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ADVANTAGEOUS DEFINITIONS CONCERNING VALUE

Bert Decker, Lt. Colonel, USAF

April 1966

VALUE ENGINEERING DIVISION
TECHNICAL REQUIREMENTS AND STANDARDS OFFICE
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FOREWORD

This paper was originally written for the Executive Council for Value Analysis and Engineering, Commonwealth of Massachusetts of which the author was Chairman, to provide basic linguistic assumptions upon which the council could agree in making Value Engineering and Value Management recommendations to the Commonwealth. Inputs were later obtained from the "Advanced Course in Value Engineering" class taught by Mr. Robert Gillespie of Sylvania at Boston University. Helpful evaluations were also received from Mr. Carlos Fallon of RCA and Dr. Guy Giroux, Liaison Officer at ESD for the Defense Research Board (Canada).

The author wishes to express his gratitude to all those noted above who contributed to this paper and especially to Mr. Ted Fowler, Value Engineering Manager of Lab for Electronics who, as a member of the Commonwealth Council, recommended that it be written. However, the author also wants it clearly understood that although he is grateful for those contributions, he alone assumes the responsibility for any linguistic confusion which still exists in the paper and which he hopes will be further clarified by others after more extended creative effort and evaluation.

Review and Approval

This Technical Documentary Report has been reviewed and is approved.

FRANK E. BRANDEBERRY
Colonel, USAF
Chief, Tech Rqmts & Stds Office

ABSTRACT

Advantageous definitions of Value Engineering (VE), Value Engineering Management (VEM), Value Management (VM), and Traditional Management (TM) are given to simplify discussion and communications and stress the specific actions required to optimize the value of military systems and motivate industrial management.

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Section I

PURPOSE

1. The purpose of this paper is to advantageously define and clarify the differences between Value (V) and Worth (W), Value Engineering (VE), Value Engineering Management (VEM), Value Management (VM) and Traditional Management (TM) in order to:

1.1 Simplify discussion and communications.

1.2 Clarify and stress the specific actions required to optimize the value of military systems, products, processes and procedures and peak the profits* of defense contractors thus providing adequate military capability at the least cost.

*This assumes profits can be peaked via VE contract incentives because they provide contractor motivation and a large return for a small investment by eliminating unnecessary costs (waste).

SECTION II

ASSUMPTIONS

2. The advantageous definition of words used in a VE task depends upon:

2.1 A general semantics approach as advocated by Alfred Korzybski in his book, "Science and Sanity," in which he assumes that:

2.1.1 The word is not the thing, the map is not the territory, the symbol is not the event, and a word has no meaning by itself.

2.1.2 Nothing can be completely defined.

2.1.3 Scientists are successful and can publically verify their findings when they base their language and definitions upon "undefined" terms which can be demonstrated on a nonverbal level (usually by pointing) and are easy to grasp and learn because they establish a more reliable one-to-one correspondence between the verbal and nonverbal by having more human senses involved.

2.1.4 Human success in all endeavors is highly dependent upon the ability to create and use such scientific words which are demonstrable, measurable, verifiable, and easy to learn and correlate with actuality.

2.1.5 Such demonstrable scientific words must be developed and used to create order, structure, and measurable variant and invariant relationships of an otherwise chaotic environment.

2.2 Plus a VE approach which:

2.2.1 Simplifies by defining a function with a demonstrable verb and a measurable noun, i.e., a scientific physical effect. Examples: collects electrons, supports weight, increases voltage.

2.2.2 Reduces abstract operational requirements (a high level of abstraction function such as "provides communications") to required supporting functions which are scientific physical effects as in 2.2.1.

2.2.3 Defines the function advantageously to the VE task by stating the function in a way which reveals the highest cost; i.e., the function of a weapon system can be defined as either "provides destruction" or "moves weight" but in most cases moving weight is the most costly aspect of the problem or containing those costs most susceptible to VE.

2.3 One important basic reason for VE success is that for the first time in history it advantageously defines value in measurable terms; that is, in function measurables and dollars, i.e., value is the lowest cost for the required function.

2.4 Like all scientific statements, the definition of value in paragraph 2.3 above is an over-simplification and true only under certain specified conditions, i.e., costs must be total, the "required" function must be specified at a measurable level of performance under specified and measurable environmental constraints.

2.5 The advantageous definition of words has more historical impact than usually realized; i.e., Rene Descartes advantageous definition of a point (an intersection of two lines) in contrast with Euclid's unadvantageous definition (a point is that which has no parts) was necessary to analytic geometry, calculus, mathematical concepts of motion and change and the engineering wonders of the world.

2.6 It is profitable to define words as did Albert Einstein by starting with the phrase, "It is possible and advantageous to define..." for the simple reason this states a proposal susceptible to creative evaluation rather than a dogmatic statement which can evoke excessive verbal conformity.

