

VALUE ENGINEERING SEMINAR

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What is a Value Specialist?

A value specialist is in business to assist people in getting their money's worth for the goods and services they buy. He helps people determine what is good value in a specific situation. He does this by urging his clients to buy those things they really need and not waste money on items the clients really neither need nor want.

The value specialist is not a moralist; he does not dictate what it is his clients want. Conversely, he sees that they get what they want. For example: Client Jones asks what should I pay for a fifth of gin; I like a gin and tonic every night. The value specialist asks if Jones likes imported gin better than domestic gin. Jones says it all tastes the same to him. The value specialist says buy the cheapest gin you can find, it will cost about \$3 a fifth. Client Smith also wants a fifth of gin. Although he doesn't drink, he likes to impress his friends and business associates. His counsel: buy imported; it will cost about \$6 a fifth. Both Jones and Smith can beat the value specialist's price by careful shopping, but only by 10 or 15 per cent. Had they split the difference and bought a good domestic gin for \$4.50 a fifth, Jones would have paid 50 per cent more for something he could not have enjoyed, and Smith would not have impressed his friends and thus wasted the \$4.50 he spent.

THE IMPORTANCE OF VALUE

Under the pressure of a rapidly expanding economy and the sharpest foreign and domestic competition in history, industry is making a giant effort to increase productivity -- to turn out more and better goods faster and at less cost. Inflation, spiralling wages and prices, and increasing corporate taxes add to the problem. The challenge of placing a competitive product on the market must be accepted, not by management alone but by everyone in the business. No activity, whether engineering, manufacturing, finance or marketing, is exempt from the responsibility of providing the customer with product value -- at a fair price to him and a reasonable profit to the manufacturer.

The customer, in many cases, is the government. And the government is vitally interested in receiving more value for its defense dollar. Defense contracts contain incentive and other clauses specifically aimed at achieving value engineering from its bidders.

Much remains to be done.

This manual is to give you an understanding of value -- and of the techniques that have been developed to produce better value.

It should assist you in your study of Value Engineering and give you a lasting reference for making future cost-conscious decisions.

WHAT DOES VALUE MEAN?

For 2,000 years, men have searched for some absolute way of measuring value. Aristotle, third century philosopher, was interested in its definition. Since then men have never stopped trying to explain, define and classify it.

UTILITY THEORY

Nothing seemed more plausible to early philosophers than to associate value with utility. That is, until someone realized that iron had more utility than gold -- but gold was the more valuable.

What is the value of a small bolt in an airplane wing if failure of that bolt would cause the plane to crash, demolishing the plane and killing the pilot? What is the value of the brakes on your car which you use in one situation to park and in another situation to avoid a four-car collision? What is the value of the picture tube in your TV set, and does it have a higher or lower value than the small bolt in the airplane wing?

LABOR THEORY

Another theory proposed was the so-called labor theory of value, which said that labor and value are proportional. For example: coal has no value until it has been transported to the furnace, requiring labor for mining and transportation. Yet the same amount of sand, requiring the same amount of labor and transportation, does not have the same value at the furnace. Similarly, one does not increase the value of a product by selecting a means of production with the highest labor cost.

COST THEORY

An outgrowth of the labor theory is the cost theory - that is, all cost is labor, therefore value equals cost. This theory is upset by the same reasoning that rejected the labor theory. Cost and labor may indeed be proportional, but cost and value are not.

PRICE THEORY

Price paid in exchange has been used as a measure of value for the item received. But in reality, the price paid and the thing exchanged could not have had the same value to both persons or the exchange would never have been made.

So, after picking holes in every past definition, we have come to some conclusions:

1. VALUE IS NOT A BUILT-IN FEATURE OF ANYTHING.
2. VALUE IS ESTABLISHED BY COMPARISON.
3. VALUE IS THE RELATIONSHIP BETWEEN WHAT A PERSON WANTS AND WHAT HE IS WILLING TO GIVE IN ORDER TO GET IT.

Value is one of those familiar words which is difficult to define for the very reason that it is so well understood without definition.

KINDS OF VALUE

Iron has many uses -- but gold is more valuable.

Christmas trees represent cost and labor. What are they worth on New Year's Day?

Diamonds, like coal, are dug from the ground -- labor is all they cost. Yet they're more valuable by far.

A ten dollar bill has little use as paper and doesn't cost much to make, but it's "worth" a considerable amount of goods.

Some economists say here are four kinds of value:

USE VALUE

The power of a thing to serve our ends. The properties and qualities which accomplish a use, work or service.

Can Opener - Housepaint
Paperclip - Bulldozer

ESTEEM VALUE

The power of a thing that makes us want it. The properties, features, or attractiveness which cause the desire.

Electric Can Opener - Gold
Tie Clasp - Rembrandt Painting
Rolls-Royce

COST VALUE

The effort required to produce a thing. Anything that is produced has cost value - but this cost value has no relationship to its use, esteem or exchange value.

Obsolete inventory; Spoiled merchandise; Converted sea water as opposed to "normal" source water.

EXCHANGE VALUE

The properties or qualities which enable us to exchange a thing for something else we want.

Gold, Money, Green Stamps, Checks

VALUE RELATIONSHIPS

Anything to have value must have a use. If it is desired it also has esteem. In all probability it has cost, but its cost value does not mean that it has comparable use, esteem or exchange value.

