## REGISTRATION RATES FOR
### SAVE 1990 ANNUAL CONFERENCE

<table>
<thead>
<tr>
<th></th>
<th>MEMBERS</th>
<th>NON-MEMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Registration Discount</td>
<td>$345</td>
<td>$445</td>
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<tr>
<td>(expires February 15, 1990)</td>
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<tr>
<td>Regular Registration</td>
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<td>$485</td>
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<tr>
<td>(after February 15)</td>
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<tr>
<td>Government Employee Discount*</td>
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<td>$310</td>
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<tr>
<td>(proof of government employment required)</td>
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<tr>
<td>5-9 Multiple Registration Discount</td>
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<td>$465</td>
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<tr>
<td>(off each person, after February 15)</td>
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<tr>
<td>One Day Registrations*</td>
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<tr>
<td>Student Registration*</td>
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</tr>
<tr>
<td>Spouse Registration</td>
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<td>$100</td>
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<tr>
<td>(before February 15)</td>
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<tr>
<td>Spouse Registration</td>
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<tr>
<td>(after February 15)</td>
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<tr>
<td>Sunday SAVE Round Table</td>
<td>$30</td>
<td>$30</td>
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<tr>
<td>(and Gourmet Feast)</td>
<td></td>
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</tr>
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</table>

*No discounts applicable.

Cancellation policy: No refunds or returns after April 9, 1990.
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EDITORIAL POLICY: To provide informative, timely and interesting communications pertaining to Value Engineering / Value Analysis and related disciplines. VALUE WORLD enables contributors to express themselves professionally in advancing the art. VALUE WORLD is dedicated to the establishment of a mutual bond among those seeking to better the quality of working life and establish a communications network through which participants can interact for mutual benefit.

The views expressed in VALUE WORLD are neither approved nor disapproved by the Society. They are the expressions of the author(s).

All papers have been edited — frequently condensed — by the editor.
Value Management Workshop Leaders: Teachers, Trainers, Facilitators or All/None of the Above

by R. A. Fraser, Ph.D.

R. A. Fraser, Ph.D., Professor, Miami University, Oxford, Ohio


"In addition to all the engineering and business courses, I also studied four years of psychology and abnormal psychology . . . I've applied more of those courses in dealing with the nuts I've met in the corporate world than all the engineering courses in dealing with the nuts (and bolts) of automobiles."

—L. Iacocca

Introduction

One of the most important and frequently asked questions concerning value management (VM) training programs is "What should the participants learn?" For our purposes, we will use a revision of Kimball's definition of learning: a relatively permanent change in behavior or behavioral potentiality that results from experience and cannot be attributed to temporary body states such as those induced by illness, fatigue, or drugs.

The specific subject-matter content of such changes in behavior we are trying to develop — such as "follows the job plan" or "determines cost-function relationships" — is only one aspect of the learning issue. While such content questions are of major concern to workshop developers and the Society as a whole, they are not central to the question posed in this paper's title. Rather we need to determine the kind of learning we are trying to provide for. Among the many possible outcomes of educational experiences, those most closely related to VM activities include "implementing," "believing" and "knowing."

Outcomes of Educational Experience

Effective workshop leadership is conceived by some as the ability to induce procedural behavior. On the lowest level this means to be able to get the members to do what they're supposed to do — to figure out reasonable verb/noun functions and arrange them logically, to determine function cost relationships, to generate alternatives, etc. This type of leadership is analogous to the "back seat driver" role performed by a passenger who knows the route and directs a naive driver to the destination by saying things like "turn right here," "take the left fork in the road," and so on. The vehicle and all of its occupants finally arrive at the desired location, but what has the driver learned? He has practiced some motor skills (turning, braking, etc.) and has learned (hopefully) that the navigator gave valid directions. However, if the driver tries to repeat these actions later, by himself, the fact that he did not learn the route may become regretfully obvious.

When VM workshops are facilitated in this manner, some positive results may be obtained. Costs may be reduced and/or worth improved. New systems may be developed or new products designed. But after this kind of experience, we frequently notice a lack of use of these techniques beyond the initial workshop activity. When participants try to solve new problems later, they frequently find (like the driver in the example above) that they are lost and unable to perform as they had in the guided situation.

When participants try to solve new problems later, they frequently find that they are lost and unable to perform as they had in the guided situation.
The second possible type of learning outcome is belief. Consider a medieval apprentice who has learned from his elders that evil spirits cause disease. We would not describe the apprentice as having come to know that evil spirits cause disease for that would be admitting that spirits do cause such outcomes. Nonetheless, we may still attribute belief without committing ourselves to the embedded substantive assertion. If a given belief is true (or at least within the legitimate range of truth approximation), we may then use "knowledge" attributions as in the case of a statement such as "Lansing is the capital of Michigan." In this case, we are willing to commit to the substantive assertion.

A large percentage of learning is of the "belief" type. When a student of philosophy says "I learned that the world of sense is an illusion," he is actually allowing that he learned that such and such a philosopher believed the world of sense is an illusion. Indeed, the student himself may have come to accept the belief himself; but this is not the same as knowledge.

Some writers have distinguished a weak and strong sense of knowledge. In the weak sense, knowing means having a true belief. Use of the strong sense requires more. It requires the ability to back the belief with supportive evidence — logically or empirically. If a person says that she has learned that the area of a circle can be found by multiplying pi by the square of the radius, we would attribute knowledge — but only in the weak sense. Even if she can correctly calculate circular areas by using the formula; without the ability to provide suitable support for the validity of the formula she cannot be said to know, in the strong sense, that \( A = \pi r^2 \).

In summary, learning some quants (Q) involves coming to believe that Q. Under specific conditions it also involves coming to know that Q. These conditions include truth of Q for the weak sense and proper backing of Q for the strong sense of knowledge.

The changes in behavior discussed so far may be discussed as forms of learning. But the question still remains, what type of role is the director of such a learning enterprise performing?

Models of the Learning Process

The most basic form of learning was first studied by Ivan Pavlov and is called classical conditioning. This form of conditioning occurs when a reflexive (or elicited) response becomes associated with a new stimulus as shown in Figure 1.

![Model of Classical Conditioning](image)

Specific attitudes and values are frequently conditioned emotional responses that have become associated with previously neutral stimulus. For example, if Jack's supervisor's sarcasm is at its most biting during operation reviews, Jack may begin to loathe reviews and eventually all project meetings. The emotional responses of members to others on a team, the VM program, or the company itself will be partially determined by the conditioned and unconditioned stimuli to which members are subjected. Pavlov also identified the major conditioning principles of reinforcement, extinction, generalization and discrimination.

B. F. Skinner emphasized a second type of learning called operant conditioning wherein a voluntary (or emitted) response is strengthened when it is reinforced.

As shown in Figure 2, the discriminated stimulus is a cue that begins the whole operant conditioning sequence. It derives its power to prompt behavior from what has happened after a response. If a reward or reinforcer follows the response, the Sd will become more potent; if punishment follows, the Sd will become a signal that the particular response should not be repeated. In Figure 3, we can observe the operation of both models of conditioning in the same situation.

![Combination of Classical and Operant conditioning models](image)

The third model of learning we will consider was developed by Albert Bandura. His social learning theory attributes changes in behavior to observation and imitation. Bandura suggests that the degree to which individuals observe and imitate a model's (e.g. workshop leader) behavior can be explained in terms of four component processes: attention, retention, reproduction and reinforcement (Figure 4).
Before anything can be learned from a model, the model must be attended to. Attentionality is partly a function of learner attributes. For example, prior reinforcement can create a perceptual set in the learner (observer) that will influence future observations. Also, perceived value for the task can increase arousal level. In terms of the model's characteristics, observational learning is significantly improved when the model is respected, has high status, has demonstrated high competence, is viewed as powerful, and is attractive and similar to the observer in some way (e.g. age, background, etc.)

Once the learner has attended to the model’s behavior, the information gained must be retained. Encoding and storing symbolic information imaginally and verbally allows the learner to covertly retrieve, practice and strengthen the information long after the original observation. Learning conditions that enhance retention include increasing the degree of original learning, providing for similarity of learning and recall conditions, reducing interference, improving meaningfulness (understanding) and organizing content effectively. While value programs are especially effective in provision of “real-life” problem situations, practice in day-to-day work life is significantly different from a segregated off-site learning situation. The other factors associated with retention all require extensive time commitments.

Motor reproduction processes determine the extent to which the content learned will be transformed into performance. Practice must be preceeded by cognitive rehearsal and is compared afterwards with the model's behavior to identify need for corrective action.

Like Skinner, Bandura acknowledged the value of reinforcement and included such aspects in his theory as motivational processes. The concept is much broader however, and observational learning theory includes vicarious and self-reinforcement as well as the Skinnerian notion of direct reinforcement. Motivational processes include the provision of adequate cues for performance, the opportunity to receive feedback, and experience satisfaction or reinforcement.

**Application of Learning Principles**

From the behavioral learning theories described above, we can obtain some important pointers applicable to VM training. None of the generalizations can be stated with sufficient precision, nor have the evidential support to be considered “laws” of learning. Nonetheless, such principles permit a better analysis of workshop practices by pointing out where to look and what to expect.

1. Behavioral learning theories emphasize the significance of active responding — “Learning by doing” is still an acceptable slogan.
2. Distributed practice and frequency of repetition under a variety of circumstances are important in acquiring skill and improving retention. One-trial learning was certainly insufficient when most of us were learning geometry or Latin in school. Value management techniques are probably as difficult and require adequate practice to master.
3. Reinforcement is important and knowledge of results must be provided. Feedback — the flow or return information about our own inputs is important not only in learning to solve intellectual problems, but is also critical in learning social relationship skills.
4. Generalization and discrimination suggest the importance of practice in varied contexts so that learning will be developed appropriate to the range of stimuli.
5. Novelty in behavior can be enhanced through cueing, shaping, and imitation of models.
6. For observational learning to be effective, workshop experiences should be structured to help the participants attend to significant features, retain what they observe, reproduce the activity and experience satisfaction or reinforcement.

**Role of the Value Management Workshop Director**

After examining various types of learning outcomes, alternative explanations of the process and practical principles for improving learning activities, we now return to the original question. What conception of the workshop leader role should we use? This issue is not merely of semantic interest. Rather, the way we conceive of the leader’s role corresponds to the nature of the learning outcome we hope to obtain and has important implications for the leader’s role behavior.

