VALUE ANALYSIS

Introduction

To have value, a product or service must--in the customer's eyes--have:

APPROPRIATE PERFORMANCE
APPROPRIATE COST

The growing technology of Value Analysis and Value Engineering is bringing the same proficiency into the matter of securing appropriate cost which has, for a few decades, characterized the technologies used in securing appropriate performance.

Appropriate cost can be "lost" at any point throughout the design, manufacturing, purchasing, or sales part of the product cycle.

Inadequate human effort in any of the following phases can prejudice the case for value:

marketing concept, design concept, design detail, manufacturing concept, manufacturing operation, purchasing, sales

Providing or restoring appropriate costs to the product or service is then the task of identifying the deficiency and bringing it into the action arena.

Value Analysis is a set of techniques and procedures for accomplishing this.

The techniques do not cure the deficiency--they pinpoint it so the needed technology will be effectively used and appropriate costs will be assured or secured. The excessive unnecessary cost may be for reason of lack of sufficient use of work simplification, manufacturing engineering, industrial engineering, tool engineering, vendors' available functional products, good buying practices, good design practices, good management practices or any of dozens of others. Once the problem on the specific product or service is in clear focus, its solution can be applied from the needed technology.

Function Based

The Value Analysis approach is completely function based.

Function is defined as...

> ...something that causes the product or service to do something needed--"use" function
>
> ...or causes the buyer to buy it--"esteem" function.

Before other Value Analysis techniques are discussed, we ought to consider what "Value" really is. We define value as the lowest price we must pay for the function or service to be reliably performed.

If anything is in a product which does not contribute to "use" or "esteem" function, it should be changed or removed.

The next important technique then is relating cost to function.

Results Accomplishable

Use of Value Analysis techniques--in addition to the usual good technologies either on new designs or major redesigns of competitive, mature products--will normally identify and make it practical to prevent or remove 25% to 50% of the product cost. Use of the techniques on military gear normally identifies between 50% and 75% of the cost as unnecessary.

Why Is It Possible To Accomplish These Results?

Any product is the result of from dozens to thousands of decisions. Many of the decisions were made at different times by people of different backgrounds, competence and limitations, and made under a variety of different limiting conditions.

At least five common reasons for unnecessary cost are worthy of mention.

1. Lack of essential information at the time the decisions are made, usually lack of knowledge that the information exists.

   As an example, engineering and manufacturing did not know that for a modest sum in molds a brass arc chute could be shell molded. Thus, it cost $6.80 each instead of $2.80.

2. Lack of specific idea that would make possible production of the item for much lower cost. The idea of forging a switch arm all in one piece instead of the traditional machined casting with brazed blade was not before the decision-making people, thus it continued to cost $3 each instead of 40¢.

3. Decisions based upon honest wrong beliefs which each responsible decision-making person progressively accumultes. Manufacturing and design people in the area so accustomed to fabricating from plate honestly believed that the functions supplied by a support flange would be most economically provided by using their standard equipment for flame cutting, welding, and machining plate, although in reality an entirely different process would provide the total functions for one-eight of the cost.

4. Decisions originally forced by temporary circumstances continue "non-functioning" unnecessary costs--long periods after the temporary circumstances have ended.

> For example, a welded assembly securely and effectively fastens a cover. It cost $2.12. That was the correct way to do it with only the short time involved. However, a three-piece assembly comprising two U-bolts and a spacing strap accomplish the total function for 42¢...about one-fifth of the cost. Too often, because we have done it once under pressure of time limitations and have perhaps built tooling and trained people, we do not objectively re-evaluate and end the extra costs which were made necessary by the temporary circumstances.

5. Decisions based upon habits of people involved in the area involved built into the drafting and methods system, built into the machines and tooling, built into supplier relationships, purchasing habits and others.

Perhaps I might relate an example of a quantity of one which, getting away from habits, reduced its cost to one-tenth. A few years ago we built a laboratory with an enormous x-ray equipment to detect hidden defects in large castings and forgings. Because the radiation would injure at several thousand feet, the drawing showed a horseshoe shaped mound of concrete outside of the building to protect adjacent areas. It was 7 ft. thick and 14 ft. high. Bids showed it would cost $50,000.

