

Our former engineering vice president Harry Winne first made the statement, "If a product has the appropriate performance and the appropriate cost, then it can be said to have Value." The question is - "What is appropriate performance and what is appropriate cost?"

Appropriate performance is probably really performance as good as or a little better than competition. Appropriate cost is probably the same... cost as low as or a little lower than competition. Our competition in both performance and cost may, in your type of business, be Russia. In other businesses, it is our neighbors on shore. In still others, it is offshore.

There is no virtue in using Value Analysis techniques unless we need the results they bring. They were created for one specific purpose--to identify the areas of product work which have been insufficiently done to give us appropriate cost. If lower costs are needed, use them--if not, don't use them.

There is a general belief that unnecessary cost is bad. Unnecessary cost is normal! It always exists and always will. As long as we feel that unnecessary cost is bad, we feel, when doing cost preventative work, as though we were cleaning out the cesspool. There is unnecessary cost in everything we make. Unnecessary cost runs between 40 and 75% depending upon whether products are mature or are in the newer categories.

As soon as we can adopt a different philosophy--that unnecessary cost is not bad--thousands of engineers who have done their best, with their knowledge,

their time, their ability, with the help given them by the company, will not feel criticized when someone shows that jobs costing \$10,000 could have been done better, simpler, and more reliably for \$1000.

We often hear the word "right"--we want costs "right" before we start. There is no right cost, in the sense that this is the ultimate. There is a right cost in the sense this meets the needs of the time, as set by an informed management on the basis of all the competitive factors; but the right cost will usually still be 50% unnecessary cost.

In one case we were asked to prove a point. An excellent General Electric product, that had market acceptance and was really a leader, had cost \$35.00. The product department saw that it was time to have a complete redesign and they had taken its cost down to \$23.35--and they added a feature or two. It was in balance, it fit into its market, its costs were "right." The value analysis technique system was not used. Good normal practices of engineering and manufacturing had been used. The general manager said, "Let's hold up the tooling for a few months and see if the value analysis techniques can identify still more unnecessary cost. A very knowledgeable and capable engineer, trained in value techniques, worked on it for two months with the local people. The opportunity cost was found to be \$7.50. The question now was how much of this low opportunity cost should be immediately implemented. The point I want to make is that we never arrive at anywhere near the elimination of all of the unnecessary cost.

Profit is always taken from selling price. It is not added to cost. Selling is done at market levels and adjusted plus or minus for quality factors and for good salesmanship.

If we have the profit and we have the proper selling price, there is no use to use this kind of technique, excepting in the military type of business where cost may determine follow-on business and the best we can do is not too good.

Understanding is vital because a man must really believe something to be credible or he will not work on it. A general manager might say, "We need \$25,000 cost out of this project", but, if the people do not believe that that is obtainable, they will be professionally polite to him and go on and do what they know how to do but they won't get the \$25,000. Value Analysis motivates by making credible; but Value Analysis techniques are not motivation, they are techniques to do the job. Being motivated may get you onto the golf course, but knowing how to swing the individual strokes is what gets the score.

Value Analysis is a special system of techniques designed to identify unnecessary costs.

How does it work? How is it applied? In order to assure appropriate performance, the engineers have well-established technologies--technologies for making tests and for developing new ideas. So, performance is assured by a fine tradition of competence, of tests, of systems. Engineers know what their goal is and they know what performance they have.

To achieve "value", we have to get appropriate cost. How do we go about getting appropriate cost? There have traditionally been many ways of doing it... certain engineering practices--production engineering, industrial engineering, manufacturing engineering, work simplification, good buying, others. I want to make very clear to this group that none of them are value analysis.

Value analysis is not another name for some existing techniques, it is a different set of special techniques to accomplish one purpose and to accomplish it well.