The leader as facilitator. If our objective for the workshop is “solve problem” or “reduce cost,” this can be achieved by providing a) someone to manage the process who is knowledgeable and experienced in value management techniques and b) individuals with necessary requisite knowledge and interpersonal skill to implement the job plan as directed by the manager. Outcomes of this approach may include high levels of goal attainment — solved problems and reduced costs. However, as in the earlier example of driving to an unknown location while being directed, we cannot expect extended use of the techniques outside the workshop sessions. In highly successful experiences, members may develop very positive attitudes toward the experience thus increasing the interest in and willingness to participate in future VM programs. Nonetheless, cognitive outcomes may be similar to the experience the driver had when trying to replicate his behavior.

The leader as trainer/conditioner. If our workshop objectives specifically include outcomes such as “the
participants will be able to describe and use VM techniques," then we must be concerned about providing an appropriate environment for learning. Application of the principles derived from learning theories can make learning more efficient. In a well-constructed experience, effective practice provides for durable learning. The workshop director can be a powerful model. Thoughtful presentation of stimuli and systematic reinforcement of appropriate responses can result in the outcomes of facilitated experience (above) as well as the accommodation of new personal beliefs and knowledge (in the weak sense). Participants can carry away a repertoire of new skills that will hopefully generalize to new appropriate situations.

The workshop director can be a powerful model.

There are, nonetheless, some serious limitations. This leadership role is generally known as trainer rather than educator. Webster defines training as "imparting proficiency by drilling, to educate narrowly." Training infers providing for learning of specific information and/or skills, but does not imply that the learners can back their beliefs by appropriate and sufficient means.

If we reconsider the earlier example of a person driving on a route which is unfamiliar to him, the outcome of being directed by a trainer would differ from his experience with a facilitator. Effective conditions could provide the driver with a memorized set of directions (perhaps neumonically encoded) that he would follow (practice) a number of times and ultimately he would learn one or more efficient paths through the otherwise unknown jungle.

The aims appropriate to the roles of facilitator and trainer/conditioner are more than quite respectable. The method by which the learning is transmitted does not make the outcome more or less appropriate. The outcomes of a problem solved or strategy practiced are valuable in their own right. However, when we talk of teaching value management techniques, a very different product is suggested.

The leader as teacher. Learning does not imply that teaching has occurred. Beliefs may be propagated in numerous ways including deception, threats, propaganda, bribery, advertising, etc. What distinguishes teaching from such other methods is that teaching some Q involves trying to bring about learning that (and belief that) Q, and furthermore, knowing that Q (in the strong sense). The aim of teaching is not merely that the learner learn what the teacher takes to be true, but also that the learner be able to support it by criteria of proper backing. Returning once more to our naive driver; a guide who was acting as a teacher would have provided him with experiences that once mastered would allow the driver to explain why a certain route was appropriate besides the reason that "that's what the guide said and it worked." He then would have learned a lot about the area and alternative ways of getting through it. He would have a repertoire of alternatives against which to apply decision rules.

The range of educational (teaching) concepts is not only larger than that of belief — it is even larger than that of knowledge. One of the highest order objectives we might aspire to is that participants will not only learn VM principles as knowledge in the strong sense, but that such principles become internalized and appreciated such that they are part of the participants' normal way of thinking. Learning to value VM is beyond the cognitive aspects involved in even the strong sense of knowledge of principles. Sheffler suggests that "to learn to pay one's debts; it is not the same as learning how to pay one's debts; it is not, for example, simply the sort of thing that is involved in learning the proper use of a checkbook." Similarly, learning how to apply principles of VM is not the same as learning to value manage decisions as a way of life. In the range of workshop leadership conceptions, facilitating can induce the appropriate problem-solving behaviors; training can provide development of appropriate beliefs and knowledge in the weak sense; and effective teaching leads to knowledge in the strong sense. Those aspects that are beyond knowledge learning may also be beyond teaching. The desire and propensity to use VM approaches continuously may be more a function of observational learning than of teaching, no matter how effectively that is done. If this is the case, then we are all under a special obligation to be effective models of the value management philosophy for others to observe and imitate.

If this is the case, then we are all under a special obligation to be effective models of the value management philosophy for others to observe and imitate.

Conclusion

After reviewing the options for learning outcomes (i.e. implementing, believing, knowing) and the theoretical approaches used to explain learning; the value manager should determine which of these he/she chooses to use. The relationships among the alternatives is shown in figure 5 and comprise a rough taxonomy of value management workshop models. As we move from left to right on the chart, the worth of the experience increases in terms of the nature of the learning outcomes — their generalizability, durability and utility. Associated costs (e.g. time required, experience and abilities of both director and participants) also rise.

As each level involves different types of activities and hoped-for outcomes, workshop assessment should vary correspondingly. Level I assessment entails measurements such as reduction in the cost, cycle-time reduction, products developed, etc. The measurement of Levels II and III outcomes is even more difficult. If we aspire to knowledge outcomes, some part of the program evaluation must assess such behavior.
Insofar as the world of value management is a world of new problems, one must worry about balancing what the fledgling participant learns by costly knowledge-oriented programs against the high cost of such explorations. If VM were a series of repeatable routines, the choice would be easy. This is, unfortunately, not the case. Thus, for human resource development and advancement of our discipline, it is hoped that there will be movement from the present preponderance of activities at Levels I and II to improved Level II activities with increased efforts at Level III.

**Value Management Workshop Models**

<table>
<thead>
<tr>
<th>Leadership Role</th>
<th>Level I</th>
<th>Level II</th>
<th>Level III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitator</td>
<td>Trainer</td>
<td>Teacher</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participant Behavior (Learning)</th>
<th>Level I</th>
<th>Level II</th>
<th>Level III</th>
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</thead>
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<tr>
<td>Implementing Instructions</td>
<td>Develop beliefs, knowledge in the weak sense</td>
<td>Knowledge in the strong sense</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Level I</th>
<th>Level II</th>
<th>Level III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem solved Opportunities Capitalized</td>
<td>As listed in Level I plus new information, skills obtained</td>
<td>As listed in Level II plus developed transferable knowledge</td>
<td></td>
</tr>
</tbody>
</table>

**References**

Networking — It Works . . .

Arthur W. Schwartz, AIA, CVS is an Architect, Consultant, Real Estate Broker in Plano, Texas and is the President of the DFW Chapter of SAVE. He is a graduate of the University of Illinois - Urbana (Bach. of Architecture), a registered architect in Wisconsin, Texas and holds an NCARB Certificate. He has been in private practice for 15 years and was an architect with the Army-Air Force Exchange Service for 14 years in Hawaii and Dallas. He is a member of the American Institute of Architects, the National Trust for Historic Preservations, and SAVE.

We all know that to be successful in the Value Engineering profession it takes hard work, integrity, creativity, expertise and perseverance. But that is not quite everything. You have to get the job before you can use these things. NETWORKING is what helps us find information and facts about a project or situation that we are interested in. It helps us make the decision of whether to pursue the idea.

Successful people have used networking as a strategy long before it was given that name and had books written about it. NETWORKING is the process of identifying and then relying upon a group of business associates, friends and acquaintances to help solve problems, get answers, give advice or offer moral support. Moral support is an especially valuable asset of people in the VE community, as there are many one-man operations and these people need someone to bounce ideas off of. The real challenge is to find out who these people are and form your own network. Remember, networking is a two way street, so you must be able to do in kind with the others in your network. Trust, confidence and confidentiality are also required between people.

Successful people have used networking as a strategy long before it was given that name and had books written about it.

Getting Started

First identify members of your network. If you are multi-disciplinary you could have a number of networks. You do not need permission, there is no announcement and it does not cost anything to do it. You can tell if it is working if people call you back and they are open with their ideas and advice. A great place to start establishing your network is at the SAVE International Conference, or at professional or society meetings. Start by writing down the names of people you believe are competent and professional in VE or other specialty and whose judgement you value.

A good place to start is to retrace your career footsteps. College acquaintances, workers in offices that you have been associated with, classmates in your 40 hour SAVE workshop or other training with whom you have established special rapport, and those you judge most likely to succeed. In your daily activities you are also exposed to other firms; people from allied professions such as engineering, accounting, cost estimating, law, industry and construction. The list of opportunities is endless and limited only by how imaginative and resourceful you are.

During the past year I have attended a number of meetings of the Society of Marketing Professionals Services in Dallas and have gleaned some ways that marketing people make contacts and improve their chances of success. Here are some of the ideas:

1. Have shelves of directories at your fingertips for easy reference of names and addresses of people and companies.
2. Use networking to develop leads.
3. Market research - Do you know who is doing work? Do you know city, region, state and county economic conditions and other market indicators? Are you watching the demographics of the area? Are you finding out information about future projects and client plans in the early stages.
before the information becomes "set in stone" and all the decisions and selections are made?

4. Call contractors and other vendors to find out the pulse of what is going on in the area. Making "warm calls," is a lot easier than making "cold calls" if you have some information.

5. Know who your competition is. What are they doing and what are their strengths and weaknesses? Do they have a lot of work? Is their manpower, expertise and special consultants appropriate for the job?

6. Pick the people that you want to work with and for. This is one of the hardest lessons that we all have to learn. You don't have to work with people that you don't like or trust - usually. Move on and find those that you like and get positive results from.

7. Before the job is firmed up look to specialty consultants for networking opportunities as they are called in by the client for advice.

8. Network with consultants and other people that you will use if you get the job.

9. Position yourself for success and use networking to preclude chasing jobs and projects that you don't have a chance to win.

10. You can find out almost anything - just ask. Ask consultants, engineers, bankers and even the clients. It is surprising what the client will tell you if you simply ask.

Key Ideas to Follow:
- Find leads
- Develop leads
- Close
- Stay with the basics

Associates

The members of your network will be identified with you so choose carefully. In the litigious world that we live in we may be "judged" by the company that we keep.

Developing, expanding and refining your network is a continuous activity. The telephone makes networking a simple, quick and inexpensive way of exchanging information. SAVE is an excellent base to work within to develop your network. Two good sources of names and telephone numbers published by SAVE are the Annual Directory and the Value Analysis / Value Engineering CONSULTANTS DIRECTORY. Use these as a base and expand into your areas of expertise and interest. For example, engineers have the Society of Professional Engineers, architects have the American Institute of Architects and so forth.