Then something happened that broke the habit pattern. The works manager in that area acts as a landlord, leasing out the area to the different businesses. He heard about this concrete and said, "I have leased you this land for a certain period of time but I want to make sure that if you put that concrete in and decide to move, you will take the concrete with you."

Concrete was the usual way to stop radiation but this upset the habit pattern; so they called in a man who happened to have had Value Analysis experience to work it out. He asked questions.

> "What is the concrete for?"
>
> They said, "To stop x-rays."
>
> "What else will stop x-rays?"
>
> "Lead," he was told but lead cost too much.

"What else?"

The value man suggested dirt.

"That would do the job if you had enough."

"How much would that take?"

They found a factor of two to one, so they used a ring of dirt 14 ft. thick instead of concrete 7 ft. thick... got out the drawings, erased the concrete, put on the dirt, and got the bids. Cost was $5000 instead of the originally planned $50,000 which habits put into the specification.

How Are The Value Analysis Techniques Used?

Now we must get down to the serious business of learning to select and use a few of the special Value Analysis and Engineering techniques.

This process starts and proceeds as follows:

1. Identify the function or functions clearly. Precisely, exactly what is the desired or required function?

Divide Into Functional Areas of Cost--

How much does the main function cost?
Electrical function?
Mechanical function?
Base?
Support?
Cover?
Finish?
Appearance (Is it designed "in" - not "tacked on")?
What are Key Tolerances?
Are we paying extra for something in design that's not desirable (such as shock)?
Avoid duplication of function.

2. Evaluate the Function or Functions in Dollars.

How is value determined? Unfortunately, there is nothing inherent about value. It is determined by comparison. The only way to determine whether a given part, a functional assembly, or complete design has true value is to compare it wisely to something else. To analyze value is to compare.

3. Cause alternatives to be developed by use of the Value Analysis Job Plan as a framework and the individual Value Analysis techniques as needed throughout the process.

4. The Job Plan

Information Phase

Secure all pertinent facts--actual samples of parts and assembly where practicable. Costs, quantities, vendors, drawings, specifications, planning cards and manufacturing methods information.

Learn the basic engineering, with the engineer, ask questions, listen, develop with him a thorough understanding of the product.

Learn the basic manufacturing--observe manufacturing, ask questions, listen, study.

Decide the amount of effort that should reasonably be expended on each item of cost.

Speculative Phase

Generate every possible solution to the problem.

Consult others who may help you.

Systematically explore various materials, machine processes, rearrangement of parts, etc.

Encourage free use of the imagination.

Record every suggestion that seems remotely possible.

Analytical Phase

Estimate the dollar value of each idea.

Develop all ideas with emphasis placed in proportion to their value and probability of accomplishment.

Investigate those ideas with an "obvious" reason why "it won't work."

List the good points and the bad points. Eliminate or overcome the objections.

Set up a program to vigorously pursue ideas with most promise.

Program Planning Phase

Break the job down into a progression of functional areas; i.e., a fastening job, an electrical contact job, a support job, a dust protection job, etc.

Select the top specialist, if any, in the company to consult on each.

Select from one to three of the best suppliers for each functional area of the product.

Program Execution Phase

Pointing out the top function desired--discuss the problems and solicit specific suggestions with both in-company and out-of-company specialists.

Constantly pursue thoroughly and intensely until suggestions of all specialists are in. Work with vendor companies until they can provide alternate practical suggestions and quotations.

Periodically support the work of the specialists by speculative or idea study and evaluation pertaining to the individual functional areas.

Stick to each promising suggestion. Thrash it out and reach definite tangible usable conclusion.

Status Summary and Conclusion

Issue a concise suggestion sheet in management language covering each function which shows possibilities.

The sheet shows pertinent information, such as...

...before and after sketch.
...quantities used per year.
...material, labor, and shop cost.
...suggested cost, and tool cost, if any.
...statement describing function.
...suggestions in condensed form.

Send copies to the man designated by the manager to receive and follow up, also to others who should receive them.

Send all quotations to the purchasing group concerned. Attach all specific engineering data, engineering studies, etc. to one copy and all studies pertinent to manufacturing methods, techniques, etc. to another of the copies given to the designated follow-up man.