Human desire produces esteem value. Scarcity, urgent need, prestige or esthetic qualities cause human desire.

A bouquet of violets cause human desire by its esthetic qualities.

The world's largest collection of Johann Sebastian Bach's original manuscripts gives prestige to its owner, but has no more use value than printed copies of the sheet music.

Both air and water have use value, but they are so abundant that we usually take them for granted. If either were denied us, however, their esteem value would rise sharply.

A cubic foot of water is worth a fraction of a cent delivered through your water meter. This can be considered its use value. In a municipal water system it is also its approximate cost value. The same amount of water has considerable esteem value to a thirsty man on the desert. If the same man had plenty of water and others had none, the water would have exchange value to him.

Value has no relation to the actual cost of producing a part or device nor does it have any relationship to the consequences in the event of failure of that part or device.

Value is determined only by comparison. It is the lowest price you must pay to provide a reliable function. "Lowest price" implies comparison - wise comparison of values - to determine VALUE.

The value of a bolt in an airplane wing is determined by the means of providing the function of that bolt at the lowest cost. If the cost of the bolt in question was 25 cents and the bolt was found to be too small the size might be increased and the cost might become 50 cents or \$1, but never will the cost - or the value - be equal to the cost of the plane or the value of the pilot's life. The value of the brakes on the car is established by the lowest cost at which the braking function can be provided. The value of the TV picture tube is determined by the lowest cost at which its function can be produced.

VALUE IN INDUSTRY

VALUE IS THE LOWEST COST TO PROVIDE
ESSENTIAL FUNCTION
FUNCTION IS ANYTHING THAT MAKES THE
PRODUCT WORK OR SELL

Through Value Analysis, General Electric Corporation found that an average of 25% of manufacturing costs are unnecessary. They increase the cost of the product but add nothing to its VALUE.

This extra cost is present in industry TODAY -- because of habit; thought patterns; personal limitations; the difficulty of disseminating ideas -- and because today's thinking is based on yesterday's knowledge.

Companies engaged in producing consumer goods must consider esteem along with use so they can sell their products. Government contractors cannot ignore saleability, but are far more concerned with the use value of their products.

Value research shows that government contractors produce goods, principally intended to serve a "use", that contain far more excess cost than ordinary consumer goods. Some of the excess cost can be analyzed as prestige or "technical aesthetics", but most of it is a result of NOT KNOWING THE DOLLAR VALUES OF FUNCTIONAL AREAS in the product at the time money was expended.

Value Engineering is an organized, systematic and creative approach for efficient identification of unnecessary cost -- cost which provides neither quality nor use nor life nor appearance nor customer features.

Value Engineering is a specific set of techniques that produce remarkable results because it attacks the basic problem - it cures the disease rather than the symptoms.

Value Engineering techniques aim to provide more value for the customer. They bear no relation to cost reduction techniques, which focus only on costs and how to reduce them.

Value Engineering techniques take the fundamental approach of function; they are aimed at providing for the reliable performance of a function with the essential quality at the lowest cost, instead of merely taking the product as it stands and trying to produce it at the lowest cost.

Value Engineering is really a philosophy or a way of thinking that applies to all functions in a business and to all businesses, large or small.

The Birth

"The Father of Value Analysis". That's what they call Lawrence D. Miles. And probably no man ever had a stranger introduction to his child. Pulled into the General Electric Corporation offices one day, Miles, a long-time employee of GE, didn't have any idea why he was there. Then one of the corporation officers asked him suddenly, "Miles, did you know that Lucky Strike Green went to war?" Confused, Miles admitted he remembered the famous World War II advertising slogan.

"But did you know it never came back?" the same officer asked quietly. This anecdote illustrated for Miles the odd fact, brought to light by World War II, that many emergency substitutions of material made because of war-caused material shortages not only cost less, but improved the product.

The green color of Lucky Strike packages was impossible to obtain in World War II. So the company was forced to "send it to war".

But sales didn't suffer, the package worked as well. All that was lacking was the added cost of the color.

So Lucky Strike Green became a war casualty.

And General Electric wanted Miles to make similar accidental benefits of war-time exigencies to occur in peacetime on purpose.

The Growth

Miles' approach was first to analyze the function of a part or product and then find a simple, low cost method of performing the function. He found that by comparing the function of a part with its cost, he could locate what he calls areas of "poor value."

The Navy's BUSHIPS found out about GE's Value Analysis and started a similar program they called Value Engineering. It embodied the same techniques and concepts but the Navy used teams composed of representatives from Engineering, Purchasing and Manufacturing in a seminar situation.

The Challenge

The philosophy of Value Engineering is to give the customer more for his money -- to assure that he will receive goods and services which will reliably perform those functions he requires at minimum cost.

Value Engineering is not merely a search for new materials and processes -- the laboratories, Engineering and Manufacturing organizations are constantly doing that.

Nor is it a substitute for the effective cost reduction committees which daily are increasing our value.

Value Engineering is a well-informed creative study of every item of cost in every part or material with one objective -- equal or better performance at lower cost.

SIX REASONS FOR UNNECESSARY COSTS (POOR VALUE) IN A PRODUCT

1. Lack of information at the time of decision making.
2. Lack of good idea.
3. Something created to satisfy temporary circumstances and never changed.
4. Honest wrong belief.
5. Habit.
6. Attitude.