People who attend the 40 hour SAVE workshop are usually serious about their profession. They want to learn as much as possible about VE and how to make it work for them and their company. These are the people who make a commitment of time and resources to share their experiences with others and to learn more from recognized experts in the field. So find these people keep in touch. Another place sometimes overlooked is the SAVE Chapter meeting. We can expand our network by attending and participating in society activities. Talk to people and share business cards. (Get a good rolodex going.) Put a smile on your face and "press the flesh." It is incredible the opportunities out there if one goes and looks for them.

Cultivation

The best way to keep a network going is to use it. To paraphrase the biblical words "as you sow so you shall reap" and giving produces a ten-fold return. When someone asks you for advice or assistance, or asks you to handle a referral, consider it a compliment. In a profession where you need positive feedback to keep your batteries charged up, it is a real source of satisfaction to know that others consider you a vital member of their network.

The best way to keep a network going is to use it.

Dividends

Yes, networking does pay dividends. These invaluable contacts and friendships will not happen until you get organized and use the system. You need to rub elbows with others in your profession. Get a stack of business cards, put your money and credit card in your pocket, tell the people in your office that you will be gone for a while (or turn on your answering machine) and get out there networking.
Value Analysis of the Shell of Portable Bunk Houses: A Case Study

by A. D. Gupta & Col. L. M. Gupta

A.D. Gupta is Assistant Professor of Industrial Engineering at IIT Delhi. He is First Class First Gold Medalist in B.Sc. Engineering (Mech.), and M. Tech. (First Class with Distinction) in Industrial and Production Engineering. He served for two years with Union Carbide India Ltd. and has been on the faculty of IIT Delhi since 1974. He has 17 publications to his credit in various journals, viz. International Journal of Quality and Reliability Management, PRODUCTIVITY, Industrial Engineering Journal, Industrial Engineering and Management, Integrated Management, Journal of the Institution of Engineers, Proceedings of the Indo-British Conference on Engineering Production, 1976, etc. He has supervised as many as 32 projects at the Master of Technology level. His main interests are Value Management, Operations Research and Quality Assurance.

Col. L.M. Gupta did his M. Tech in Industrial Engineering at IIT Delhi. This paper is based on a part of his M. Tech project carried out under the guidance of Prof. A.D. Gupta. Col. Gupta is working as Production Manager in a Government of India Organization dealing with manufacturing and overhauling of various vehicles and equipment.

Introduction

Value Engineering (VE) has become an indispensi- ble tool for product design improvement and cost reduction in the face of growing market competition. Value Analysis (VA) is an organized effort to innovate a product or system design which satisfies the user desired functions at minimum cost and is such that the cost incurred to achieve each function is comparable to its importance. The necessary functions include not only the work performance of a product, but also its reliability, maintainability, ease of implementation, sales appeal, etc. If a number of functional alternatives differ both in initial costs and future costs, their life cycle costs are considered as one of the attributes for comparison and evaluation.

The VE job plan, supported by a number of techniques, is executed systematically in different phases. The objective is to identify and eliminate the unnecessary costs through the development and evaluation of value alternatives.

A project was undertaken to analyze and improve the value of portable bunk houses because of their high cost and poor degree of value assurance. They had been introduced without applying value principles at the design stage. There are many types of bunk houses with different fittings. However, the outer shell is common to all categories of bunk houses and it was selected for value improvement. The construction details are given in Fig. 1. The shell consists of

1. Flooring system (including underframe & skid)
2. Superstructure

A team of experienced persons was formed to conduct the study, and to provide the necessary dynamic thrust to overcome road blocks to achieve better value results.
A project was undertaken to analyze and improve the value of portable bunk houses because of their high cost and poor degree of value assurance.

**Function Phase**

The inter-relationship of the various functions of a bunk house can be best understood with the help of Functional Analysis System Technique (FAST) diagram (Fig. 2) which is based on How and Why logic. Next, the primary and secondary functions of various components of flooring system and superstructure were defined, costs were distributed to the functions and functional worth estimated (minimum cost required to accomplish the function). This is exhibited in Table 1 for the flooring system including underframe and skid. This analysis enables us to identify the saving potential which exists for each function so that we can determine the areas for cost reduction and value improvement.

![Functional Analysis System Technique (FAST) Diagram](Image)

**Table 1**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Item</th>
<th>Basic</th>
<th>Functions</th>
<th>Functional Cost (Rs.)</th>
<th>Functional Worth (Rs.)</th>
<th>Saving Potential (Rs.)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Longitudinal Members ISMB 200x100mm</td>
<td>Transmit Load*</td>
<td>Functional Cost (Rs.)</td>
<td>3000</td>
<td>NIL</td>
<td>3000</td>
<td>Place directly on ground</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Facilitate Skidding</td>
<td>700</td>
<td>700</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Cross Members ISMB 200x100mm</td>
<td>Support Load*</td>
<td>2800</td>
<td>NIL</td>
<td>2800</td>
<td>Place directly on ground</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide Rigidity*</td>
<td>500</td>
<td>NIL</td>
<td>500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Pipe 100mm dia</td>
<td>Facilitate Skidding</td>
<td>700</td>
<td>700</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide Rigidity</td>
<td>100</td>
<td>100</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Bottom side rails ISMC 100x50mm</td>
<td>Transmit Load*</td>
<td>1200</td>
<td>NIL</td>
<td>1200</td>
<td>Place on ground</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide Rigidity</td>
<td>300</td>
<td>300</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Bottom Cross Members ISMC 100x50mm</td>
<td>Support Load*</td>
<td>3000</td>
<td>2000</td>
<td>1000</td>
<td>Use lighter section</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide Rigidity</td>
<td>300</td>
<td>300</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Bottom Steel Sheet 1.6mm</td>
<td>Support Contents*</td>
<td>1300</td>
<td>100</td>
<td>1200</td>
<td>Use packing case wood</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Protect Ply</td>
<td>300</td>
<td>100</td>
<td>200</td>
<td>Paint</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Marine Ply Wood 19mm</td>
<td>Provide Cushion*</td>
<td>1700</td>
<td>50</td>
<td>1650</td>
<td>Use mud plaster</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prevent Conduction*</td>
<td>500</td>
<td>50</td>
<td>450</td>
<td>Use mud plaster</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>PVC Tiles 3mm</td>
<td>Protect Ply*</td>
<td>2000</td>
<td>100</td>
<td>1900</td>
<td>Paint</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide Cushion*</td>
<td>500</td>
<td>100</td>
<td>400</td>
<td>Use Jute matting</td>
<td></td>
</tr>
</tbody>
</table>

*High cost and Poor Value Functions*

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This analysis enables us to identify the saving potential which exists for each function so that we can determine the areas for cost reduction and value improvement.

The primary functions of the flooring system and superstructure were identified as 'support contents' and 'enclose space' respectively by numerical evaluation of functional relationships. From the function-cost-worth analysis, it is concluded that almost all functions in flooring system are high cost and poor value functions and in case of superstructure, the maximum saving potential exists for the functions 'hide defects' and 'reduce heat/cold.' Comparison of cost (as determined from function-cost matrix) and importance (given by Functional Evaluation) of various functions led the team to these conclusions. All these functions were used in the Creation Phase to generate different ideas through creative thinking and brainstorming.

Creation Phase

The potential poor value functions are put to imaginative thinking to generate new and promising ideas. Judgement, criticism and evaluation are eliminated in this phase so that the creativity chain is not disturbed and maximum number of ideas are generated for further evaluation in the next phase. As a bunk house is nothing but a portable house, the ideas for housing are applicable here. The creation worksheets for both flooring system and superstructure are given in the Original Report.

Evaluation and Investigation Phase

This is a phase of refinement and combination of ideas where creative judgement is brought into use. A positive attitude must be maintained throughout the process of evaluation, otherwise arguments can be found to delete or discard all the ideas. On the basis of the promising least cost ideas, a few functional alternatives are generated. A systematic functional development procedure for designing a new flooring system is exhibited in Table 2. We start from the basic function 'support contents,' select a least cost idea and develop/modify the idea to satisfy all the specifications or requirements related to the primary function. Then the secondary function next in order of importance is added to the development and its specifications satisfied. This procedure is continued until all the necessary functions have been added to the design and their pertinent specifications satisfied. The total cost of design up to each stage of development is also noted. This is self explanatory from Table 2 where an alternative design has been developed. The step by step diagrammatic development is shown in Figure 3.

Table 2

Flooring System: Functional Development Work Sheet

<table>
<thead>
<tr>
<th>Functions/Specifications</th>
<th>Creative Ideas &amp; Development</th>
<th>Estimated Cost (Cumulative) (Rs.)</th>
<th>Remarks/Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 'Support contents'</td>
<td>Use Packing case wooden Floor (25mm), Cost Rs.30/sqm.</td>
<td>450.00</td>
<td></td>
</tr>
<tr>
<td>(15 sqm floor area)</td>
<td>Use 25mm Deodar wooden floor boards (Rs.142/sqm) as packing case wood may not withstand load.</td>
<td>2130.00</td>
<td>As per specifications for house live load 150 Kg/sqm</td>
</tr>
<tr>
<td>Live load 2250 Kgs.</td>
<td>Protect floor board from bottom</td>
<td>Seal the bottom and paint (Rs.20/sqm)</td>
<td>2430.00</td>
</tr>
<tr>
<td>2. 'Support Load'</td>
<td>Provide 11xISMC 75x40mm bottom members. This satisfies the bending moment and shear force design criteria (Rs.2000.00)</td>
<td>4430.00</td>
<td>Fig: 3 'B'</td>
</tr>
<tr>
<td>Total dead and live load 4500Kg</td>
<td>3. 'Transmit Load' (roof, floor &amp; walls) 2200mm apart (Rs.2000.00)</td>
<td>6430.00</td>
<td>Fig: 3 'C'</td>
</tr>
<tr>
<td>4. 'Facilitate skidding'</td>
<td>Provide 2xISMB 150x80mm as side rails 4500 Kg.</td>
<td>7230.00</td>
<td>Fig: 3 'C'</td>
</tr>
<tr>
<td>5. 'Provide Cushion'</td>
<td>Inter connect ISMBs with 2x100 (Rs.800.00)</td>
<td>7230.00</td>
<td></td>
</tr>
<tr>
<td>6. 'Protect Cushion'</td>
<td>Wooden floor provides sufficient cushioning effect. No change required.</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>7. Provide Height</td>
<td>Polish and wax wooden floor periodically, no additional protection is required.</td>
<td>—</td>
<td>PVC tiles need more frequent polishing</td>
</tr>
<tr>
<td>8. Provide rigidity</td>
<td>2xISMBs 150x80mm will provide the necessary height</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>9. Prevent conduction</td>
<td>ISMBs, ISMCs &amp; Pipes will provide sufficient rigidity</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>TOTAL COST</td>
<td>Rs.7230.00</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>
their life cycle costs estimated. A numerical rating grid approach has been used for calculating the weights of attributes or decision criteria (Table 3). The technique of decision matrix has been used to select the maximum value solution which satisfies the combination of product requirements in the best manner (Table 4). After careful review and comparison, only four alternatives qualified for the decision matrix test. There are a number of objectives/requirements which are met in different proportions by various alternatives and we have to select the one which fits best in the overall frame of objectives. The analysis shows that Alternative 1 (12mm NOVAPAN with one side mat finish) has the maximum value score and therefore, it is recommended.