The value analysis or value engineering techniques have for their purpose the identifying of the product area where more and better work has to be done, in order to get better cost. Maybe it will be found that we must have a different marketing concept to get appropriate cost; maybe different design detail to get it; maybe a different manufacturing approach; maybe a different manufacturing operation; maybe different and better buying. The value analysis techniques are search oriented. They do not contain knowledge. They do not take cost out of anything. They do bring into clear focus the product areas where the work is deficient by the standards set by the department. Manufacturing engineering, seeing that deficient area, takes out the cost; design engineering takes it out; the marketing approach takes it out; and the managing process takes it out.

I want all of you to see very clearly that these value analysis techniques were created for one purpose--to identify, in the step by step process which creates a product, the step that has not done well enough to get costs which compete with our competitors, be they Russia or someone near.

What is more of the nature of these techniques? Value analysis or engineering techniques, to be effective, must be used from the marketing concept stage right through all stages into the end product. A deficient action in any stage can prejudice the cause for value. Here is a technology to bring

into clear focus which one of these stages, all done in series without individual measurements as to proficiency, is lacking so the necessary work can be done.

Let's look at these techniques as a new system. But, people will say, "I see in the techniques just exactly what I have been doing in manufacturing, in purchasing, in engineering, and in marketing all along"--and they're right.

Let Us Learn By Comparison.

Whenever you come out with a new product, is every part of that new product exotic? new? something no one has ever seen?

I hope that you will help build airplanes that will take off straight up, but I expect to find some parts in those airplanes that also exist in others.

I want to bring into clear focus that a new system, or a new product, does not exist of totally new parts. It contains 95% - maybe 99% - of known technologies, known types of parts, known functions. The automobile and the airplane have the same function in general--transporting people or material, but, if transporting certain things long distances fast is the objective, the airplane may be ten to a hundred times as efficient. Still - look at them. They both have wheels. They both have motors. They both have gas tanks. They have batteries. They have aluminum. They are arranged in a different system. Some things are emphasized and a few are totally new. The value analysis system is exactly that. Techniques were taken from all technologies. What are some new parts? The whole technology is built upon the

customer only buying function. There are two types of function: a "use" function--something that causes a product to work; or an "esteem" function--something that pleases him and causes him to buy. Then we evaluate function; i. e., put a value in dollars on that function. This is what is new. Any money that goes into a product is for a function--it is either a use function to cause a product to do something the customer wants, or an esteem function to cause it to please him so he'll like this color or shape or some other aspect and buy it.

Evaluating functions can be learned in about a week and people become proficient at it and comfortable with it. I was up in the TV Department about a year ago for a meeting about a third the size of this, of engineering, marketing, and manufacturing people. One of the engineers said, "We just changed a switch on our TV--we used to pull it to turn it on and push it to turn it off--we just changed it to a push-push switch where you push it to turn it on, push it again to turn it off, and it's costing us \$48,000 a year more." I said, "Let's take this item and try it. Just what function does this \$48,000 buy us?" The engineer who made the decision said, "We (the engineer and the product planner) talked it over and thought it over and decided it was a little better." What did it buy? Did it buy "use" functions or "esteem" function -- did it make it work better or cause customers to buy it?

Did it work better? The engineer said absolutely not--it does not work better. Now then, we know the \$48,000 went for "esteem" function. How do we get back money that goes in for esteem function? That particular feature

must cause enough buyers to buy to give the money back with profit. About a month later I had a telephone call from a very elated gentleman. He said, "We ran some tests to find out what effect this switch has on the customers' buying decisions and we found it has none. He said, "We went back to the push-pull and are saving the money."

One technique, then, that is new, is that, after we clearly identify what the customer wants, a dollar value is put on it, per year or per product, whichever is most handy. A second thing that is new and very controversial is--we design first to dollars, second to performance.

Every engineer, of which I am one, has always first found a way to accomplish the performance and then gone to work to add other factors such as, lightness, reliability, low cost, etc. Now I want to submit to you gentlemen that this is wrong. Whenever we have challenging cost objectives and challenging performance objectives both to achieve, here's what happens. If we first design to performance objectives, we use up the time, we use up the money, we work out and debug a solution. Here it goes...complicated, costly. But if we say, "I will not spend one penny of resources or time on any approach that doesn't--right from the start--appear to be in the ball park cost-wise," it forces creativity which will give approaches that will get performance and cost often with greater reliability.