It is to the relief or prevention of these, that Value Engineering is dedicated.

Two of the most important factors in holding cost down are knowing what things are available and how much they cost. Value Engineering must bring new information into the product from new areas within the company and from specialty suppliers outside of the company -- new possibilities and new value opportunities -- and see that designers have information available to make cost conscious decision.

Relationship of Value Engineering to Cost Reduction

The most basic principle of Value Engineering is the use of the functional approach.

The functional approach has been around a long time...but people refuse to use it. They still pick up a part and say, "How can we get this for less?" rather than look at the function the part performs and say, "How can we perform the function for less?"

How can we make the part cheaper? This has been the conventional cost-reduction approach. Material replacement, different tools, different production methods or a speed up of operations. How can we make this particular part for less money?

Another approach along the same line is the purchaser's viewpoint. "Who will sell it to us for less?" This shows in make-or-buy decisions, competitive bidding, selection of qualified bidders, etc.

The Functional Approach

Value Engineering starts from a completely different reference point -- a functional definition -- and provides a systematic and organized method of finding the most economical way to provide the function.

The Value Engineer constantly relates cost to function. Instead of asking how to make something cheaper, he asks "What function is required?", "What is that function really worth?", and "What are the alternatives?" -- "How many ways can the function be provided?"

He wants to know also "What are the costs?" in order to present a choice that will offer the most value.

In fact, a series of questions must be asked and answered in order to fully incorporate the functional approach.

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

Value Engineering boils down to defining a function and finding the lowest cost method to reliably perform that function.

Defining a function is not easy. It requires careful thought, all the facts, and a genuine understanding of the product.

Finding the lowest cost means to perform the function is not easy either. It requires an open mind, ingenuity, and knowledge in order to establish alternate methods of performing the function.

It also requires detailed knowledge of how much things cost. This knowledge is often unknown and must be found only by painstaking investigation.

Identify a function.

Evaluate the function by comparison.

Develop value alternatives.

Value Engineering in Practice

Value Engineering is often described as an attitude an attitude of constructive discontent an attitude of constant questioning an attitude that the product can be improved -- that unnecessary cost, cost that does not contribute to value, can be removed -- that quality and reliability can be maintained or improved at lower cost.

But this attitude must be channeled to get the best results.

The channeling is provided by the Value Engineering Job Plan -- an organized approach to a Value Engineering study -- and by a systematic use of the Value Engineering Techniques.

There are five essential characteristics peculiar to a Value Engineering study.

- . A functional approach
- . A research effort
- . Creativity
- . Attitude
- . Use of a dollar sign for measurement

All the techniques - all the phases of the job plan fall into one or more of these essential areas.

The Study in a Nutshell

Armed with your ATTITUDE of constructive discontent you first RESEARCH your product -- learn all you can about it. With this knowledge you can define FUNCTIONS and associate DOLLAR VALUE with those functions. You will then be able to use your CREATIVITY to develop alternate means to provide the functions. You can analyze value by comparing the costs of the various means.

UNDERSTAND THE PRODUCT

First Step: GET THE FACTS

Here is the place to ask -- "What is it?"

"What does it do?"

"What does it cost?"

For the answer to "What is it", you want to know more than its name.

You want to know

... What is it made of?

... What does it look like?

... How big is it?

... How is it made?

... and everything else about "what is it" that will help you know your product

The heart of Value Engineering is next ... the functional approach.

Here the question is

The key to effective
Value Engineering -
CHALLENGE
EVERYTHING!!!

... What does it do?

... What must it do?

... What does the user want it to do?

... Why does it do it this way?

... How does it do it?

... How well is it done?

Where do you get the answers to all of these questions?

From the designer ... if you want to know why a certain material was used or a tolerance was called out on a blueprint.

From the people who use it ... if you want to find out what the part must do.

From the supplier ... if you wonder why he made it this way.

From the customer ... if you want to find out what he wants.

From the buyer, the planner, the testing group, the service and maintenance groups from every source of information you have time for.

- GET ALL THE FACTS -

In half the cases when all the facts are supposed to be in, they're not. Unless you get more facts than anyone else you will miss untold opportunities. When you don't have facts you are using personal opinion. Many a problem solves itself when you get all the facts.

A circuit board module frame assembly was fitted with a special handle to facilitate its insertion and removal from a missile-borne package. The package had a total of twenty-six removable modules, each with its separate handle. The handles were specially made for this job and cost \$7.50 each for a total of \$195 worth of handles in each airborne package.

The reason for the built-in handles was "obvious." One could visualize a missile on the pad, in the late stages of countdown. Something is wrong with a portion of a circuit! A technician rushes up, opens a whatzit in the side of the missile, grabs the ready handle of a module, removes it and plugs in a good one.

When someone GOT THE FACTS it turned out that modules were NOT removed during countdown. They weren't even removed while the package was in the missile. THEY WERE ONLY REMOVED WHEN THE PACKAGE WAS IN THE SHOP.

This fact led to a proposal to furnish a simple 25 cent tool to be kept in the shop -- a tool that would do the job of many \$7.50 handles.

All Indians walk in single file. At least the one I saw did.

THE NEXT AND MOST IMPORTANT STEP . . . DEFINE THE FUNCTION

All Value Engineering work rests squarely on the foundation of a clear, simplified definition of function.