2.7 One of the most retarding factors to VE, VEM and VM has been linguistic confusion concerning them and their required actions.

2.8 All past industrial and scientific innovations can be defined as "a new way of talking about some event or the behavior of something." Further, all creative principles and techniques can be generalized as a method which has a tendency to force us to talk about some problem mess differently.

2.9 Scientists have successful language (as in paragraph 2.1.3) for talking about the behavior (events) of physical things, but have yet to develop highly scientific language for talking about what they themselves do; i.e., there are no precise measurable

terms for scientific behavior. The same is true for value engineers. They have successful scientific words for what their products do, but not for what they do.

2.10 Merely because precise measurables for scientific and VE behavior are lacking does not preclude having demonstrable and verifiable words for defining scientific and VE behavior. If a value engineer is told "define the function of the product as required by paragraph 2.2.1 above" and he does it, that he has done it can be publically verified. Whether a value engineer has done or not done a specific of a VE Job Plan can also be verified, if that task is defined using verifiable terms.

2.11 It is advantageous to define VE, VEM, and VM tasks in terms which are demonstrable, verifiable and when possible measurable. For instance, it is advantageous to establish a task by stating, "Write at least ten ways of defining the function using demonstrable verbs and measurable nouns" rather than stating, "Define the function." All measurement is relative, but bench marks help.

2.12 It is assumed that the purpose of any principle, definition or formula is to be a "guide for action," that is, it tells us what to do; i.e., E=IR tells us that if we desire to know the voltage, we must multiply current (I) by resistance (R).

SECTION III

VALUE, WORTH, PROFIT & RETURN

3.1 The objective of this chapter is to define "value," "worth," "profit," and "return on investment" advantageously in measurable terms from the viewpoint of the producer. In doing so, the following assumptions are made:

3.1.1 It is advantageous to first define "value" alone without modifiers; i.e., not "use value" and/or "esteem value" but just one universal "value," on the premise that the value of a product is the result of the physical functions and attributes of a product and the cost of those physical functions and attributes regardless of the reason why people need or desire those physical entities. For instance, a shortage may increase the number of dollars a person will pay for diamonds or kiln dried lumber, but it is the physical properties of the diamonds and dried lumber which are lacking and must be produced.

3.1.2 Assumption 3.1.1 above does not negate the possibility nor the advantage of later making an analysis of those functions - and their costs - which provide "use" in contrast to "esteem". In fact, it is also possible and advantageous to ascertain those functions and physical attributes which provides "reliability" and/or any other desired product or system characteristic and thus provide more adequate cost visibility of realistic needs.

3.1.3 The fact that "value" per se has no one universal measurable dimension does not negate the advantage of having it equated to measurables; i.e., the fact that transportation capacity has no one universal measurable dimension does not negate the advantage of equating capacity to ton-miles per hour.

3.1.4 In some cases, with some types of problems, it is advantageous when defining value to keep the functional requirement a constant while in other problems, it is advantageous to vary the functional requirement.

3.1.5 Since traditionally and conventionally "worth" has varied with the viewpoint, it is deemed advantageous to define worth from the viewpoint of the producer even if it is the customer's desires which establishes that worth.

3.1.6 It is highly advantageous to define all terms in measurable, demonstrable, verifiable terms - what we conventionally

call "physical" terms - and countable dollars regardless of the reasons for those "physical" aspects; i.e., whether the purpose of those functions is to provide use, esteem, dependability or reliability, etc.

3.2 It is possible and advantageous to first define value as directly proportional to function capability and inversely proportional to cost, that is, the value of a product is maximum when the required function capability is a defined constant and cost is minimum.

3.2.1 This concept of maximum value can be symbolized as:

$$Vmax = \frac{f}{Cmin}$$

3.2.2 The measurables in such a definition vary with the required function. For instance, if the required function is "moves/weight" the measurables can be "ton-miles per hour per dollar." If the required function is "transmit pulse" the value measurables can be "pulses per second per dollar."

3.2.3 This maximum value cannot be ascertained on a single unit production basis only since overhead and production costs decrease per unit as the number of units produced increase and since production costs also normally decrease with time in accordance with ascertainable learning curves (experience curve analysis).

3.2.4 Further, total life costs - spares, maintenance, operational, logistic costs, etc. - must be considered if maximum value is to be ascertained.

3.3 It is possible and advantageous - for reasons noted below - to first define worth - from the viewpoint of the producer - as directly proportional to price and inversely proportional to function capability; that is, the worth to the producer of a product or service is maximum when price is maximum and the required function capability is kept constant.