The third thing that's new is that the techniques of value engineering are not knowledge based. There is nothing in them about manufacturing processes, high temperature metallurgy, good buying, etc. There is everything in them to show how to take a problem and search for the area where the answer will be found.

Something else that's new is the quick rejection technique of value analysis. Searches are made. Approaches are abandoned instantly. Search is continued if the criteria of cost will not be met.

For another difference--the techniques face the fact that roadblocks exist everywhere. Usually the roadblocks are people... people's honest wrong beliefs, people's habits, etc. Recognizing and dealing with human roadblocks is necessary if hard value objectives are required.

In review, the value analysis system consists of some techniques you've always used--some new ones and some familiar ones more emphasized.

What is emphasized? One thing that is greatly emphasized is creativity. We do not put too much time in teaching it because the engineers have had fine creative engineering programs; but it must be used ten times as much as it has been and right at the critical spots with definite objectives, when we go after cost objectives that are vastly lower than what we are going after now.

I expect that some of us believe that getting good value is a trade-off. We trade off a little more weight for lower cost, or a little sacrifice in performance for lower cost. I want to tell you that this is not usually true. Usually getting half the cost or a fifth of the cost means simply that we now have the right idea, the right way to approach it; and we get all of the quality and offer more. We get lightness. We get simplicity. We get more reliability. Let's do not think of trade-offs. It is using a better system to get better approaches where we need them.

One of our engineering managers the other day said, "Larry, why is it that we always underdesign, no matter how many engineers we assign to a job?" This was a very profound question. So we did a little study on it. We determined that it was because we handicapped the engineers so much in the environment limitations. We set up a case where we gave the engineers what in our judgment was the environment that would bring tremendous results.

We selected four responsible engineers. Each one took an important segment of an important product. These segments would have from fifteen to two hundred components, but they were functional in nature. Visualize four tables. We put the engineers in the middle of each table--four engineers, four tables.

Now, what does each need so that he can really achieve hard objectives of cost and performance at minimum cost in a minimum of time? Because this product had performance, and what was needed was cost, a trained and experienced value engineer was borrowed and assigned to each engineer to help stretch his reach and save us money and time.

We never want more than three men working at a table because experience shows that it slows down the work; so the third was the man who, according to that product, could help most. In one case it was a tool engineer. In another case, it was a good materials man. These men had an environment that would really let them accomplish. But, we found it was not enough. We found that we had to make available to them certain other knowledge. It was arranged

that certain other people be on call. One was a product planner. He would come immediately and would be available when the engineer needed some guidance. He would bring back the answer the engineer needed. There was a manufacturing specialist, a process specialist, a second purchasing man, a very good cost specialist, and about one or two other men.

The work that was accomplished by this group is startling and can be further reported at any time. This very successful experiment showed what the engineer needs and what he can accomplish if he is given the environment he needs.

We were concerned about decision-making so we hired an engineering manager and gave him an assignment for a year to research throughout General Electric the types of decisions that were made that affected costs, often causing costs to be too high. I would like to report to you on some of his findings.

The cost we have is the result of hundreds of thousands of decisions. As I look at that product (J-79 engine) a hundred thousand wouldn't be enough. There are at least 500,000 decisions in that, made through the past twenty years by different engineers, under different limitations, with different knowledge, with different pressures, and it arrives at this. The question is... How is each individual decision made?

There are three important shades of gray that dictate and screen each of these decisions. If we could set these up on shaded celluloid and look through them with a photo electric lamp, we could get the same decision.