To get this clear, simple definition, you must discipline yourself to think in the simplest terms:

Before we decide what to do, let's find out where we are and what we want to do.

A. Lincoln

ONE VERB AND ONE NOUN FOR ANY FUNCTIONAL DEFINITION

If a function can be described in two words, it is probably clearly understood. If more words are used, it isn't. If you keep expanding your words, eventually you have a paragraph which doesn't describe the function of the part at all ... but rather explains how the part is performing now.

This is difficult ... but worth it. The mere effort it takes forces you to concentrate solely on function, rather than the part as it is.

Some examples:

Connects ... Parts

Transmits ... Motion

Protects ... Surface

Conducts ... Current

Supports ... Case

Put these verb-noun definitions on the Function Definition Worksheet -- and keep them where you can see them. You'll find that your first definition or verb-noun combination may not be the functional definition you're looking for so you ask two more questions:

How does it do it?

Why does it do it?

These questions will help clarify your definition. Add the answers, in verb-noun combinations, to your Function Definition Worksheet.

Then question these definitions in the same way.

Keep it up until you are satisfied that you have defined what the part or assembly really does or what you really want it do do.

For example, let's take your kitchen refrigerator. What does it do? Well, your first answer might be "provides cold." So you write that on your worksheet. When you

ask "How does it do it?", your answer will probably be "transfers heat." Put it down. "Why does it do it?" would eventually end up "Preserves food."

FUNCTION DEFINITION WORKSHEET	
COMPONENT	FUNCTION (Verb-noun)
refrigerator	~~provides cold~~ ~~transfers heat~~ preserves food

Looking at your worksheet now, you might decide that what you're really trying to do is to preserve food. Provide cold and transfer heat are only ways to provide this function.

NOTE: If it were a laboratory refrigerator, the answer to "Why does it provide cold?" might well be "inhibit bacteria" or "condition material."

If preserving food is the only function of your refrigerator, you might try to get better value by evaluating alternate methods ---

If it's cold you want and if you're convinced that some type of heat exchange is how you want to get it, you can evaluate alternate methods to transfer heat --- Servel refrigeration compared to compressor type, for example.

The goal of Value Engineering
is to develop practical
value alternatives.

Basic and Secondary Functions

A product, an assembly, even a single part -- all have a basic function and usually one or more secondary functions.

The basic function is the specific purpose for which the item was made ... the reason for its existence in the first place. It is the function that must remain even if everything else is eliminated.

Basic functions are nearly always use functions. Your refrigerator has the basic function to "preserve food."

But it has secondary functions -- something else it does or other features that help sell it, give it esteem value, fulfill quality and reliability requirements.

Such functions as "make ice-cubes"; "freeze ice-cream"; "chill martinis."

Such features as shelves in the door, egg racks and a butter conditioner.

Such attractions as colored enamel and chrome-plated hardware.

Each of these functions or features has its cost -- and also its value.

The functional evaluation is not complete until the costs have been broken down and assessed against each function and feature ... along with some idea of what each function or feature is worth.

The Function Evaluation Chart is designed to tabulate these functions as well as to assign costs and values to them.

. WHAT DO YOU USE FOR A STANDARD OF COMPARISON?

Commercial equivalents which you buy for home use will give you good value comparisons. For instance, if you see an electric switch costing \$5 on equipment you are reviewing, you might question its value. Why? Because you know from experience that this function may be performed by a household type costing 29 cents at the local hardware store.

Another type of comparison can be made by reviewing competitive items. Perhaps a competitor has found a better way -- has incorporated more value in his product -- and if he has, we can use this in our search for value.

Determining worth is essentially a technique of comparison to familiar items or functions. It follows naturally then that a broad experience will help you get the most value into the items being reviewed.

EVALUATE BY COMPARISON with <u>Common parts.</u> <u>Standard parts.</u> <u>Basic materials.</u>

Evaluate Functional Areas

Another technique is to divide costs into functional areas and then define just what it is you are buying with that cost -- using the verb-noun definition.

The refrigerator, for example, has functional areas of mechanical, electrical, insulation, features, appearance, assembly, etc. This method of dividing costs into functional areas drastically highlights areas of poor value -- areas whose cost-function ratio is inconsistent with that of other areas.

Spotlight Hidden Costs

Examine the tolerances and finishes specified. These cost money. If possible, determine and assign a dollar-sign against inspection, fabrication and test tolerances.

Did you ever consider that a drawing shows a preconceived idea of the method of manufacture? Does it have to? Frequently the tolerances spelled out on a drawing will dictate a milling machine operation, yet a cast or welded part will do the job. Tolerances may cost dearly yet contribute no value. •

Another idea of hidden cost is a result of habit. A common example of this is standard call-outs. Such notations as 1/8" rivets on 1" centers. Examine these areas. Satisfy yourself that this is necessary not habit.

TAKE THE CREATIVE STEP

Up to now we have answers on what the item actually is, what its basic and secondary functions are, what these cost to perform, and what we think it's really worth to perform them.

Now we must find something else which will do a job as well as the present item -- something else with the same QUALITY and RELIABILITY -- or BETTER.

- Don't take this step until your mind is completely freed from the part and oriented toward the function.
- Here is where you suspend judgement
- Here is where you put your imagination to work.
- Here is where you "BLAST!! CREATE AND REFINE."
- Here is where you do your "brainstorming" for new and divergent ways to provide the function.