3.3.1 This concept of worth to the producer can be symbolized as:

$$Wmax = \frac{Pmax}{f}$$

3.3.2 The measurables of worth to the producer are the same measurables as used in value in paragraph 3.2 above.

3.3.3 Further, this definition of worth must be ascertained on a total production-total life basis; that is, total worth equals total sales dollars divided by the constant required function capability.

3.4 Based on the definitions above, it is possible and advantageous - for reasons noted below - to first define profit as equal to price less cost; that is,

$$\text{Profit} = \text{Pmax} - \text{Cmin}$$

3.4.1 This definition is applicable to both unit profit and total profits; that is,

$$\text{Unit Profit} = \text{Unit Pmax} - \text{Unit Cmin}$$

and total Profit for N units = N Unit Pmax - N Unit Cmin

3.4.2 The measurable of this definition of profit is dollars.

3.5 Based on the above definitions, it is possible and advantageous - for reasons noted below - to first define return on investment (ROI) as profit divided by cost; that is,

$$\text{ROI} = \frac{\text{Pmax} - \text{Cmin}}{\text{Cmin}}$$

3.5.1 The measurable of this definition is in percent.

3.5.2 It should be noted that an increase in Cmin provides a greater percent of ROI than an equal increase in Pmax; i.e., it is more profitable to increase value than to increase worth a like amount.

3.6 For some problems, it is possible and advantageous - for reasons noted later - to also define value as directly proportional to function capability (which is varied) and inversely proportional to cost (which is kept constant at a dollar for convenience) that is, the value of a product, process or procedure is maximum and the cost is minimum (or when the function capability is maximum per dollar).

3.6.1 This concept of maximum value can be symbolized as:

$$\text{Vmax} = \frac{\text{Fmax}}{\text{Cmin}} \text{ or } \frac{\text{Fmax}}{\$1.00}$$

3.6.2 This concept of maximum value provides a means of ascertaining maximum value when the required function of a machine is of the type "produce/pencils" and total costs vary in accordance with the number of pencils made per hour.

3.7 The above definitions are deemed advantageous for the following reasons:

3.7.1 All the definitions are simple, easy to grasp and are in measurable terms.

3.7.2 The definition of value in measurable terms provides the first scientific approach to the problem of design; i.e., value could not be achieved until it was measurable.

3.7.3 The definition of value in measurable terms provides the first opportunity to develop scientific management; i.e., in the past, the performance of organizational people could not be correlated with the only justified purpose of their performance; i.e., to the value of the product. Now, with value defined in measurable terms, it provides a basis for a measurable evaluation of the contribution of that performance to value.

3.7.4 These measurable definitions of value and worth, especially when the latter is ascertained by marketing research which determines what people will pay for specified functions, provides a more scientific approach towards merchantising which, in turn, reduces both risk and waste.

3.7.5 The worth definition is from the viewpoint of the producer (although its price is determined by the customer). Actually, a customer as a buyer has no use for a worth definition since a buyer is interested in value as defined.

3.7.6 Linguistic confusion concerning "esteem value," "use value", etc., is simplified by having only one "value" and lumping all esteem, use, etc., requirements under "required function capability."

3.7.7 The definitions cover cases where it is advantageous to consider function capability a constant, but also can be used in cases where it is advantageous to consider the function capability a variable.

3.7.8 These measurable definitions also provide opportunities for analyses concerning organizational functions; i.e., the value of differently designed organizations, which can lead to more efficient organizations.

3.7.9 Most important, the value definition in measurable terms allows the responsibility for value to be pinpointed. This was not possible prior to this capability to measure value.

SECTION IV

VALUE ENGINEERING (VE)

4.1 It is possible and advantageous - for reasons noted later* - to simply define VE as those human actions which are demonstrable, verifiable, and required by a VE Job Plan (VEJP).

4.2 It is possible and advantageous - for reasons noted later* - to define VE in more detail as a planned, systematic sequence of demonstrable, verifiable human actions which:

4.2.1 Complete the actions required by a VEJP.

4.2.2 Utilize demonstrable, verifiable, flexible, guides for action specified by the VEJP called "creative principles," "forcing techniques," "VE techniques," "check lists," "formats," etc., which evoke the required behavior with a high degree of probability if demonstratibly applied.

4.2.3 Tend to optimize cooperative creative behavior of a specified group concerned with the value of a specific product, process or procedure.

4.3 An outline of a VEJP follows:

PHASE 1 - PROJECT SELECTION

1.1 Locate where, by whom, for what, and why money is being spent.

1.2 Select high cost/large quantity/poor performance products, processes, procedures, and/or functions.

1.3 Estimate cost of possible VE projects.

1.4 Estimate potential savings.

1.5 List all possible evaluative criteria for selecting projects.

1.6 Select and use most advantageous evaluative criteria.

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* In Part VIII.

