added operation?

The head must be moved down slightly on the shank, it must be made a hexagon, another head must be made in the middle of the nail to provide the necessary spacing action, then 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¢--about the 1/4¢ indicated by the function evaluation. The practical alternative was created by the step-by-step use of the blast-create-refine techniques

A technique basically oriented toward the ever-present "overabundance" of roadblocks is

AVOID GENERALITIES--GET DOWN TO SPECIFICS

Nearly every generality is a force for perpuating the status quo. An early step must be the elimination of the generality by insisting that all decision criteria come precisely from the situation being studied--none from generalities. Generalities act to stop action very much as fog stops traffic. Although there are not necessarily obstructions in the fog, there is likewise no assurance of the absence of them.

Some such generalities might be: Black plastics are brittle; stainless steel is ductile; dies for that part are too costly.

Precisely what plastic? and what application? and what cost? Precisely what stainless steel? what treatment? what applications? what cost? Precisely what is the part? where is the best know-how? what do dies cost?

An example of eliminating the roadblock in this last case was: 3000 per year rather heavy, small, simple stampings were to be produced. The tooling manager said, "Parts too heavy; quantities too low; dies cannot be liquidated." Cost -- $1.41 each.

After the "roadblock" was overcome and quotations secured from a small lot vendor, the dies cost $75, the parts 39¢ each. For an expenditure of $75, a return of $3000 per year was secured -- but only after some technique had dealt with the roadblock.

The Emphasis

These points should be especially noted here: greatly increased emphasis on function; such increased emphasis on practical creativity; increased emphasis on promptly utilizing a special function and cost-related knowledge system for the creation of better, more practical alternatives.

Also, there must be an extreme emphasis on (1) identifying the "stoppers" or roadblocks which prevent value information development, and (2) the use of special techniques to deal with them. The technique "Avoid Generalities--Get Down To Specifics" is an example of one of several in this class.

SUMMARY

The technology of Value Analysis and Engineering consists of a system of techniques and of special knowledge which are used in the design concept stage, the design stage, the purchasing stage, and the manufacturing stage to efficiently identify unnecessary costs so that they may be prevented or removed.

This technology is function-based and operates first, to establish appropriate cost, or value, of the functions; then, to create alternative means for reliably accomplishing them. It includes specific techniques for dealing with roadblocks which stop or impede the process of idea development, information gathering, or alternative implementation. By providing better answers, not only costs but also quality and reliability are improve

Industrial engineers readily appreciate the magnitude of opportunity to identify and prevent or remove unnecessary costs. Those who are able to secure training in the techniques of Value Analysis and Value Engineering will find great assistance in this set of techniques and procedures which will assist them in applying their technologies efficiently and effectively.