WHAT ELSE WILL DO THE JOB?

It's smart to get input from other areas to help answer this question. It may be that the item can have a substitute made by a vendor who specializes in this type product. The PURCHASING AGENT will know of such a vendor.

It may be that we can make something in our own shop which will

satisfy the requirements and yet cost a great deal less money. The OPERATIONS people would be able to help here.

Maybe the tolerances on certain areas are too close for requirements and are making the price of the item too much due to rejects. Here QUALITY CONTROL can make worthwhile suggestions.

A team approach of this type is an essential in finding "what else will do the job."

PUT A DOLLAR SIGN ON EACH MAIN IDEA

Analyze the ideas you've cooked up. It's important to remember that you're not trying to eliminate ideas, but are trying to see how ideas can be made to work.

Now you are ready to add judgement to your ideas in order to refine them. Cull over the ideas and select several which appear most promising. Write down the reasons for rejecting each of the others. You may want to return to them later if the first ideas selected to not pan out.

Of the ideas selected, estimate your cost of each. Compare this to the original cost and to your estimate of worth.

Now arrange them in an order of precedence and systematically pursue each one until you feel that you have the best solution.

Efficiency is not the negative virtue of eliminating what is wasteful, but the positive virtue of building up what is best.

INVESTIGATE BEFORE YOU INVEST

Take the best ideas and develop them into usable proposals. You want to check the feasibility of your ideas and verify the details. Don't hesitate to ask for help -- help from company specialists -- help from suppliers and outside specialists. When consulting specialty or other vendors, don't just hand them a drawing or specification and ask "What can you do with this?" Instead get them thinking of the functions you want. They may know of a specialty process, product or material that may help you.

USE ALL OF INDUSTRY'S KNOW-HOW

Don't re-discover the wheel

Since the end of World War II, the following true story has been brought to light.

It seems that Von Braun was appointed project engineer of the V-2 rocket development, and one of the problems that became apparent was that of a high-pressure fuel pump to pump fuel into the combustion chamber. They worked on the project for six months, decided on the specifications for the pump, investigated various designs and began to suspect that the specifications were impossible to meet.

After six months

Von Braun finally decided to call in all the pump manufacturers in Germany and talk to them about the problem. He felt that the best way to handle the situation was to read off the list of specifications to the assembled engineers and manufacturers, hoping that when he reached a point where the specifications were seemingly impossible, that he would be able to draw the men into a discussion leading to a solution.

The experts met

So he spoke before the assembled group of pump manufacturers, listing one-by-one the specifications for the pump and pausing after each for any comments. The specifications were as follows:

1. The pump had to deliver 150 lbs. of fuel per second.
2. The pump must operate at 300 lb/sq.in. pressure at the low pressure end.
3. With this rate of delivery and pressure, the pressure must be maintained constant to within about .4%.
4. The pump must be capable of being stored for long periods of time, and yet be immediately available for use.
5. After being out of service for some length of time, it must come to full and constant pressure delivery within a matter of three seconds.

Impossible?

After each of these specifications he surveyed the audience, but no one made any comments. After Von Braun had finished, he rather apologetically asked, "Does anyone have any comments or any ideas?"

One fellow rose and said, "Sir, it looks to me like what you need is a standard firefighter's pump. A standard firefighter's pump has to deliver large volumes of water in order to put out a fire. It has to deliver the water at a high pressure so that the firemen can be at a safe distance from the fire. The pressure must remain very constant, because otherwise the stream cannot be directed. A firefighter's pump has to be stored for long periods, because fires may not occur for six months or a year and yet, when they do occur, the pump has to work and it has to come to full pressure delivery in a very short time."

A six months margin

In Winston Churchill's History of the Second World War, he said that if the V-2 rocket had become operational six months sooner, the outcome of the war, favorable to the allies, would have been seriously in question.

KNOW YOU ARE RIGHT

Review each idea with the thought "Is this really the best idea?"

Don't be afraid to exercise your own judgement at this point.

You are now ready to get the answer to the question "What does that cost?" You obtain cost information from the same sources as before: Estimating, Factory departments, company experts, vendors of standard products and specialty vendors. You need cost information on new material, fabrication, inspection, testing, tooling, design and incorporation, and implementation or cost-of-change.

Armed with these facts you are ready to make a final evaluation and come up with a proposal. At this time you will probably be the "expert" on the project. You know more facts about it than anyone else. So trust your judgement -- it is based on fact, isn't it?

MAKE YOUR PROPOSAL

Make a report of your research, your creativity and your proposal. Communicate to others the results of your efforts. Sell your recommendations.

The report must be prepared so as to be understood. Include pertinent information such as before-and-after pictures, before-and-after cost breakdowns and vendor quotations. Attach or reference all specific engineering data, engineering studies and studies pertinent to manufacturing methods, techniques, etc. Send your report to the person or persons who are responsible for the item or who are in a position to make decisions regarding it.

THE VALUE ENGINEERING TECHNIQUES

Twenty Keys to Value

1. Use the Value Engineering Job Plan
2. Get all the facts
3. Use information from only the best source
4. Define the function
5. Evaluate by Comparison
6. Analyze cost
7. Do creative thinking
8. Evaluate the function
9. Blast, Create, Refine
10. Identify and overcome roadblocks
11. Challenge requirements
12. Use specialty vendors
13. Use the company's specialists
14. Use standards
15. Use good human relations
16. Get new information
17. Get a dollar sign on every given tolerance
18. Work on specifics - avoid generalities
19. Use your own judgement
20. Use the criterion "Would I spend my money this way?"