**Recommendation Phase and Conclusions**

The precise and systematic presentation of the results of the VA study is essential for selling the proposed alterations to top management and to motivate positive actions in favour of their implementation.

The brief summary of recommendations is presented in Table 5. The proposal will reduce the cost of the shell of a bunk house by about Rs. 37,700/- (35%) and reduce the weight by about 820 Kg without impairing its quality of service. The proposed design for the flooring system including underframe and skid (Fig. 3 'C') and use of 12mm NOVAPAN with one side mat finish or roof/side panelling are recommended for installation.

<table>
<thead>
<tr>
<th>Table 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numerical Evaluation of Weight Factors for Attributes</td>
</tr>
<tr>
<td><strong>Function:</strong> Hide Defects</td>
</tr>
<tr>
<td>Attributes</td>
</tr>
<tr>
<td>Ease of Implementation</td>
</tr>
<tr>
<td>Facility of Maintenance</td>
</tr>
<tr>
<td>Durability</td>
</tr>
<tr>
<td>Total Life Cycle Cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation Phase: Decision Matrix</td>
</tr>
<tr>
<td><strong>Function:</strong> Hide Defects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Decision Criteria</th>
<th>Ease of Implementation</th>
<th>Facility of Maintenance</th>
<th>Durability</th>
<th>Total Life Cycle Cost</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALTERNATIVE PROPOSALS</strong></td>
<td><strong>WEIGHT FACTORS</strong>*</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
</tr>
<tr>
<td>1. EXISTING 9mm MARINE PLY with 1.6mm FORMICA</td>
<td>A</td>
<td>V</td>
<td>V</td>
<td>J</td>
<td>(Rs.11900)</td>
</tr>
<tr>
<td>2. ALTERNATIVE 1 12mm NOVAPAN with one side finish mat</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>G</td>
<td>(Rs.8600)</td>
</tr>
<tr>
<td>3. ALTERNATIVE 2 9mm MARINE PLY with wall paper</td>
<td>G</td>
<td>A</td>
<td>J</td>
<td>V</td>
<td>(Rs.8340)</td>
</tr>
<tr>
<td>4. ALTERNATIVE 3 19mm PACKING WOOD with 1.6mm FORMICA</td>
<td>J</td>
<td>G</td>
<td>G</td>
<td>E</td>
<td>(Rs.7800)</td>
</tr>
<tr>
<td>5. ALTERNATIVE 4 DECORATIVE VENEERED PARTICLE BOARD, 12mm</td>
<td>V</td>
<td>J</td>
<td>A</td>
<td>E</td>
<td>(Rs.7800)</td>
</tr>
</tbody>
</table>

*From Table 3

**GUIDE:**
- Excellent E-5
- Very Good V-4
- Good G-3
- Average A-2
- Just Acceptable J-1

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Functional Development Sketch

Table 5
Summary of Recommendations
Sheel of Portable Bunk House

<table>
<thead>
<tr>
<th>Existing</th>
<th>Proposed</th>
<th>Proposed(^t) Saving Weight (Kg)</th>
<th>Saving Cost (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. FLOOR INCLUDING UNDER FRAME AND SKID</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Longitudinal Members-Skid</td>
<td>ISMB 200x100 mm-2</td>
<td>ISMB 150x80 mm-2</td>
<td>135</td>
</tr>
<tr>
<td>(b) Cross Members-Skid</td>
<td>ISMB 200x100 mm-5</td>
<td>NOT REQUIRED</td>
<td>305</td>
</tr>
<tr>
<td>(c) Bottom Side Rails</td>
<td>ISMC 100x50 mm-2</td>
<td>NOT REQUIRED</td>
<td>111</td>
</tr>
<tr>
<td>(d) Bottom Cross Members</td>
<td>ISMC 100x50 mm-11</td>
<td>ISMC 75x40 mm-11</td>
<td>65</td>
</tr>
<tr>
<td>(e) Bottom Steel Sheet</td>
<td>1.6mm</td>
<td>NOT REQUIRED</td>
<td>188</td>
</tr>
<tr>
<td>(f) Floor</td>
<td>19mm Marine ply</td>
<td>25mm DEODAR FLOOR BOARDS</td>
<td>-127</td>
</tr>
<tr>
<td>(g) Floor Covering</td>
<td>3mm PVC Tiles</td>
<td>NOT REQUIRED</td>
<td>67</td>
</tr>
<tr>
<td><strong>2. SUPERSTRUCTURE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Side Panelling</td>
<td>9mm Ply + 1.6mm Formica</td>
<td>12mm NOVAPAN</td>
<td>-32</td>
</tr>
<tr>
<td>(b) Other changes not presented in the paper (3)</td>
<td></td>
<td></td>
<td>110</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td></td>
<td></td>
<td><strong>822</strong></td>
</tr>
</tbody>
</table>

References


Figure 3

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Sheel of Portable Bunk House

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<th>Proposed(^t) Saving Weight (Kg)</th>
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<tr>
<td><strong>TOTAL:</strong></td>
<td></td>
<td></td>
<td><strong>822</strong></td>
</tr>
</tbody>
</table>
The Missing Ingredient

by Richard J. Park, PE, CVS

Richard J. Park, PE, CVS, Fellow SAVE is President of R.J. Park & Associates, Inc. Birmingham, MI.

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Introduction

Do you know about the accomplishments and legacy of Lawrence D. Miles?

Every American businessman should be able to answer yes, but can they?

However, they could probably answer "yes" if the person named was W. Edwards Demming, Joseph Juran or Genichi Taguchi.

Japanese Recognition

Mr. Miles has been recognized in Japan and awarded the Third Order of the Sacred Treasure by the Emperor for his invention of Value Analysis-Engineering (VE) and the resultant effect his ideas have had on Japanese industry and the country's economy. The medal is awarded to Japanese and non-Japanese but it has been awarded to only three other Americans; Lillian Gilbreth, Peter Drucker and W. Edwards Demming.

Although VE has been internationally recognized and is being applied and growing vigorously around the world, even behind the iron curtain, it is in Japan where it is being applied most effectively. Over 400 companies are applying VE in Japan and the number increases daily. Hitachi alone employs over 300 VE specialists to control cost and improve value in products, process and administration in all areas of the company. Every manager in Japan knows about Larry Miles and values his ideas. Why is this not true in the U.S.?

Let us take a look at history.

Over 400 companies are applying VE in Japan and the number increases daily. Hitachi alone employs over 300 VE specialists to control cost and improve value in products, process and administration in all areas of the company.

The Japanese System

Every American manager who is anyone has made the pilgrimage to Japan to see for himself the source of the industrial miracle. Results of their investigations have been varied. Some have seen effective applications of standard American systems; stuff we have been talking about for years but not really applied vigorously. Others have seen miraculous cures. Still others don't seem to have seen anything. By this time, everything should have been seen by someone.

The key question is, what have we learned? In most cases, it seems that the answer is, not very much.

What the Japanese have done is to effectively apply American methods that have been around for 30-40 years. They may look new because they have been adapted to fit the Japanese conditions.

Peter Drucker, Abraham Maslow, B.F. Skinner, David McGregor, Felix Osborn, Elliott Jacques and others have been telling us about motivation, needs, wants, organization, accountability, commitment, creativity.
environment, etc. for years. Although we have spent millions of dollars learning about their ideas, how effectively have we applied them?

In 1981 at the SAVE International Conference in St. Louis, Mr. Sochio Akazawa, Executive Vice President of Fujitsu, Ltd., said, “We did not do anything particularly remarkable; we merely introduced your ideas and implemented them in our own way! Japan has been striving to modernize ever since the Meiji Restoration of 1868. I say modernize, not westernize. The two are quite different. What we have done is to examine, to analyze European and American ways, accepting some, rejecting others and modifying still others to make them fit our traditions and culture.”

**Why Don’t We Americans Practice What We Preach?**

VE has now been around for over 30 years. It has been polished and honed to an effective system that is being applied to improve the value of products, services, manufacturing processes, administrative operations and even to forecast and plan future conditions.

There are those who feel that VE is good but is out of date and has been superseded by new, more useful systems such as Taguchi Methods, Quality Function Deployment, Continuous Quality Improvement and a host of others.

The fact is that these are excellent systems and are producing major benefit for those who use them. However, do they satisfy all of our needs or is there something missing?

---

**The fact is that these are excellent systems and are producing major benefit for those who use them.**

---

**The Missing Ingredient**

VE makes use of a small multi-disciplined group of individuals. The system follows a job plan that guides the group step-by-step through the VE process. According to German standard 69-910 “... the job plan is tailored to human peculiarities.” It guides the group through the mind opening complexities of function analysis to the precision thinking necessary to develop questions for creative effort. VE concentrates on brainpower.
The Selection and Use of VA/VE Professionals

by Roger B. Sperling, AVS

Roger B. Sperling, AVS, VE Site Coordinator, Plant Engineering, Lawrence Livermore National Laboratory, Livermore, California

Introduction

After the Lawrence Livermore National Library trained 22 architects and engineers in Value Analysis/Value Engineering (VA/VE) by means of a SAVE-certified 40-hour workshop and began conducting VE studies of facilities designs in-house, a management decision was made to establish contracts with one or more firms specializing in VA/VE to augment the trained staff. A request for quotation (RFQ) was published and a number of consultant firms submitted qualifications. These were evaluated and the highest ranked were interviewed. Two firms were selected and multi-task contracts were developed. At the end of the first year, each firm has conducted two or three VE studies; a review of the process used to select them and their initial performance can guide future VA/VE work at the Laboratory. Lessons learned in this first year also can serve as a model for other government-funded institutions interested in beginning VA/VE programs.