PHASE 2 - PROJECT DATA COLLECTION

2.1 Obtain and record all available costs.

2.2 Use best source information.

2.3 Ascertain all specifications and requirements.

2.4 Search for hidden costs.

2.5 Question all participants and record answers.

PHASE 3 - FUNCTIONALLY ANALYZE

3.1 Define each function advantageously.

3.2 Use a demonstratable verb and a measurable noun.

3.3 Reduce high level abstract functions (operational requirement) to its required supporting functions which are physical effects (demonstratable verb and measurable noun).

3.4 Determine the basic, secondary, essential, and non-essential use and esteem functions of all parts and assemblies.

PHASE 4 - FUNCTIONAL COST ANALYSIS

4.1 Ascertain the value standard of each function by comparison or formula.

4.2 Develop Cost-To-Standard Ratics.

4.3 Use realistic overhead costs.

PHASE 5 - DEVELOPMENT OF ALTERNATIVES

5.1 Defer judgment in listing alternatives.

5.2 First strive for quantity not quality.

5.3 List any alternative which might be advantageous.

5.4 Incubate and list more.

5.5 Broaden the function (move up the ladder of abstraction) and list more alternatives.

5.6 Combine, rearrange, or modify alternatives.

PHASE 6 - COST ANALYSIS OF ALTERNATIVES

6.1 Establish low cost targets.

6.2 Use Quick Reject Method.

6.3 Use specialists.

6.4 Identify and overcome roadblocks.

6.5 Use creative check lists.

6.6 Extend creative effort.

PHASE 7 - EVALUATION

7.1 List many evaluative criteria.

7.2 Select and use most appropriate evaluative criteria.

7.3 Use measurable, costed terms.

7.4 Record evaluations.

7.5 Document decisions.

7.6 Incubate and review.

PHASE 8 - PROPOSAL SUBMISSION

8.1 Develop one page "Before and After."

8.2 Provide realistic cost data.

8.3 Picture results.

8.4 Anticipate roadblocks.

8.5 Estimate year and/or production run savings.

8.6 Eliminate unmeasurable and/or undemonstratable terms.

8.7 Provide specific implementation recommendations.

8.8 Limit presentation to five minutes.

PHASE 9 - FOLLOW-UP

9.1 Ascertain implementation schedule.

9.2 Anticipate roadblocks, apathy, and procrastination.

9.3 Check project reception.

9.4 Schedule milestone check points.

9.5 Monitor checkpoints personally.

PHASE 10 - FINAL REPORT

10.1 Compare estimated with actual savings.

10.2 Update VE costs to VE savings ratio.

10.3 Review VE effectiveness.

10.4 Report VE progress and effectiveness.

10.5 Update VE effectiveness plan.

SECTION V

VALUE ENGINEERING MANAGEMENT (VEM)

5.1 It is possible and advantageous - for reasons noted later* - to define VEM as those managerial tasks required to select, fund, man, implement, monitor and control VE studies and assure the implementation of the recommendations, report the results, and evaluate the effectiveness of VE studies. A list of VEM tasks follow:

5.2 Value Engineering Management Tasks:

PHASE 1 - PINPOINT HIGH COSTS

1.1 Select high cost/large quantity/poor performance products, processes, procedures, and/or cost areas.

1.2 Use Basic Function Value Standards, Cost-To-Standard Ratios, Maintenance Reports, Comptroller Cost Data Reports, etc., to so select high potential saving items.

1.3 If the above do not reveal cost targets, establish small percent cost reduction targets.

PHASE 2 - ESTABLISH A VALUE TEAM

2.1 Ascertain what organizational sections have impact upon the high cost items selected in accordance with 1 above.

2.2 Determine what knowledge, cost data, and experience is needed to value engineer those selected items.

2.3 Selected Value Specialists as dictated by 2.1 and 2.2 above.

2.4 Request Value Support on an ad hoc basis if necessary.

2.5 Assign a Value Team Chairman.

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* In Part VIII.

PHASE 3 - HAVE VALUE TEAM DEVELOP A VALUE STUDY which includes:

3.1 Estimated cost (manpower, time, and resources) of making the selected Value Study.

3.2 Estimated savings.

3.3 Schedule of VE events, deadlines, and reports closely correlated with the Master Schedule.

3.4 Other comments and/or recommendation include possible constraints to the selected Value Study.

PHASE 4 - APPROVE, MODIFY AND APPROVE, OR DISAPPROVE THE VALUE STUDY PLAN

PHASE 5 - MONITOR THE VALUE STUDY

5.1 Assure the schedule is met.

5.2 Assure the VEJP is followed.

5.3 Assure Value Documentation is developed.

5.4 Help create a creative climate.

5.5 Review progress reports.

PHASE 6 - DEMAND BRIEF, WELL DOCUMENTED REPORT

6.1 Review "Before and After" implementation costs, savings, and recommendations.

6.2 Have staff review and evaluate the supporting Value Documentation.

PHASE 7 - APPROVE, MODIFY AND APPROVE, OR DISAPPROVE THE VALUE STUDY RECOMMENDATIONS

7.1 If recommendations are disapproved or modified, state why.

7.2 If recommendations are approved, praise the Value Team.

PHASE 8 - PASS APPROVED RECOMMENDATIONS TO ACTIONEES

8.1 Assure actionees have authority and resources to implement the approved recommendations.

8.2 Assure actionees schedule implementation of Value Study recommendations.

8.3 Have the Value Study Chairman provide follow-up.

8.4 Have the Value Study Chairman write a Final Report including VE Cost-To-VE Saving Ratio.

PHASE 9 - REPORT SAVINGS

9.1 Report VECPs in accordance with AFR 320-2.

9.2 Report all VE savings in accordance with AFR 400-12.

PHASE 10 - REVIEW, EVALUATE AND REPORT VE EFFECTIVENESS

10.1 Recap VE effectiveness of all Value Studies.

10.2 Report any beneficial by-products of the VE program.

10.3 Make recommendations to Value Management concerning actions, procedures, and directives needed to optimize the total VE program.

5.3 The above definition of VEM does not imply that the VE Manager is restricted to the above actions. It merely implies that those actions in 4.2 above are advantageously defined as VEM tasks.

SECTION VI

VALUE MANAGEMENT (VM)

6.1 It is possible and advantageous - for reasons noted later* - to define VM as those managerial tasks required to optimize the group creative behavior of the total organization by developing organizations, plans, procedures, controls, tactics, strategies, policies, practices, and directives which consider:

6.1.1 One factor which VM should consider is the many organizational and procedural constraints which cause both unnecessary costs and conformity. These inherent and costly organizational discrepancies indicate that modern organizations rather than being highly efficient are actually highly effective in causing waste. Further, this implies that doing Value Studies which overcome those constraints is highly necessary, but insufficient since it would be much more profitable to eliminate the constraints and thus prevent unnecessary costs. It follows that VM must therefore radically evaluate those constraints and discrepancies which cause unnecessary costs. They follow:

6.1.1.1 Lack of information and ideas.

6.1.1.2 Failure to use available specialists.

6.1.1.3 Lack of a group creative plan.

6.1.1.4 Split authority, capability and responsibility.

6.1.1.5 Selfish Sectional Efficiency.

6.1.1.6 Empire Building.

6.1.1.7 Knowledge hoarding for the sake of power.

6.1.1.8 Inadequate horizontal communications.

6.1.1.9 Lack of cost consciousness.

6.1.1.10 Lack of cost visibility.

6.1.1.11 Honest wrong beliefs.

6.1.1.12 Inability to change.

* In Part VIII

6.1.2 Another factor which VM must consider to optimize its value program is the knowledge gained by evaluating VE and VEM effectiveness. There are many reasons why VE is successful in producing optimum value. Application of a few of its many techniques often improves the product. However, VE studies must be evaluated in detail to ascertain if all techniques have been applied. Further, knowledge gained from many VE studies; i.e., size of teams, duration of studies, percent of product cost saved, etc., all helps in evaluating VEM effectiveness, training needs, and VE study needs.

6.1.3 Another factor which VM should consider to optimize its value program - and perhaps this is the most important factor - hinges upon an analysis or evaluation of VE as a "rebellion from beneath" as it was so correctly labeled by Deputy Assistant Secretary of Defense, George Fouch. On the premise that any rebellion involves change which can only be profitably optimized by effective managerial control and direction, an evaluation of the implications of that rebellion follows:

6.1.3.1 According to Larry Miles, the originator of VE, only 25% of VE problems are technical problems while 75% are what he calls "people" problems. Since control of people is normally much more a managerial problem than an engineering problem (even if some engineers must manage people) value teams, in pushing to eliminate unnecessary costs, found many traditional managerial procedures in need of change. (Examples will be covered in paragraph 6.2). This push to so change managerial procedures resulted in VE being called a "rebellion from beneath." <u>One important implication is that some TM procedures and practices must be changed if value is to be optimized</u>. It follows that only managers can make such changes and most important, it follows that <u>managers must understand the VE techniques which make it so obvious that such change is required</u>.

6.1.3.2 Because it has been VE principles and techniques which have carried VE into managerial problem areas as noted above, the VE techniques have actually become managerial tools to be understood and used by managers if value is to be optimized. <u>This means that the top managers must learn the VE techniques</u>, understand <u>their implications</u>, <u>how to use them</u> and <u>especially be able to evaluate whether their subordinates are using them effectively</u>. This indicates that

as far as the VE techniques are concerned, VE is not "just another discipline" which the manager does not have to learn because he can delegate it.