1. The first one is the shade that comes down from above--what do we think the boss wants. By the boss I mean all of his associates, the company management, the company rules, the company reputation. What do I think it will be popular for me to do in this case.
2. The second one we might say is what comes up from the man. It's his own particular attitude screen. There is not a person in this room who looks at anything objectively. This is real. We try to but the minute we have experience the attitude comes...we try stainless steel and something goes wrong. We are embarrassed in front of the boss and our peers and we don't like the stuff. We try a different approach to a problem and it works wonderfully. We like it. We give it more credit than it deserves.
3. The third shade is formed by the objective information available at the time the problem is at hand.

When we put those three together and take a sharp look, that's the decision we get. This is one of the reasons why there is so much unnecessary cost.

Sometimes we make our job of doing business awfully hard. I'm not here to mouth platitudes but to relate to you some experiences as your consultant. I have said to many groups, if we could only cut the telephone lines permanently between the sales office and the factory, on the matter of costs, we might get into more good businesses. Now let me make this point. I'll expect you to use the point where it fits, not in the fringes where it doesn't.

Everything has to be sold at market levels. This is really true. The customer doesn't care what our costs are. He either buys or doesn't. Therefore, if we decide what type of business is ours and what percentage of it we should have, then bid market levels and get it, we know we have a good sales organization. If we can't get it, we know something in our sales approach must be changed.

Then we come back to the shop. If we can make the products for appropriate cost, we have adequate profit. If we can't, we can use the technology of value engineering and fix it.

On the other hand, if we cannot sell the products because they didn't perform, we know we have a performance engineering job. We will have engineering fix that deficiency.

Let's keep selling clean by letting them sell at market cost levels; keep engineering clean by holding them responsible for competitive performance; keep manufacturing clean by expecting shipments and quality standards to be maintained--then, if our profit is not right, use value engineering practices to fix the cost.

Everyone, certainly myself included, is fearful of deviating from the past; but let me present a view to you.

The general manager is the lowest man on the totem pole who is accountable in measured terms for profit. He either has it or he doesn't.

His engineering manager is accountable in measured terms for performance. He either has it or he doesn't. His manufacturing manager is accountable for shipment and for specification quality in his products. He either has it or he doesn't. His sales people either get orders or they don't. But, when it comes to appropriate cost, which has now become very important, our general manager is almost helpless.

The result is that we see in our organizations throughout the company the parade of general managers. This parade is not because they can't make products that work. It is usually because they do not have in their organization framework men of section level competence and authority to whom they can delegate the job of assuring appropriate cost--and whom they can hold accountable for results. So they, in effect, say to everyone, "Please get me lower cost." Each says, "Yes, boss" and tries. Getting appropriate cost is so important, and there is a technology that will do it. So you will, in a decade, see the twelve-year old organization pattern which has served us very well in the past, gradually modified.

We were pleased a few months ago when our vice president McCune, as a result of a number of meetings he had with operating people, said, and I quote, "A year ago I thought value analysis techniques were for the birds, and this value measurement and value standard and value control were just figments of the imagination." He said, "I am telling you today that I have changed." He went on to say, "Engineers should have training in Value Analysis

techniques and approaches." This brings some problems and some opportunities since the company is not, at the present, set up to provide this kind of training to so many people who require it.

It is asked, "If we had these engineers trained in basic value analysis techniques would they get the value we need?" The answer is "No." Nor would you--if challenging goals in high temperature were required--expect to train all engineers sufficiently to secure these required results. It is the inefficient way to do it. You would train the engineers in enough metallurgy so that they would know when they have a solvable problem, the nature of this problem, and who to call in to solve it. This is exactly the way value consultants are starting to be used and will be used.

I will read a few questions that have been asked and answer them. Some have come from Washington; some from other meetings.

1. What is the difference between value engineering and good design engineering?

The question could also be asked, and often is, "What is the difference between value analysis and good manufacturing? What is the difference between value analysis and good purchasing?" The answer is the same. I believe you understand it.

Value engineering or analysis identifies the area in which more results must be achieved regardless of which technology has inadequately contributed. Its search techniques help that area--if necessary--to get the required results.