Selection of VE Professionals

Overview

A timeline for the first year of selecting and using VE professionals is presented in Figure 1. The total time is fourteen months, from the first RFQ through the first five studies. The time shows that it took over eight months to bring two VE consultant firms on board with multi-task contracts. However, the first use of Firm A occurred at the seventh month even before a formal contract was in place; this was accomplished by special arrangement with the Purchasing Department. The key lessons learned from participating in the selection are summarized chronologically starting with the RFQ.

Request for Quotation

The first RFQ was based on the format used for establishing task contracts (fixed dollar amount, one-year, renewable) for Architectural/Engineering (A/E) design consultants. The language was changed to tailor it to VA/VE work, such as requiring Certified Value Specialists (CVS) as team leaders. When the initial solicitation was formally issued (publicized in the Commerce Business Daily [CBD]), there were only two valid responses because we had used the standard 75-mile limit of geographic location for consultants. This limit was originally designed to hire local A/E firms who could work closely with Plant Engineering (PE) and attend meetings (over many months of a design project) at minimum cost to the Laboratory. But this proved to be an artificial restriction for VA/VE work.

Therefore, a second RFQ was prepared with the geographical limit expanded to 1,000 miles from the Laboratory. This was published in the CBD and sent to known VE consulting firms. Eighteen responses were received. The 1,000 mile limit seemed then to be an appropriate boundary to keep travel costs from becoming excessive, while capturing many more potential firms. Now it appears that we could have used no limit (except for the continental U.S.) with little impact on VE study costs. While some of the responding firms had offices within the 1,000 mile radius, others had cooperating design firms with VE-trained personnel within that distance. Both conditions were acceptable for qualification as a Laboratory VE consultant. An artificial qualifying distance may have excluded other well-qualified firms; therefore, none is recommended for future solicitations.

Selection Board

The five-person Selection Board, composed of the Chief Engineer of the Design Division, the VE Site Coordinator, the PE contracts Administrator, a design architect and a purchasing agent, reviewed the firms' qualifications statements, interviewed the selected firms and made the final evaluation and selection. The board had experience with the A/E design firm selection
process and no significant changes were made for reviewing the qualifications of VE professionals. Three members were VA/VE-trained (two individuals would later administer the work of the successful firms); this experience was essential to evaluate the difference in philosophy and applications of VA/VE presented by the candidate firms.

Three members were VA/VE-trained (two individuals would later administer the work of the successful firms); this experience was essential to evaluate the difference in philosophy and applications of VA/VE presented by the candidate firms.

Evaluation Process

The evaluation of the proposals submitted by the VE firms used a score sheet designed for this solicitation. This was a numerical scoring of the areas of experience and expertise of the VE firms and their staff of consultants. Using this sheet the Standard Forms could be scored by each board member and a numerical ranking assigned to each firm. This process made the evaluation of the proposals as objective as was practical. Out of eighteen firms who submitted proposals, eight were selected for interviews.

A similar process was used for the evaluation of the firms interviewed by the board. A different score sheet was specially prepared to assist each board member in ranking the firms who made oral presentations. The two score sheets were independent; the first set (proposal ranking) was put aside once the proposal ranking was completed, and the second set (presentation ranking) was the basis for the final selection. Of the eight interviewed firms, the two highest ranked were selected for multi-task contracts. No significant changes will be made in the evaluation process for future solicitations.

Interview Process

The successful eight firms (from the evaluation of proposals) were invited to make formal oral presentations before the Selection Board. The invitation to appear described a two-hour interview divided between a review of qualifications (of the prime firm and any sub-consultants) and a presentation of a recent VE study conducted by the proposed VE team. The intention was for the candidate team to make an Information Phase presentation to show the results of a recently completed VE study and, more importantly, to show the style of presentation, including the use of visual aids. The Laboratory has high standards for presentations because they are the primary means of informing management of results of projects. Therefore, it was important to select VE consultants who could make clear, concise presentations of VE study results.

Eight interviews were scheduled for two consecutive days, four each day. This had the advantage of presenting all eight candidates quickly. But, it had the disadvantage of being an intense experience without sufficient breaks between presentations. Future interviews will be scheduled over a longer period. This will make it easier for the board to assimilate and reflect on the information received as well as loosen the schedule to give some flexibility to the two-hour presentations.

Multi-Task Contracts

The Selection Board's work was done when the two highest ranked firms were selected from the final eight. The Purchasing Department prepared multi-task contracts. The details of this process are not pertinent to this discussion; however, it is important to note that the task-type contract is especially useful for VA/VE work. Studies frequently need to be conducted on short notice. It is extremely helpful to have a contractual mechanism that allows the PE Contracts Administrator to call upon the services of a VE firm on as little as one week's notice. The multi-task contract does this by having all the fee negotiations completed up front so that the assignment of a specific study is a simple matter of developing a scope of work and an estimate of study costs. The pre-qualified VE consultant need only submit a fee proposal to be hired for a study.

Use of VE Professionals

Overview

The first five VE Studies were done over a six-month period, as shown in Figure 1. Twice pairs of studies were done in consecutive weeks, using different consultant teams; meeting this schedule would have been much more difficult to do in-house under the present level of VE staffing. Each study was different and each team used different approaches. The key lessons learned from observing these studies, and comparing them with in-house studies, are summarized chronologically starting with project selection and ending with the phases of the VE Job Plan.

Timeline for Selection and Initial Use of Two VE Consultants

Timeline for Selection and Initial Use of Two VE Consultants

<table>
<thead>
<tr>
<th>MONTHS</th>
<th>Request for Quote</th>
<th>Establish Two Multi-Task Contracts</th>
<th>VE Firm A</th>
<th>VE Firm B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 1</td>
<td></td>
<td></td>
<td>February</td>
<td></td>
</tr>
<tr>
<td>Feb</td>
<td></td>
<td></td>
<td>February</td>
<td></td>
</tr>
<tr>
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<td>March</td>
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</tbody>
</table>

Figure 1
Project Selection

Before the consultant is sent a scope of work to do a VA/VE study, a project must be selected. This selection is now jointly done by the Project Manager, the VE Site Coordinator and PE management. Criteria have been developed which suggest the number of studies to be done during the life of a facilities design project, with one million dollars Total Estimated Construction Cost (TECC) being the usual lower limit. Figure 2 summarizes these criteria. At least one study is recommended at the Title I (35%) design stage. Optional studies can be done earlier or later.

In the final analysis, project selection depends on the answer the VE Site Coordinator gives to management’s question: “Does it make sense to VE this project?” The first year discussions with the two VE consultants were helpful in answering this question. After nine studies were completed (five by PE pre-qualified VE firms), we developed guidelines for project selection. To help document the selection a VE Rating Index (VERI) is used (see Figure 3). This is a simple scoring of known factors about potential VE projects, including cost, under/over budget, design phase, number of disciplines and design complexity. Small, single-discipline projects with costs under budget score low; large, multi-discipline projects with costs over budget score high. While the database is still small, it appears that the VERI score may correlate with the actual implemented savings, expressed as Return on Investment (ROI). As more studies are completed and their results implemented, we will be able to see if VERI is a reliable predictor of VE potential ROI. Less tangible reasons for doing VA/VE (such as independent design/cost review) may override the cost savings considerations on some projects.

As more studies are completed and their results implemented, we will be able to see if VERI is a reliable predictor of VE potential ROI.

<table>
<thead>
<tr>
<th>Value Engineering Study Criteria</th>
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<tbody>
<tr>
<td><strong>VE CATEGORY</strong></td>
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<tr>
<td>-----------------</td>
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<tr>
<td>1</td>
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<tr>
<td>2</td>
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Team Selection

Once a project was selected for VE, the next step was to determine who would perform the study. We had three choices: VE Firm A, VE Firm B or an in-house PE VE Team. An important reason for using the outside firms is their objectivity. We found it extremely valuable to have fresh input on project designs by VE-trained design professionals who have no prior knowledge of the project or of Laboratory design methods. Another reason is to have experienced CVS team leaders manage the studies (we relaxed this requirement only in special cases). We require that half of the team members be from the local area to minimize travel costs and ensure knowledge of prevailing construction methods. Our own construction managers and building coordinators were included on VE teams to provide ready information on Laboratory procedures and construction practices. Continuous participation of all team members is encouraged to take full advantage of cross-discipline interactions, except where a specialist is required for only one or two days.

![Figure 3](image-url)

Our experience with consultant teams has been positive. However, the Laboratory is missing an opportunity to extend the VA/VE training of its own design professionals and take advantage of the team building benefits of the process; we also are failing to teach Function Analysis to our architects and engineers to enhance the process by which we develop facility designs. Therefore, we are reevaluating our procedures for determining which studies should be done by in-house teams. The use of VA/VE principles in working management issues as well as design issues can be expanded.

Team Training

Our scope of work requires prior VE training for all team members. In most cases this has been fulfilled;
however, some consultant team members had no prior VE training or experience. The VE consultant performed limited orientation for those newcomers before the start of the study and some training occurred as the study proceeded. From our experience with in-house teams we know that lack of training can affect the study results. On the other hand, an untrained person can provide a stimulus to the team of otherwise experienced professionals by questioning the theory and procedure and forcing the principles of VA/VE to be articulated during the study. In general we feel that it is better to have trained team members; last minute orientation and in-study training should be limited to one person out of five.

Information Phase

The VE studies have all been conducted on-site in Laboratory conference rooms. This is convenient because the project team is close by as are technical and administrative resources. However, it is essential that the VE Site Coordinator be available at least half time to facilitate the exchange of information requested by the VE team; this is especially true at the beginning of the study when information gathering is the main activity. We alert our technical managers to be available during coming studies, and invite the project manager, project engineer and the design team (or outside A/E), client and user to brief the VE team on Day 1 of the study. We have learned to allow an open exchange of ideas but not let the VE team be limited by the boundaries that may be proscribed by the members of the design or management teams. VE must be allowed to question function. We have extended the Information Phase into succeeding days by keeping channels of communication open between the VE team and the design team. Often the VE Site Coordinator plays a crucial role in facilitating contracts so that questions can be answered quickly. A site visit is conducted as part of the Information Phase; we have found that crucial data often are revealed in the field which can potentially enhance any VE study. Consultants use a time-saving method of developing cost models in the office before the study begins. However, this has the disadvantage of reducing the team's sense of ownership of the models and may limit their use as guides to idea development. We believe adequate time needs to be devoted to explaining the evolution of cost models.