6.1.3.3 Another VE implication hinges upon the fact that value is not a responsibility easy to delegate. Prior to VE, everyone and, therefore, no one, was responsible for value. All departments have impact upon the value of the product or at least should have. Otherwise, how do we justify the existance of the department? Actually, value is a horizontal problem which cannot be delegated to any one vertical department while being consistent with conventional command and organizational principles. In fact, one reason for the spectacular successes of value engineering is that it delegates the responsibility for the value of one specific product to the leader of a small capable Value Team. This, unfortunately, does not mean that the general value responsibility has been successfully delegated to one vertical section. The conclusion is obvious. The top manager cannot delegate the value responsibility. He alone is responsible. It follows that the Value Program must be managed from the top. The Top Manager is the Value Manager.

6.1.3.4 Another reason why VE is called "a rebellion from beneath" hinges upon the reasons for unnecessary costs and costly conformity covered in paragraph 5.1.1.1 above. These reasons are actual organizational constraints inherent in the organization itself. Further, those constraints are based upon deeply ingrained verbal habits and unconscious erroneous assumptions extremely difficult to change. To correct those constraints, VM has to re-evaluate not only the organization structures, the functional relationships demanded by that structure, and organizational principles, policies, practices and procedures all of which is a chaotic linguistic mess especially where functions have not been defined advantageously as covered in Part II. Such an evaluation is a matter for VM and not for VE alone.

6.1.3.5 Perhaps the one clarification which is most important concerning this "rebellion from beneath" is this. Prior to VE, it was erroneously assumed that comptrollers control costs and managers manage costs. They do not. In fact, they cannot control or manage costs for the simple reason it is the many low-level technical and administrative decision makers who create costs. For instance, a draftsman who establishes on a drawing an unnecessary and costly degree of tolerance, creates

unnecessary costs. It is these many low-level creators of costs getting together as a Value Team who have created the "rebellion from beneath" by optimizing costs. The optimizing of their co-operative creative behavior is the profitable rebellion. Managers can never make all the optimizing decisions. They can, however, influence those people making those decisions. They can also create a creative climate which is helpful. However, merely establishing a creative climate is not enough. It is highly necessary, but insufficient. Managers must insure that the VEJP and its techniques are used to optimize group creative behavior. Optimizing group creative behavior is a much more difficult and complex task than optimizing individual creative behavior. This is VE's most important lesson. It teaches us how to deliberately optimize group creative behavior.

6.1.3.6 Another important implication is this. Prior to VE's measurable definition of value, management's measurement of the performance of individuals in the various vertical organizational segments had no valid base; i.e., there was no meaningful correlation between the activities of each segment and the value of the product being produced. Now with value measurable, there is an opportunity to develop a meaningful correlation between the work being performed and the value of the product. In fact, this is one of VM's most creative challenges.

6.1.3.7 The general implication of the value rebellion is this. The resistance to VE has been because it attempts to change traditional managerial procedures. This resistance generates costly conflict and inefficiencies. VM can reduce the inefficient conflict only by changing the "rebellion from beneath" to a "creative crusade by chiefs," by directing and controlling the creative VE program and by learning to apply this optimization of group creative behavior techniques to all managerial problems rather than to only the problem of design. To be more specific, VM will develop a VM Job Plan which will optimize managerial tasks as the VEJP optimized the design task. That is what the creative principles of VE promise. This is the broad challenge.

6.1.4 The application of the VE techniques as VM tactics and strategies. This consideration by VM is based upon the following assumptions:

6.1.4.1 All VE "creative techniques" can be used as VM "creative techniques."

6.1.4.2 VE has "forcing techniques" which have a tendency to "force" behavior in certain desired directions or towards certain desired goals. A work sheet, for instance, which calls for a complete functional analysis "forces" a person to consider every aspect of a product, process or procedure. Basic Function Value Standards and the "Quick Reject" method, for instance, have a tendency to force people to strive for those alternatives which provide the function at the lowest cost. VE has many such forcing techniques. The implication is that VM can and must use such VE forcing techniques as VM tactics.

6.1.4.3 It is possible and advantageous to list all VE techniques and generate creative possibilities for using them as VM tactics. An example of VM using a forcing technique as a VM tactic is, of course, the establishment of arbitrary VE cost reduction targets from the top down to improve cost consciousness. This is usually done, incidently, not as a matter of principle; i.e., deliberately using a VE technique as a VM tactic, but because research has demonstrated that if such arbitrary cost savings targets are established, costs will be cut at least five percent. The assumption here is that all VE techniques can be profitably applied as VM tactics as a matter of principle; i.e., as a proven guide for action.

6.2 VM Tasks. Following are specific management tasks required by the considerations and assumptions of 6.1 above. These tasks are necessary to optimize the total value program and were not apparent to TM prior to VE.