THE VALUE ENGINEERING TECHNIQUES

1. USE THE VALUE ENGINEERING JOB PLAN

Value Engineering is an organized and systematic search for better value. The VE Job Plan is what makes it organized and systematic.

2. GET ALL THE FACTS

This is a realistic, hard-boiled job. You need facts on costs, inventory, requirements, usage, specs, development, manufacturing and history. You'll find that in most cases when all the facts are supposed to be in, they're not! Unless you get more facts than anyone else, you're not going to get the job done.

3. USE INFORMATION FROM ONLY THE BEST SOURCE

Not just the "normal" source - not the easiest source - but the best source. Get answers about manufacturing from manufacturing, purchasing answers from purchasing, customer needs and wants from no one but the customer.

4. DEFINE THE FUNCTION

Define the function in two words - a verb and a noun. This forces you to separate functions - to consider them one at a time. It keeps you from considering a part or assembly as it is, and focuses your creativity on what it does.

If a function can be described in two words, it is probably clearly understood. If more words are required, they won't describe the function at all but rather will explain how it is being performed.

Define all functions - basic function, secondary functions, functions of assemblies, functions of each part, functional areas.

Define each function at different levels of abstraction - to help identify the functions that are really wanted.

Write down all the functions that come to mind. Select the function or functions which best describe what you really want, crossing out those that don't apply.

5. EVALUATE BY COMPARISON

Value is determined by comparison - no other way. Compare the item with familiar commonplace items that perform similar jobs. What does it look like? What does it make you think of? What else costs about the same? What has similar attributes? These may be in entirely unrelated fields, such as universal hardware or even toys.

6. ANALYZE COSTS

Know the type of cost information that will let you tie specific bits of cost to specific bits of function. The more accurately this association can be made, the better.

Know the shop cost (as far as possible) of:

- Each component
- Each manufacturing process applied to a component
- Each step of assembly
- Each tolerance, special finish, etc.
- Each inspection

Consider all recurring costs.

- Raw material
- Direct labor
- Overhead
- Inspection
- Purchased parts and material
- Rejection, rework and retest, scrap

Consider non-recurring costs (portions that have not been expended). Engineering, Tooling, Planning.

Know cost per unit. Consider units to be manufactured.

Consider cost per pound, per foot, square-foot, gallon, per unit of tensile strength, per unit of weight increase (or decrease), length increase, area or volume increase, etc.

Know shipping and packing cost.

Consider total cost. Are you influencing maintenance costs, for example?

7. DO CREATIVE THINKING

Turn off the judicial part of your mind. Put your imagination to work. Apply creativity to the functional definitions, not to products. What else will do the job? In what new and unique ways can the function be performed? Someone has said there are at least eight ways of doing practically everything.

Use both individual and group creativity - brainstorm!
SUSPEND JUDGEMENT! Bring out as many possible alternatives as you can, regardless of how practical they seem at first. Save judgement till later.

8. EVALUATE THE FUNCTION

Technique #1. Evaluate the function

- . Define each function
- . Identify basic and secondary functions
- . Evaluate each function by comparison
- . Ask - and answer - five basic questions
 1. What is the item?
 2. What does it do?
 3. What else will do the job?
 4. What does that cost?
 5. What does it cost now?

Technique #2. Evaluate functional areas. Divide costs into functional areas - such as the electrical function of a switch as opposed to its mechanical function of switching - or the threads of a bolt that, by themselves, have both a cost and a function.

Relate cost to function. Find out where the money is being spent. Then find out what you are buying with that money.

Divide costs in one or more functional ways until you find a cost that seems unreasonable.

Technique #3. Evaluate basic function. This is a step-by-step approach to the analysis of a device or assembly. It can also be applied to parts, especially where you can identify definite functional areas of the part.

- . Temporarily accept all other parts of the product as satisfactory.
- . Temporarily assume that only basic function has value.
- . Identify the basic function or functions of the assembly.
- . Identify the basic functions of the parts of the assembly. At this time, identify a function as basic only if it contributes to the performance of the basic function of the assembly. (Remember that each part will have its own basic function.)
- . Evaluate the functions by comparison.
- . The total values of the individual basic functions is the value of the assembly's basic function.

9. BLAST, CREATE AND THEN REFIN

It's more effective to take a simple concept and build up to meet all needed requirements than it is to take a complex idea and try to identify and eliminate all of the elements of unnecessary cost.

Blast. Blast down to basic functions only - strip them bare by temporarily disregarding all other parts of the product or by accepting them as-is, and by temporarily disregarding secondary functions.

Create. Do creative thinking to develop alternate ways-and-means of accomplishing the over-simplified concepts revealed by the blasting. These should be the simplest and least expensive ways you can think of, even if you know full well they are not entirely satisfactory.

Refine. The refining comes about when you start to adapt the ideas so they are satisfactory. Other refinements will appear when the secondary functions are reviewed. Continue creativity. Knowingly add increments of function along with additional increments of cost until the refined product fully accomplishes the total function - then STOP.