Function Phase

The unique aspect of VE is Function Analysis and a special tool is the FAST Diagram; these make VE different from and superior to other cost reduction procedures. Yet VE studies have been done without Function Analysis and FAST. The first assignments given to our VE consultants were office and laboratory buildings; when no formal Function Analysis was used, the omission was questioned. Standard or routine facilities design projects don't always require it, was the answer; we use it informally, where needed. At our request, Function Analysis/FAST have been included as a distinct part of all subsequent studies. The time is well spent, we believe, because this analysis procedure brings the project into sharper focus for the whole team. It is such an important issue that we have made the point of inserting the "Function Phase" into our VE Job Plan.

At our request, Function Analysis/FAST have been included as a distinct part of all subsequent studies.

Speculation Phase

Brainstorming is designed to be a loose, uninhibited, "there is no such thing as a dumb idea" method for developing a long list of alternate ways of satisfying project functions. Some of the brainstorming sessions observed so far have been too restrained, (in one case a team member came prepared with a list of "spontaneous" ideas). The team should feel that the Speculation Phase is an open, positive experience. It is the team leader's responsibility to prepare the team (especially inexperienced members) by teaching the principles of creativity so that ideas flow freely. We encourage the expression of "silly" ideas to stimulate creativity in the brainstorming sessions, as opposed to filtering them out and requiring the expression of only "technically valid" ideas, which has an inhibiting effect. It is easier to edit a long list of ideas from an enthusiastic team than to strain to build a list from an inhibited team.

Analysis Phase

There are many schemes for ranking brainstorming ideas, the first step in the Analysis Phase. The one we liked best used a split score: points for "acceptability" plus points for "savings." A very good idea scores high in both categories. But some highly acceptable ideas may have low potential savings; the opposite may also be true. It is important to make this distinction (as opposed to a simple 1, 2, 3 ranking) so that team members can later judge which ideas are candidates for development. When many ideas need to be analyzed, ranked and grouped, it is helpful to divide the task into disciplines. This parallel processing of ideas speeds the work at the expense of losing cross-disciplinary interaction, but can be used to save time. VE consultants tend to be less formal in the Analysis Phase, tailoring the work to the project. When special problems arise, matrix analysis procedures are applied to good advantage. The trick is not to burden the team with paperwork or procedures and only use VE techniques that are really needed.

Development Phase

The Development Phase is the crucial transition from multi-discipline teamwork to individual team member efforts. The study room walls are usually covered with lists of ranked ideas which also may be grouped by discipline. In some studies with untrained people, we observed a hesitancy to dig in and develop a VE proposal. It is essential that the team leader assume a supervising role and see that everyone is engaged in the Development Phase. More experienced persons can become too deeply involved in one proposal and fail to start or fully develop complementary proposals in
that discipline. Again, the team leader must exercise management skills to allocate the available hours to the development work. Techniques such as brief team meetings to list goals and accomplishments and "over-the-shoulder" reviews serve to focus the team effort and maximize output. Results are better when the team leader is not involved in too many details or preparing too many proposals, but can manage and check the work of others.

Presentation Phase

VE consultants prepare excellent reports and they produce them quickly. We have always had reports returned ten calendar days after the study; when the report was exceptionally large, extra time was allowed. Our final report guidelines outline the report format and give some specific Laboratory requirements. The practice of including undeveloped ideas in the report narrative is useful; it shows potentially valuable ideas which were not developed because they were of lower priority. We have been very pleased with the reports and find them to be useful documents for implementing the cost savings proposals.

Implementation Phase

Our current scope of work suggests that the VE consultant may be asked to participate in the Implementation Phase of the project study. During the first year we did not ask the team leader or a team member to return to the Laboratory for an implementation meeting. These meetings (there are usually more than one) include the project manager, project engineer, A/E design firm's representative, client and user, along with the VE Site Coordinator when needed. Assignments are made to study individual proposals for implementation; the group reaches consensus to accept/reject proposals. The weakness in this procedure is that the VE team is only indirectly represented (by the VE Site Coordinator) and detailed questions may not be thoroughly answered. We are evaluating the costs/benefits of more consultant involvement in the Implementation Phase.

Summary

The lessons learned from the first year of selecting and using VA/VE professionals are summarized below:

The Selection of VA/VE Professionals

- Selection Board
- Evaluation Process
- Interview Process
- Multi-Task Contracts
- Request for Quotation
- Flexible requirements allow many qualified firms to bid.
- VA/VE experience facilitates evaluation and ranking for firms.
- Scoring schemes objectify the ranking procedure.
- Formal oral presentations demonstrate firms' capabilities.
- Open-ended contracts ensure fast-response to VE studies.

The Use of VA/VE Professionals

- Project Selection
- Team Selection
- Team Training
- Information Phase
- Function Phase
- Speculation Phase
- Analysis Phase
- Development Phase
- Presentation Phase
- Report Phase
- Implementation Phase
- Guidelines help project managers select projects for VA/VE.
- Consultants and in-house teams balance a VA/VE program.
- Trained teams produce VE proposals more effectively.
- Open information exchange between VE Team and Design Team strengthens VE proposals.
- Function Analysis must be included in every study.
- Free brainstorming is key to productive speculation.
- Careful ranking of ideas speeds up analysis.
- Close team supervision achieves VE proposal development goals.
- Careful planning produces a strong oral presentation.
- Well-written, timely reports assist implementation.
- Consultant input facilitates implementation of proposals.

Acknowledgement.

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VE-PRO, Software for Value Engineering Program Management

by Laurence W. Paulson & Jerry J. Simpson

Laurence W. Paulson and Jerry J. Simpson, Department of Defense Industrial Productivity Support Office


Concept

Industrial Productivity Support Office (IPSO) is developing a software program for Department of Defense (DoD) VE Project/Program management (VE-PRO). VE-PRO will be available to all DoD VE program managers. The initial thrust behind this project was to provide an easy and automated method to input data to VE Data Information Storage and Retrieval System (VEDISARS). It soon became clear that the idea of providing a VE program management software package held considerable interest on its own merits.

VE-PRO will provide each DoD VE program manager with a standard computerized management system. It is written for the widely used IBM/DOS compatible computer systems. The program is compiled to fit easily on one floppy disc; the data can be held on a separate disc. Project data is automatically archived as each project is closed. The archived data is not included in the activity VE-PRO data base, thus making the data base smaller and consequently faster to interact with. The archived data is still readily available and normally will be stored on a separate disc where it can be accessed with a utility program which is part of the VE-PRO.

VE-PRO will start tracking projects as they are assigned to the individual project officers. It will provide the program manager an overview of the progress of each project and project officer as well as periodic reviews of his overall program.

VE-PRO will automatically generate year-end statistics required for the annual DoD VE Statistical Summary Report to the Deputy Secretary of Defense for Production Support. It will: (1) keep a running count of the number of VE projects opened and those that have been approved and implemented, (2) keep savings totals for the fiscal year, (3) count the number of full-time VE personnel as well as the kind and amount of VE training planned and completed.

VE-PRO will also, as originally intended, provide summary report data on each approved and implemented government initiated Value Engineering Proposals (VEPs) and contractor submitted Value Engineering Change and contractor submitted Value Engineering Change Proposals (VECPs) to VEDISARS. This data will be in electronic format and will thereby expedite its transfer.

History

VE-PRO is based on the "Big Brother" information management program developed by the Defense General Supply Center (DGSC) in Richmond, Virginia. The Big Brother program was written in 1985 to help DGSC track their VE projects and resulting savings.

Also in 1985, IPSO launched the VEDISARS pilot program, a data base of summary reports of accepted and implemented DoD VE actions. The influx of data into VEDISARS continues to be slow. Upon learning of Big Brother, IPSO asked if DGSC could develop a program feature with the capability to print project data on DD Form 2333, which is the form used to submit VE summary data to VEDISARS. It was envisioned that this feature would help expedite transmission of data.
to VEDISARS. This was the seed of an idea for a software program that DoD offices could use to manage their VE programs. A program that would generate the necessary data for the year-end DoD VE statistical Summary as well as automatically generate data for the VEDISARS database as each project was opened and subsequently closed.

Basing VE-PRO on an existing management information program yields the advantage of starting with a program of known value. Several features of Big Brother have immediate value and can be used without change in VE-PRO such as the automatic compilation of data for VEDISARS. Other features need to be generalized or added; for example, the program already tracks some information needed for the year-end VE Statistical Summary, but some statistics such as the number of new projects are not calculated, and some data, such as the amount of VE training, is not stored.

**How It Works**

VE-PRO is written in DBASE III and will run on an IBM compatible microcomputer with at least 512KB RAM. VE-PRO will be compiled meaning that it will run faster and will not need DBASE III to run.

VE-PRO uses a relational data base. Project data is not stored in one large data base; it is stored in many smaller ones. Similar data, such as cost data, is stored together; the data bases are related by unique fields which makes the project data behave as if it were all in one location. Separating the data this way allows for a modular design and quick data searches.

VE-PRO is menu driven. While some procedures are automatic, like archival of old project data, most procedures such as searching for records or printing reports are done by selecting options from menus (Figure 1a - e). Adding a new project is accomplished in this manner. The adding procedure provides the user a unique project number, and new records are appended to each of the modular data bases using the unique project number to relate the records.

The main data base keeps track of descriptive information of the VE project (Figure 2). In addition to the project number, the data base contains the name of the project officer, beginning and end dates of the project, item nomenclature, the part number, the national stock number, the open/close status of the project, and whether or not the project is a VEP or a VECP.