2. One of the engineering managers for a large research organization of the government said, "My problem on these fuses is that my cost is so high I can't get enough of them, and I want to reduce the cost. I have a hundred engineers working at the job of reducing cost. To double my results, wouldn't I just hire another hundred engineers?"

The answer is a resounding... "NO!" If you had the responsibility for preparing a better tax report for your department than the people there were able to prepare and had five accountants working on it, would you hire five more accountants or would you hire one man who has the special depth of knowledge and technique and skill?

The same is true here. The answer is absolutely NO. You would hire ten skilled and competent value engineers to lengthen the reach of the hundred you already have... that would probably triple the speed and accomplishment.

3. Isn't value engineering a crutch for poor training and lack of experience? Wouldn't varied assignments under well-qualified people be a better long-term addition?

Value Engineering is a totally different approach... a set of techniques to identify the areas requiring the knowledge, techniques and skills of manufacturing engineering, of buying, and others to make further contribution to the product.

4. Can you comment on the need for modernized accounting methods, such as having greater definition, smaller and more specific burden areas, etc. ?

We cannot expect to get the kind of costs we need unless men making decisions have meaningful costs. We wouldn't hope to get good performance unless we had meaningful tests. Meaningful tests bear the same relationship to good performance that meaningful costs bear to good costs. The finance manager of a department said, "I recognize that we do not have a system that gives meaningful costs; i. e., costs that show how the business will really be affected by choice of design and manufacturing alternatives."

He said, "Our accounting system was put together for tax accounting and for profit accounting purposes and they do those very well.

Then they came along and divided certain things up and they didn't do them so well." He said, "We could create for you a system that would provide meaningful costs for decision making." Those costs are also absolutely necessary if hard cost objectives are really important.

5. In value engineering, how do you overcome the "not-invented here" complex ?

I don't believe I can contribute to that aspect. In any area in which we have made previous decisions, we should disqualify ourselves when new and hard cost objectives are needed.

6. In order to get maximum benefit from value engineering, should it be applied at the industrial engineering phases?

Appropriate cost can be lost at any stage of the product cycle, starting with the marketing concept, moving into engineering concept, into design, and so on. Apply it where it is needed. Certainly don't plan to "do it wrong first--then change it."

Now, I'll close with just a few thoughts.

As we look ahead, let's make sure that if you haven't had a chance to get the understanding that gives you a comfortable "feel", that you question enough to get understanding. Let's find a way to follow through on vice president McCune's suggestion that substantially all engineers have opportunity to get training in value analysis techniques. Let's recognize that value techniques are not a different name for technology that existed, but one specific system created to fit General Electric type of products. Let's use them when the job is to get lower costs.

Because so many of you are engineers, we will list the results from the four engineers organized in the ideal environment previously discussed.

They were working on a very competitive product for which General Electric has 40% of the available market. We had a good profit. The market levels dropped 25%. The general manager said, "I'm not going to lose my position. I'll sell at market price. We have a cost problem. We'll fix it." This action came in January.

By the first of October, coming from the production lines were improved products. Four million dollars of cost were reduced to three million.

It is useful to review the areas of actions required to change the \$1,000,000 from the cost to the "profit-before" column.

1. Purchasing got \$100,000 of it without changing of engineering or manufacturing.
2. Manufacturing methods got \$100,000 of it without any actions of purchasing or engineering.
3. Engineering, without any actions of others, got \$100,000.
4. Now we come to the real pay dirt. Items which required engineering actions--changing something, picking a different way to accomplish a function or a group of functions, then purchasing following up buying something different--got \$400,000.
5. Items requiring engineering actions followed by manufacturing got \$200,000.
6. Items which required engineering changes, which allowed different actions by purchasing and by manufacturing, added another \$100,000.

This summed up to the one conclusion--\$800,000 out of a million dollars required at least some initial different actions by engineering. The engineer is the key man in the task of securing drastically better cost actions. When he learns to use competent value engineers--as he has learned to use the necessary competence in areas of performance engineering--he will make possible the profit objectives established by our management.