6.2.1 The reorientation of the organization's traditional cost analysis so it provides cost of functions in addition to cost of components.

6.2.2 The establishment of Basic Function Value Standards, Relative Costs, and other measuring criteria needed for effective VE.

6.2.3 The establishment of comptroller, budget, and project procedures and priorities for selecting, funding, manning, monitoring, controlling and implementing VE Studies and VE Study recommendations.

6.2.4 The establishment of cost targeting procedures in both design and procurement, cost target monitoring, and cost targeting effectiveness measurement.

6.2.5 The establishment of procedures and specific plans to quickly reassign personnel who have been value engineered out of unnecessary tasks.

6.2.6 The establishment of procedures to rebudget funds saved by VE funds.

6.2.7 The establishment of procedures and evaluative criteria for evaluating VE effectiveness and VM effectiveness.

6.2.8 The establishment of procedures for resolving VE conflicts.

6.2.9 The establishment of plans and means for VE/VEM/VM training, education and publicity.

6.2.10 The dissemination of cross-fertilizing information, cost standards, and other VE/VEM/VM data.

6.2.11 The specification and dissemination of the VE/VM responsibilities and duties of all staff and operating agencies on the assumption that any agency which does not have some measurable or demonstrable impact upon value should be deactivated.

6.2.12 The reduction of all high-level organizational functions to low-level supporting functions which are measurable.

SECTION VII

TRADITIONAL MANAGEMENT (TM)

7.1 It is possible and advantageous - for reasons noted later* - to define TM as those management actions not based upon the VE considerations covered in Parts I, II, III, IV, V and VI above; that is, based upon an ignorance of VE techniques, knowledge, and experience.

7.2 The above assumption does not assume that all of VE is new or that VE has not built upon the effective aspects of traditional management. VE has attempted to optimize the best in TM; however, it is the new and unique aspects of VE and their implications upon which VM concentrates since they provide guidance of which TM was not aware.

7.3 Some unique aspects of VE, the possibilities of which TM was not aware of, follow:

7.3.1 VE pinpoints value for the first time in history by scientifically defining value in measurable demonstrable terms and uses a product oriented VE functional cost analysis which provides an improved cost visibility directly related to detailed requirements.

7.3.2 VE results in big percent cost reductions plus product improvement.

7.3.3 VE utilizes a group creative plan, the VEJP which has a tendency to optimize group dynamics and creative behavior and negate the conformity of "the organizational man."

7.3.4 VE is horizontally organized thus improving horizontal communications and overcoming the inherent vertical organization constraints which cause unnecessary costs and conformity.

7.3.5 VE teaches a behavioristic approach which stresses that engineers and industrial people have human weaknesses which cause unnecessary costs. It also provides guides for action to overcome those human "roadblocks."

7.3.6 VE provides swift dollar-success training in which people successfully cut costs to a measurable degree while learning VE.

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* In Part VIII

7.3.7 VE provides a quick profitable return for a small investment; i.e., in a 6% profit situation, it takes a $152/3 investment to make a dollar profit, in VE a $.10 to $.20 investment often produces a dollar return, or more.

7.3.8 VE provides a greater return and a bigger percent of return for becoming competitive. Prior to VE, becoming competitive normally reduced return and percent of return.

7.3.9 In government contracting with VE both the government and the contractor can gain because unnecessary costs (waste) are eliminated. This has a tendency to enhance mutual trust.

7.3.10 VE is more difficult to manage than other disciplines because it strives to overcome traditional organization constraints and challenges organizational principles and TM procedures.

7.3.11 VE highlights and pinpoints organizational constraints which cause unnecessary costs, degrades value and causes conformity and which must be prevented if value is to be optimized, group creative behavior shaped, innovation increased and profits peaked.

SECTION VIII

WHY THE DEFINITIONS ARE DEEMED ADVANTAGEOUS

8.1 The above definitions are deemed advantageous for the following reasons:

8.1.1 They simplify discussion by limiting VE to the specific actions of the VEJP, VEM to the management of VE studies, VM to VE knowledge, experience, and evaluations, and TM to prior to VE knowledge and experience.

8.1.2 They separate the over-all complex problem into three easy-to-grasp segments, VE, VEM and VM.

8.1.3 They clarify and stress the specific actions required under the three segments.

8.1.4 They clarify the fact that with the VEJP we have a proven sequence of demonstrable techniques and actions which can be improved, but which are now highly successful if conscientiously and demonstrably applied.

8.1.5 They clarify the fact that we have no VM Job Plan, but are in need of one and that VE techniques can be profitably used as VM tactics.

8.1.6 They clarify the fact that the VM problem is more difficult, more complex, but in need of more attention and provides many opportunities.