**VE DATA INFO STORAGE AND RETREIVAL SYSTEM**

<table>
<thead>
<tr>
<th>VEDISARS MENU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Enter New VEDISARS Record</td>
</tr>
<tr>
<td>2. Edit or Update VEDISARS Record</td>
</tr>
<tr>
<td>3. Print List of VEDISARS Records</td>
</tr>
<tr>
<td>4. Print DD Form 2333</td>
</tr>
<tr>
<td>5. Print VEDISARS Worksheet</td>
</tr>
<tr>
<td>6. Prepare VEDISARS Data for Electronic Transfer</td>
</tr>
</tbody>
</table>

**Figure 1**

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**VALUE ENGINEERING PROJECT DATABASE**

| 1. Introduction |
| 2. VE Project Menu |
| 3. Report Menu |
| 4. Research Menu |
| 5. VEDISARS Menu |
| 6. Summary Project Menu |

(a) VE-PRO Main Menu

**VALUE ENGINEERING PROJECT MENU**

| 1. Enter New Project |
| 2. Edit Project Data |
| 3. Print Project Worksheet |

(b) VE-PRO VE Project Menu

**VALUE ENGINEERING PROJECT REPORT MENU**

| 1. Print Project Listing and Status |
| 2. Print Project Summary Sheets |
| 3. Print Listing of Monthly Savings |
| 4. Print List of Competition Breaks |

(c) VE-PRO Report Menu

**VALUE ENGINEERING RESEARCH MENU**

| 1. Locate Project Number by NSN |
| 2. List Reported Savings by PN |

(d) VE-PRO Research Menu

---

**VALUE ENGINEERING PROJECT DATA FOR PROJECT NUMBER VECP0001**

| DATE INITIATED 8409 |
| VALUE ENGINEER LASTOKIE, THOMAS E. |
| NSN 1670-00-147-3854 |
| ITEM NAME AIRCRAFT BRAKES |
| TYPE PROJECT VEC |
| BASIC FUNCTION STOP AIRCRAFT |
| PROJECT STATUS COMPLETED |
| PROPOSED VE ACTION REDESIGN |
| VE PROPOSAL APPROVED (Y/N) Y |
| DATE VE ACTION COMPLETE 8409 |
| DATE PROJECT REPORTED 8409 |

**Figure 2**

The savings data base tracks cost data such as unit costs before and after VE, before and after production lead time, production quantities, and three year savings figures (Figure 3). When the project is approved and archived, the three year savings figures, the project number, and the project officer data is transferred to a summary data base which keeps track of fiscal year totals.

**PROJECT SAVINGS DATA FOR PROJECT VECP0001**

| DATE REPORTED 8409 |
| BEFORE VE . . . |
| UNIT COST |
| PRODUCTION LEAD TIME |
| COST SOURCE LAST AWARD |
| CONTRACT NUMBER F3657-82-2117 |
| AFTER VE . . . |
| UNIT COST |
| PRODUCTION LEAD TIME |
| CONTRACT NUMBER F3657-82-2117 |
| AWARD DATE 8409 |
| AWARD QUANTITY |

**Figure 3**
The summary data base collects information used in the year-end VE Statistical Summary. As previously mentioned, it includes fiscal year totals such as VEP and VECP savings, number of proposals developed and accepted, personnel resources, and training figures. One area of the VE Statistical Summary that is not covered is the narrative required to discuss the accomplishments of the DoD VE Program. VE-PRO is written in DBASE III, which is not an integrated software program. DBASE III does not handle text well, therefore, neither does VE-PRO. A short narrative for VEDISARS is kept in a narrative data base (Figure 4), but the text editing features are not elegant.

---

DBASE III does not handle text well, therefore, neither does VE-PRO. A short narrative for VEDISARS is kept in a narrative data base, but the text editing features are not elegant.

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Data needed for VEDISARS is copied to a temporary data base when the project is archived. Even though this temporary data base is accessed from the main menu of VE-PRO, it does not interact with the other data bases of VE-PRO. Editing records and printing project data from the temporary data base is permitted, but the main purpose of copying this data is to allow processing (saving in delimited format) for electronic transfer to GIDEP. Once data is saved in delimited format, the temporary data base is deleted; however, project data is still available in the archive file.

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NARRATIVE DESCRIPTION FOR PROJECT NUMBER VECP0001

WHEEL AND BRAKE ASSEMBLY WILL BE MODIFIED TO USE CARBON HEAT SINKS IN LIEU OF BERYLLIUM AND BE COMPLETELY INTERCHANGEABLE WITH C-5A WHEEL AND BRAKE ASSEMBLY. FUNCTION PERFORMANCE EQUAL TO OR EXCEED ESTABLISHED C-5A EXCEPT THAT STATIC TORQUE GROUND COEFFICIENT OF FRICTION BE 0.31 OR GREATER IN LIEU OF 0.55. BRAKES WILL HOLD AIRCRAFT STATIONARY DURING MAXIMUM ENGINE THRUST.

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Figure 4

VE-PRO is a data hacking and management program; it provides for the collection of VE project data and the compilation of the VE summary statistics. The program is not intended to be an analytical tool. VE-PRO does not provide the facilities for cost estimating, selection of best solution, and other aspects of VE analysis. The strength of the VE-PRO program is that it allows quick data searches of ongoing projects, automatic report generation and automatic compilation of summary statistics.

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Bibliography

F. Louis Fackler, P.E., Associate Vice Chancellor - Facilities / Services University of California, Santa Cruz, California.

Lou Fackler has more than 30 years experience with the University of California in both construction of campus facilities and operation and maintenance of plant. Fackler graduated from the Berkeley campus of the University in 1948 with a BS in ME and is a registered professional engineer in California.

As Associate Vice Chancellor, he is responsible for campus physical planning and construction, physical plant including campus transportation and parking, the campus fire department, environmental health and safety, purchasing and receiving.

Under Fackler's leadership, total energy consumption (on a unit basis) has been reduced by more than 50% since the "energy crisis" of the early 1970's.

I wish to discuss the relationship between the design professional and the University in planning the construction of major campus facilities. Methods must be developed through which the University can obtain the best possible facility by working in a constructive and critical way with design professionals.

At a recent meeting of campus architects and planners of the nine-campus University of California system, the moderator requested a listing of items that caused the most difficulty in planning, budgeting, developing, and delivery of new facilities. While some 36 items were listed, the ones having unanimous agreement were inability to get the faculty's attention, designers that pay no attention to program or budget, difficulty in maintaining proper schedules, and cost overruns. We believe that the Santa Cruz campus' approach to VE has gone a long ways towards solving these problems.

At the University of California, Santa Cruz, we plan to move into Natural Sciences Unit 3 the fall of 1989. This is the first major building to be constructed on the campus in almost 15 years. This project provides biology and chemistry research facilities of more than 57,000 assignable square feet, in a building of approximately 95,000 gross square feet, at a budget of approximately $24,000,000. The building includes research laboratories, research support facilities, faculty offices and academic administrative support space for molecular biology, microbiology, cell and developmental biology, genetic biology, and neurophysiology, as well as space for biochemistry and biophysical chemistry.

We wanted to make sure that we would obtain a state of the art science building within the established budget, and one which would be energy efficient and provide maintainable life cycle costs.

To obtain these objectives, a Project Planning Guide was prepared outlining the space needs for the various disciplines and functions, and providing an overall budget for the project. Unfortunately, project budgets must be established before preliminary design can proceed, therefore, great reliance is placed on costs of similar buildings, both in the University of California system and in other educational systems.

We also hired a consultant to provide a Detailed Project Program which was based on extensive interviews with the Natural Science 3 Building Committee, and other members of the faculty who would occupy the building.

Armed with our desire for the best possible science building, a Project Planning Guide and a Detailed Project Program, we proceeded to preliminary planning. University procedures require that VE take place but we were not sure what it all meant. We reviewed the literature and discussed the process used on other campuses with our colleagues, and then established our own version of VE.

Two important concepts used in the Santa Cruz approach to VE are: (1) The process started at the...
conceptual stage so that all involved could freely express their ideas in providing for the best solution, and (2) the Building Committee and others within the project discipline participated fully in all aspects of VE as a continuation of the programming effort of the project.

Figure 1 indicates potential savings due to VE during the life of a project. It is clear that the greatest potential for savings is at the conceptual and preliminary design phase of the project.

![Potential VE Savings During Project Life Cycle](image)

Early in the concept phase, a program is produced which defines goals, requirements and applicable criteria. The owner establishes most of this input and makes it available to the designer. The designer, in turn, establishes a price framework which becomes the preliminary estimate. Studies have shown that it is the designer who has by far the largest impact on the total life-cycle cost of a project. The owner, too, has a significant impact on costs by establishing requirements which become the basis for the designer's efforts. Between them, the owner and the designer establish roughly 70% of the total life-cycle cost of the project by the end of the concept design phase. Thus it is apparent that a VE analysis made during the concept phase has a tremendous potential for improving quality and reducing costs.

The second concept was the involvement of the building committee. This is an extremely important concept. The first VE session was an educational session to review and test the program, and to have the building committee fully involved in the process. Having all of the major decision makers in one room with respected professionals in their various fields present, means that the project moves along at a rapid pace with a full understanding of all participants as to why certain decisions were made.

Given our desire to tailor a program for our needs, and costs involved, we decided on “do it yourself” VE.

In establishing a VE process, the make up of the “VE team” and the selection of other persons who participated in the process and the timing of VE sessions within the design process was decided upon.

The participants were divided into five teams as shown in Figure 2.

**VE TEAM**
- Architect - Arch/Site Leader
- Structure Engineer - Struc/Civil Eng. Ldr.
- Mechanical Engineer - Mech/Elec Leader
- Cost Consultant - Cost Control Leader
- Campus Consulting Architect
- Campus Consulting
- Landscape Architect
- Architect (2)
- Construction Consultant

**EXECUTIVE ARCH TEAM**
- Executive Architect
- Project Architects (4)
- Landscape Architect
- Structural Engineer
- Civil Engineer
- Mechanical Engineer
- Electrical Engineer

**UC TECHNICAL TEAM**
- Campus Architect
- Project Manager
- Architect (2) Recorder
- Civil Engineer - Recorder
- Mechanical Engineer
- Electrical Eng. - Recorder
- Planner (EIR)
- Ed. Facilities Planner
- Phys. Plant Administrator

**BUILDING COMMITTEE**
- Chair (Faculty)
- Dean (Soc. Sci.)
- Faculty (5)
- Housing Staff (2)
- Division Staff (2)
- Students (2)
- Ed. Facilities Planner

**OTHERS**
- Vice Chancellor
- Office of Pres.
- Dept. of Finance
- Legisltv Analyst
- UCSC Staff (3)

When design professionals are being considered, it is vital that the concept of VE be discussed with each firm. The design firm must know going in that its design will be carefully reviewed and studied by other design professionals, as well as members of the building committee and other representatives of the owner.