10. IDENTIFY AND OVERCOME ROADBLOCKS

- . Anticipate roadblocks.
- . Evaluate whether roadblocks are real or imaginary.
- . Roadblocks can be things - they can be situations - they can be people.
- . Most roadblocks are the result of habit - or attitude.
- . Look out for self-imposed roadblocks.
- . Identify the specific roadblock - define it as clearly and sharply as possible.
- . Then set about overcoming it.

11. CHALLENGE REQUIREMENTS

Challenge requirements and specifications (including Military Specifications) for such things as finishes, tolerances, stress, tests, inspection and delivery schedules. These usually cost a lot of money. Finding an unnecessary, unwanted or obsolete requirement will pay quick dividends.

Here are some reasons why requirements should be challenged - reasons why they may be unnecessary.

- . Changing conditions. What was true then may not be true now.
- . Poor communications. Misunderstanding as to actual requirements.
- . Lack of time. When original decisions were made.
- . Product patterned after a prototype.
- . Lack of cost knowledge. Not knowing the specific cost of the requirement.
- . Unknown technical requirements. Stress, heat, radiation.
- . Pride of fatherhood. On the part of whoever made the specification.

At one time specifications and requirements were sacred. No one dared question them. We assumed that the customer or whoever made the specification knew that it would produce what he wanted. Value work has shown over and over that specifications and so-called requirements are only methods used to obtain the functions that represent real value to the user. If anything is sacred it's the customer desired functions and features -- not the specifications. The military customer not only permits his specifications to be challenged, he has offered to share the savings with the contractors who challenge (and change) them successfully.

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12. USE SPECIALTY VENDORS

Draw on the almost unlimited resources of industry. Take advantage of the know-how of people who make a business of producing the product, process or service you want - or one like the one you want.

- . Use specialty products and processes.
- . Look for vendors who specialize in manufacturing, processes, testing, design, stamping, molding, etc.
- . Use Job Shops.
- . Find large and small quantity producers.
- . Look for newly developed processes, materials, tools and machines.
- . Ask Purchasing and Vendor Research to recommend specialty vendors.
- . Avoid expensive "do-it-yourself" approaches.
- . Don't re-invent the wheel.

13. USE THE COMPANY'S SPECIALISTS

A company like ours has people and departments whose sole purpose is to give specialized service. Take advantage of what's already here. Don't hesitate to seek out and consult company experts.

14. USE STANDARDS

Search diligently for a standard. Standard products are inherently less costly than "special" or "one-time use" parts. The full meaning of this technique includes the appropriate use of parts of standard products as well as the use of the standard product itself. Can the product be designed to accept a standard part rather than designing a "special" part to fit the product?

15. USE GOOD HUMAN RELATIONS

Human beings dislike change. Value work nearly always involves a change of some sort. People may be suspicious of your motives, and they probably won't want to accept your ideas.

Treat people with the dignity and consideration they have a right to expect. Avoid any appearance of being critical. Give willing and enthusiastic credit to others. Try to make them a part of the opportunity to get better value.

16. GET NEW INFORMATION

Bring new information into each functional area. Find what new products, materials or techniques have been developed since the last time someone studied the item. Find what changes in requirements have been made.

17. GET A DOLLAR SIGN ON EVERY GIVEN TOLERANCE

Tolerances cost money. So do finishes. Generally speaking, a tight tolerance costs more than a loose one. If possible, determine and assign a \$ against inspection, fabrication and test tolerances.

The tolerance (or finish) spelled out on a drawing might force a milling machine operation when a cast or welded part will do the job. In other words, they may cost dearly but contribute no value. Be sure those called for are needed and not the result of habit.

Define and evaluate the function of the tolerance or finish.

18. WORK ON SPECIFICS - AVOID GENERALITIES

"It always costs more to machine a part than it does to fabricate it!" "It's not practical to buy these because we can't get good quality." Recognize that generalities are a force that keeps the status-quo.

The first step must be to eliminate the generality in order to come to grips with the specific problem. What does this specific item cost? Can we (buy, cast, fabricate, machine, eliminate, etc.) this specific item in this specific case.

19. USE YOUR OWN JUDGEMENT

How much of your time do you put in doing things exactly as you think they should be done?

Someone has said that Value Engineering is "organized common sense." If you're going to get value, it's vital to do what makes the best sense. Any deviation from answers that make the best sense will result in either lower performance or lower value. Performance can be checked right away by tests. Decreased value, on the other hand, often shows up only as buying resistance. Even then, cause and effect are so separated that you can't always connect sales or profit loss with specific poor value decisions.

20. USE THE CRITERION, "WOULD I SPEND MY MONEY THIS WAY?"

When the average person spends his own money, he's governed by the following typical conditions:

- . He has a limited amount to spend.
- . He tries to get the most use and appearance he can for his money.
- . He expects to get these functions within reasonable limits in return for his money. If he doesn't, he makes appropriate changes - either then or the next time he gets ready to spend his money.
- . He knows he can't get reasonable value in exchange for his resources unless he has value alternatives clearly set up and uses all the information he can get hold of to make a decision.
- . Before he spends his money, he will have a good idea of the relative use values, the relative esteem values and their relative costs.

THE VALUE ENGINEERING JOB PLAN

INFORMATION PHASE: Research and data gathering -- Get the Facts
 and Know the Costs.

DETERMINE FUNCTIONS

CREATIVE PHASE: Think of all possible alternate means of obtaining the functions -- Speculate.