5. One of the Value Analysis techniques which is used as needed is...

Get Away From Generalities - Get Down To Specifics

[1]"Forty thousand 1/4 x 3 inch screws were required. It was necessary that they be threaded all the way to the head. Standard screws contained only a 1 inch length of thread, but they were purchased and then put in a screw machine for extension of the threads to the head. The costs became 12¢. The arrangement satisfied all involved because (1) purchasing could buy available standard screws with no problems; (2) manufacturing had the equipment and welcomed the work which could be put on its machines; and (3) the engineers obtained the screw they needed. As is so often the case, all considerations except those of value were properly cared for. The use of value analysis techniques showed that the function was not worth 12¢. Accepting no generalities as bases for decision, suppliers were asked for bids on supplying screws with the proper full-length thread initially. This resulted in a change to buying the screws ready to use for 2-1/2¢ each. The purchase and modification of standard products may be a good-sounding generality that does not guarantee best value."

6. Another of the techniques is...[1]

"Blast, Create, Then Refine

"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. 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 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

[1]Miles, L. D., "The Techniques of Value Analysis and Engineering", McGraw-Hill Book Company, New York, 1961.

constructed product concept to accomplish the total functions with the same reliability and over-all benefits for a cost of one-half to one-tenth of the original."

For example,[1]

"The clamp bar shown in Figure 3.3 is made of steel, 1x1/2", with two 1/2" threaded holes. It is 2" long. Required quantity is 4000 per year. What is the function? Half concealed inside heavy equipment, this clamp bar performs a basic function which could be provided by two 1/2" nuts. It does, however, also provide the secondary convenience function of compensating for the fact that there is no space in which to insert a wrench to hold individual nuts during the tightening operation. Further, the clamp bar is desirable to keep individual nuts from becoming loosened during the use of the equipment. The over-all function, then, consists of a holding function, approximately equivalent to that which would be performed by two nuts, plus some type of secondary fastening function, such as could be provided by welding the two nuts together, welding them to a common piece of metal, or pressing them into some sort of holder which would keep them together.

"Blast. The basic function for which this part was designed, we find, could be accomplished by two nuts which cost 1-1/2¢ each. Hence, the value of the basic function is 3¢. This represents a typical blast finding. We have an alternative which will provide an important segment of the function, though it will not accomplish the over-all function. To do that the two nuts must somehow be fastened together.

"Create. How to fasten the nuts together is the subject of the second step, and we arrive at these solutions.

1. Weld the two nuts side by side.
2. Weld the two nuts to a piece of wire.
3. Weld the two nuts to a piece of sheet metal.
4. Press the two nuts into two holes in a piece of sheet metal.

Approximate costs for the above alternatives are brought into view.

"Refine. Particular complications or problems to be solved in each case are now generally considered. While so investigating, we find that a vendor makes and sells weld nuts of the proper size. Further, we find that the factory has proper facilities for making a small stamping and for welding the two nuts into the stamping. The result of the blasting, creating, and refining is the double nut assembly shown in Figure 3-4. Its cost is 8¢, while the cost of the clamp bar had been 32¢. In other words, by applying the technique, an alternative is provided which reliably accomplishes the over-all function for one-fourth of the cost."

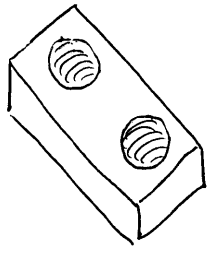

Figure 3-3.

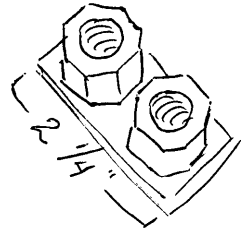

Figure 3-4.

7. Other Value Analysis techniques which often hold the solution to the problem are:

Get all available costs.
Use information from only the best source.
Use real creativity.
Identify and overcome roadblocks.
Use industry specialists to extend specialized knowledge.
Get a dollar sign on the key tolerances.
Utilize vendors' available functional products.
Utilize and pay for vendors' skills and knowledge.
Utilize specialty processes.
Utilize applicable standards.
Use the criterion, "Would I spend my money this way?"

Conclusion

This, then, is Value Analysis...first, clearly determining the functions required; secondly, evaluating the functions in dollars; third, creatively and effectively causing search for the best combinations of ideas, processes, specialty materials and specialty suppliers who can, at lowest cost, reliably accomplish these functions; fourth, causing these alternatives to come before the appropriate decision-making people.