*Value World, Jan./Feb./Mar., 1990 25*
We established VE at three points within the process.

1. Conceptual or Program Phase

The Conceptual Phase, focused on bringing the Building Committee up to speed on the design process, and provided an in-depth review and validation of the Detailed Project Program. During this session the range of design alternatives in structural, electrical, and mechanical systems was narrowed and special systems which may be appropriate to the type of discipline in the facility under consideration were carefully reviewed.

This structured process of program validation helps build consensus that moves all participants, including the Building Committee, towards a willingness to make the timely decisions that will be needed in early schematic design. Narrowing the alternatives through the participation of a group of experts, that is the VE team, saves considerable time.

With the involvement of the Building Committee in every VE session, the committee, in consideration with others, makes the trade-offs that inevitably emerge when it is discovered that the ideal project is beyond the scope of the budget.

The VE context provides a valuable forum for making trade-off decisions in which the faculty building committee can interact and benefit directly from a team of experts.

The VE context provides a valuable forum for making trade-off decisions in which the faculty building committee can interact and benefit directly from a team of experts.

2. Schematic Design Phase

The Schematic Design Phase concentrates on the Schematic design of the project. Studies and feasibility analyses of the various alternative layouts and systems were presented by the executive architect for review. The objective of this phase workshop was to determine the most cost-effective design solution appropriate to the site which will fulfill the stated program; this session makes determinations necessary for the executive architect to prepare schematic plans for presentation to the University Regents for design approval.

3. Preliminary Plan Phase

The Preliminary Plan Phase reviews preliminary design development documents along with the detailed cost estimate, analyzes cost of the various systems and determines what alternatives or trade-offs might be effective in reducing costs consistent with quality construction and program considerations.

As a result of determinations and studies made during the first two VE phases, the Executive Architect and consultants present resulting schematic plans, preliminary design development documents and a complete cost breakdown.

If the project is over budget and/or over the program area allowed by the State-approved Project Planning Guide, this is the session during which final trade-offs are made to bring the project within budget and into conformance with programmed area.

The following describes the process which took place at each of the workshops for Natural Sciences Unit 3. On Sunday afternoon, prior to the first session, the VE moderator and campus technical team met with the VE team and the executive architect team to discuss the process. The meeting was followed by an informal dinner hosted by the University. This helped set the right feeling for the sessions and gave all a chance to know each other before the start of a formal session. Figure 2 may help in understanding who participated in the workshops and how the sessions were structured. (See Figure 2)

Workshop #1

The first workshop took place on the campus in July, 1985, and its objective was to help educate all present on state of the art science buildings and determine the various alternatives which should be considered in the design.

At the conclusion of the first day, each recorder provided the University representative a report (hand-written or on dictation equipment). These reports were drafted and were available the next morning.

The second morning's session was one of education and testing of the program. The design team reviewed the master plan of the site which it had prepared and the programming consultant discussed the detailed project program. The VE team discussed laboratory design, mechanical design for laboratory buildings, and structural and vibration design considerations. The cost consultant discussed cost of science buildings, and showed examples of items which contribute most to cost.

In the afternoon, three group sessions were established: One for architectural, one for mechanical and electrical, and one for structural and vibration. Each group session had a member of the VE team as moderator and campus technical team met with the VE moderator and campus technical team met with the VE team and the executive architect team to discuss the process. The meeting was followed by an informal dinner hosted by the University. This helped set the right feeling for the sessions and gave all a chance to know each other before the start of a formal session. Figure 2 may help in understanding who participated in the workshops and how the sessions were structured. (See Figure 2)

At the end of the afternoon at a general session, each group leader reported on discussions of the various group sessions. Each group leader made notes of the meetings and these were typed and distributed the next day as the groups met. On the second day of the workshop, the group sessions continued in the morning, and during the afternoon there was a general meeting at which conclusions and recommendations were discussed.
As a result of the first workshop, the Executive Architect and consultants were provided with a list of design alternatives and requested to analyze and determine cost and effectiveness of the various alternatives and to make recommendations at the next VE workshop.

**Workshop #2**

The second workshop took place in September 1985. It provided direction to the architect for the schematic design phase.

The format was similar to Workshop No. 1 in that there was a general meeting the first morning, group meetings in the afternoon and the next morning, and finally, a general meeting on the second afternoon to decide upon the best design solutions.

As a result of this VE workshop, the general site layout was determined. In reviewing building siting, the VE team and the owner's representatives decided that a planned addition to the nearby University Science Library should not be located as planned but should be restited to give valuable open space between these rather large and massive buildings.

Also, a number of building schematic designs were reviewed and a design providing office space in the middle with laboratory space on each side was determined to be the best programatically. This decision provided for interactive space in the office section, and provided economies in design since the office section could be a less costly structure than the laboratory wings.

With this information the executive architect was able to develop an appropriate schematic design.

**Workshop #3**

The third workshop, in January 1986, was necessary to assist the design team in providing complete preliminary plans and cost estimate for submittal to the State of California so that construction funds would be forthcoming in the 1986-87 budget.

Again, the format was similar to that of the other two sessions. Of great concern to all of us was that the desired plan was approximately $4 million over the construction budget, about a 20% overage.

Because we had considered various alternatives during the VE process, and because we had excellent service from the executive architect's cost consultant, through all phases, especially the third workshop, we were able to investigate alternatives and to come up with potential savings of the entire amount.

Each group was asked to review the schematic documents in light of the detailed cost estimate and to make recommendations for changes which would help keep the project within budget, remembering that VE is more than "cost cutting" and that function and ongoing maintenance costs must be carefully considered in any cost reduction suggestion. In other words, the value must remain when the costs are reduced.

At the general session, each group leader discussed possible cost savings. All participated in a general brainstorming session to decide the priority of the various trade offs.

Finally, all of these items were listed, grouped as architectural, structural, and mechanical/electrical categories, and were assigned priorities. The total possible cost reduction exceeded the $4 million goal and the executive architect was then given the chore of reviewing proposed changes and bringing the project within budget.

Because of the thorough analyses and determination of priorities accomplished through VE, it was possible for the architect to make constructive changes to the project to bring it within budget. These changes consisted of items which did not materially affect the quality or function of the building.

VE also assisted in keeping the project on schedule and made it possible to meet each submittal deadline for funding. With funds available for planning July 1, 1985, it was possible to complete preliminary plans by the February 15, deadline to assure working drawings and construction funding provided July 1, 1986. The working drawings were complete by February 15, 1987, and bids were received which were within the construction budget. Construction will be completed in August 1989.

This paper describes our first project in which we used our concept of "VE." Since that time, we have successfully completed VE sessions on a science library, another major wet lab science building, and are starting the process on Colleges Nine and Ten, academic space for economics, psychology, and anthropology, as well as residential space for students.

We are very pleased with the process we call VE at Santa Cruz. We believe that it helped us materially in keeping projects on schedule, within budget, and in keeping faculty representatives fully informed on the planning process and what they should expect of the completed project. Perhaps the greatest attribute is that of assembling all the decision makers in one room at three specific points within the life of the project. Faculty members who came through this process have a much greater respect for what is involved in planning and constructing a major project, and while there still may be criticism, it is much better informed and constructive than we have received in the past from those who have not participated in the process.

While the process may not be perfect, we plan to continue to improve it, and find it to be an effective planning tool for successful delivery of major building projects.
"Thunder"
A Way With Words

by Tom King, CVS

Communications is a very important aspect of VE. Often the same degree of technical proficiency will succeed or fail, determined largely by the skill and manner in which communications are handled.

Let me retrieve some communications gems from my personal collection to illustrate this point.

- Three Mile Island nuclear meltdown in my home state of Pennsylvania: The town fathers blew the siren to warn people to stay indoors. Result: The people rushed outside to see why the sirens were blaring.
- Franklin News Herald headline, April 28, 1982: "British Troops Take South Georgia." I was tempted to call my brother in Macon to see if he was O.K.
- Sign on my Holiday Inn motel room mirror: "Notice. The contents of this room will be checked promptly upon your departure. Anything left behind will be forwarded via your car license number on file." If your experiences parallel mine, no motel manager has ever been thoughtful enough to forward my favorite tie or wrinkled gutchies. But I have received misdirected dunning letters for missing towels — for which I wondered the same thing while staying there; where were they?
- Letter to whom it may concern on behalf of a job applicant: "I cannot recommend Mr. "X" too highly." As the prospective employer I contemplated whether it engendered enthusiastic support or a veiled clue?
- Drawing note: Stamp Part Number F.S. Result: all the production parts were scrapped as parts were stamped on a mirror finish surface. Buyers understood F.S. to mean farside; N.S. to be nearside. Unfortunately the vendors understanding was - F.S., frontsie; B.S., backside.
- Sign on carton in national paint store: "Always put new stock behind or beneath present stock. Keep selling fresh paint." It occurs to me that they might not sell real old paint this way, but neither would they ever sell fresh paint.
- Sign in sports section of large chain store: "Shotgun Shells - 16 Years Old" That turned me off in a hurry. Who needs old ammo?
- Suppliers letter to me after looking at JOY's 10SC Shuttle Car model: "Upon reviewing your TENNESSEE' Shuttle Car' This convinced me of the deep analytical review actually given the product.

I have lots of others, but you get the point. To be an effective value engineer your communications must be effective.

On another issue, choice of words is quite important. We can be turned on or turned off by words.

Let me give you some of my current un-favorites.

SHARE - During Sunday School years this word was OK and valid. But I'm afraid too many pseudo-psychiatrists, TV preachers, baloney peddlers and theory X managers overused the word. Now, everytime I hear the phrase - "I want to share something with you," my feet brace, my buttocks find the sanctuary of a pillow and I prepare for the worst.

CONSTRUCTIVE CRITICISM - Talk about a bellweather for pain coming, try this. "I'm going to give you some 'constructive criticism.' This delivery is seldom in gift form and believe me it is far better to give than receive.

Two new buzzwords are really turnoffs also - VIABLE and INFRASTRUCTURE. When progress is lacking these baloney words make the planning look strategic and lofty.

Saying all this, I will try to stay on top of this communications thing.

And if anything viable develops, I promise to share it with you.
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