SUSPEND JUDGMENT

EVALUATION PHASE: Analyze ideas. Estimate their dollar values.
 Relate cost and function.

INVESTIGATION PHASE: Pick the best ideas and plan their development.
Plan the proposals.

REPORTING PHASE: Prepare a concise report. Give the facts and proposals to those who can do something about it.

THE VALUE ENGINEERING JOB PLAN

I. INFORMATION PHASE

- . Get all the facts.

Costs
Quantities
Vendors
Test results
Specifications
Manufacturing process information

- . Get drawings and planning cards.
- . Get samples of parts and assemblies whenever you can.
- . Study the item's history: engineering, manufacturing, procurement.
- . Analyze costs.
- . Discuss thoroughly with everyone involved.

Talk to the designer.
Talk to the person responsible for decisions regarding the item.
Learn the basic manufacturing -- observe the manufacturing.
Get purchasing information from the buyer.
Ask questions, listen, study, develop a complete understanding of the product and its function.

- . Try to find what functions the customer or user really needs or wants.
- . Decide the amount of effort that should reasonably be expended on each item of cost.
- . Organize your material. Discriminate between significant and insignificant facts.
- . Define functions verb-noun definitions.

II. CREATIVE PHASE

- . Apply creative thinking to the functions defined in the information phase. Create alternatives.
- . Use your imagination - overcome habit and tradition.
- . Suspend judgment.
- . Concentrate on simple, direct ways to perform basic functions - features and secondary functions will be added as needed.
- .. Consult others who may help you.
- . Create as many ideas as you can.
- . Systematically explore various materials, machine processes, rearrangement of parts, etc.
- . Record every suggestion that seems remotely possible.

III. EVALUATION PHASE

- . Analyze ideas - which ideas have greatest chance of success?
- . Don't try to eliminate ideas - analyze them to see how they can be made to work.
- .. Pay special attention to ideas that have an "obvious" reason why "it won't work".
- . Select the best specialists for consultation.
- . Select the best vendors for consultation.
- . Estimate the dollar cost of each idea.
- . Relate specific costs to specific functions.

IV. INVESTIGATION PHASE

- . Pick the best ideas - plan the steps of development.
- . What is needed to prove the idea?
- . Consult with experts from both inside and outside the company.
- . Can a specialty vendor make it?
- . Is it already available somewhere? Is something like it available somewhere? Can you change the idea, without injuring function, so that available items can be used?
- . Use standard parts and materials. Try to alter the idea slightly so standards can be used.
- . Plan the preferred proposal - plan alternate proposals if feasible.

V. REPORTING PHASE

- . Assemble a concise report.
- . Report information such as:
 - Before and after sketches of the parts
 - Description of functions
 - Quantities used
 - Costs - including material, labor, overhead
 - Proposed means of performing the functions
 - Proposed costs
- . Include cost of change and implementation
 - Engineering costs
 - Tooling costs
 - Testing
 - Other non-recurring costs
- . Attach copies of pertinent data such as engineering studies, test results, vendor quotations, etc.
- . Get copies of the report in the hands of persons responsible for the item or who are in a position to make decisions regarding it.

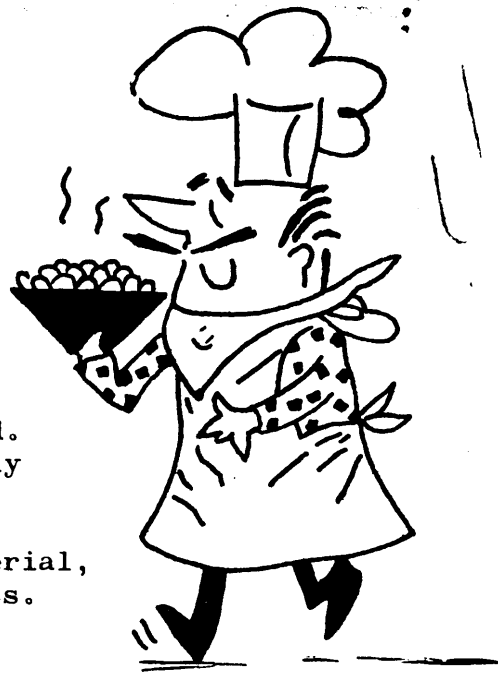
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A BAKER'S DOZEN TESTS FOR VALUE

If costs are "Fantastic" you are probably receiving poor value. One approach would be to weigh a part and see how much it costs per pound. Parts costing more per pound than gold can nearly always have their value improved.

Does its use contribute value? Every material, every part, every operation must pass these tests.

1. Can we do without it?
2. Do you think it costs more than it's worth?
3. Is there anything better to do the job?
4. Does it do more than is required? Can some of its features be eliminated without impairing function?
5. Is its cost out of proportion to its usefulness?
6. Does it cost more than the total of reasonable labor, overhead, material and profit?
7. Does the value of sub-components appear inconsistent?
8. Can it be integrated? Can its functions be combined?
9. Are specifications out of line with requirements? Are tests out of line with requirements? Is inspection out of line with requirements?
10. Can a standard product be found which will be useable?
11. Is anyone buying it for less?
12. Can it be made by a lower cost method? Considering the quantities used, could a less costly tooling method be used?
13. If it was your money, would you refuse to buy the item because it cost too much?



If the answer to any of the above questions is YES, you are not receiving good value.