8.1.7 They clarify the fact that top management is very much in need of VE, VEM, and VM training and education.

8.1.8 The ten-step VEJP is considered more advantageous than the normal four or five step VEJP in that it provides more specific demonstrable steps which are generally understood, but not stressed in the normal VEJP.

8.1.9 They clarify and stress specific actions which must be taken by VM in order to optimize value and group creative behavior and peak profits, actions which were not deemed necessary under TM.

8.1.10 They provide more specific verbalizations for creative evaluation and improvement.

SECTION IX

DICTIONARY DEFINITIONS

9.1 Another method of defining words in contrast to the advantageous way noted above is the "dictionary approach" which is to search the current literature and ascertain how words are being used. In that approach, sheer statistics determine whether a given meaning of a word is listed in the dictionary as the first, second or nth meaning. Further, connotations have a tendency to increase and soon out number the denoted meanings of words over a period of time so that dictionary listings continually change with time.

9.2 Following are a list of value engineering terms recorded in accordance with the dictionary approach. However, this list is based upon a very small sample of the literature and is highly likely to change in the present literature explosion concerning value engineering.

9.3 Value Analysis

9.3.1 Assessment of the value of a product, process, or procedure.

9.3.2 Close scrutiny and definition of a product's function and the comparative costs of performing those functions in other conceivable and realistic ways.

9.3.3 The name sometimes given to a section in Procurement responsible for finding materials which will provide a required function for less cost.

9.4 Value Engineering

9.4.1 Deliberate and creative application of value analysis techniques by a team in a planned, systematic, horizontally organized manner to produce optimum performance, quality, reliability and maintainability in a product, process or procedure for the least total cost.

9.4.2 Application of a Value Engineering Job Plan's steps by a team of selected specialists.

9.4.3 Application of the value analysis techniques by an individual to his everyday tasks.

9.5 Value Assurance

9.5.1 Value analysis/engineering during the conceptual and definition phases to insure cost avoidance.

9.5.2 Name sometimes given to a division which is responsible for value engineering and other disciplines.

9.6 Value Control

9.6.1 Procedures and documentation which insures that value analysis/engineering/assurance is being practiced.

9.6.2 In some companies, Value Control is VEM defined in Part V above.

9.7 Value Formats

Value forms or sheets such as a Functional Cost Analysis Work Sheet, Functional Evaluation work sheet, Vendor Value Questionnaire, which are systematically used as creative tools and forcing techniques in a value engineering effort.

9.8 Value Engineer

An engineer trained and qualified to select, organize, lead and implement a value engineering effort.

9.9 Value Specialist

An industrial or technical specialists trained in the value analysis/engineering/assurance techniques.

9.10 Value Team

A group of Value Specialists from those organizational activities whose responsibilities and knowledge have impact upon the value of a product being value engineered.

9.11 Total Costs

Initial purchase costs plus user supporting costs.

9.12 Value Study

9.12.1 A value analysis/engineering/assurance effort by a Value Team.

9.12.2 The paper work indicating the results of a value analysis/engineering/assurance effort by a Value Team.

9.13 Function

9.13.1 That which a product, part, process, procedure does.

9.13.2 An operation, manipulation, performance, type of behavior, a response or physical effect.

9.13.3 A mathematical relationship.

9.13.4 An organizational unit.

9.14 Functional Cost Analysis

Assessment or determination of the cost of each and every function of a product, process or procedure. In value engineering, this includes placing costs on low-level functions; i.e., physical effects.

9.15 Traditional Cost Analysis

Cost analysis which is organizational and component oriented such that costs cannot be directly correlated with production costs and value.

9.16 System Value Engineering

A value analysis/engineering/assurance effort which:

9.16.1 Is aimed at a complete system as a whole.

9.16.2 Extends from the system's conceptual and definition phases to final acquisition.

9.16.3 Considers the total life of the system and the total cost of that life.

9.16.4 Develops a system family tree of required functions and places a cost target and/or cost standard on each function.

9.16.5 Value engineers in greater detail and in greater functional depth as the project moves downstream from conception to acquisition.

9.16.6 Provides realistic low-level functional cost data for System Engineering, Design Reviews, Trade-Off Studies and System Cost Effectiveness Studies.

9.17 Value Support

Augmentation of one organization by another with value specialists needed for a specific value study on an ad hoc basis.

9.18 Value Consultant

9.18.1 A value engineer who provides value engineering consulting services.

9.18.2 A consultant or expert in some special field brought in to brief a Value Team concerning that expert's specialty.

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13. ABSTRACT

Advantageous definitions of Value Engineering (VE), Value Engineering Management (VEM), Value Management (VM), and Traditional Management (TM) are given to simplify discussion and communications and stress the specific actions required to optimize the value of military systems and motivate industrial management.

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