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Summer has arrived across most of the United States, but it soon will be gone. As is true for so many things in our lives and businesses, the only thing that is constant is change. The value methodology lets us focus on ways to improve the expected outcome.

In the past, this society—through the help of VM programs—has brought the general population many new products and innovations that otherwise may not have been possible. According to statistics from government-run value programs, the Department of Defense saved more than $700 million in 1995. Consistent use of the methodology could reap even greater benefits if more of the corporate and industrial world got the message.

Through the use of the VM methodology, we can improve management strategy and product/project outcomes. Too many times, however, firms seem to be competing solely on price—not value, which is what is necessary for the future. Customers, however, have decided which products seem to satisfy their tastes. This is a never-ending circle for some markets, because customer needs keep changing and it is difficult to keep up with what is a controlling factor today. Several business failures have shown that, by focusing on cost, cost eventually becomes all one can see.

As organizations continue to try improvements, some have come to realize that downsizing may mean cutting in the wrong places to achieve required results. The heart of product growth is not so much in retooling, but in getting more out of our critical commodity—the staff and human side of the equation. These articles will remind you that value programs can send strong messages to employees that their part is just as important as the product being produced. VM programs can be a great motivator, channeling employee knowledge, abilities and creativity for a better accomplishment of an intended function.

This issue of Value World focuses on corporate and industrial applications of the use of the value methodology, and readers will find that this issue points to many ways to improve tomorrow. Users of corporate services and industrial goods are sending some strong messages. In order to hone in on those messages, we can listen and apply some of the authors’ success stories.

As Joe Lambert, president of SAVE International, says in his quote from a Booker T. Washington speech, you should cast your bucket where you lie. This organization is ready to help by giving you opportunities to interact with other value practitioners from all over the world. Using the value methodology can provide for a means of survival and growth.

In his paper, Nick Lavingia demonstrates one means of survival and growth. He shares proven project-management techniques that can mean the difference between profit and loss. These techniques demonstrate how value improvement can affect both cost and performance.

Let’s not forget that VM programs are not always the answer to everything, however. The story by Natalya Ivanova illustrates an unusual way to improve a project.

Attendees at the recent SAVE International conference in Seattle know that Paul Romani received the Paper of the Year Award in last year’s competition. He is off to another great start, with his pointers on value engineering and performance-based service contracting. As you know, savings generated by contractors through VECPs are shared between the government and the contractor. According to his paper, it sounds as though there is an opportunity to realize even more savings.

Are there flaws with the current ASTM standard E-1699-95? Author Charles Shrive says that practitioners may need to be aware of certain areas when trying to hit a moving target. Why are users’ requirements constantly changing? Read this paper for more on what to look for when preserving the user’s values.

Have you ever heard of hard numbers and soft costs? Readers get an example of this concept in Gerald Milkie’s paper, which examines automobile pricing options. Milkie outlines what can happen when it is difficult to determine which alternative has a better cash flow or cost model. (When it comes to life-cycle costs, here’s a new one to consider: A manufacturer is considering bringing a half-breed to the market. As customers, we may soon be considering whether to drive an electric or propane-powered car. How about a half-electric, half gas-powered car, coming soon to a dealer near you?)

Just when you thought you knew all the ways to foster creativity, Jack Michaels shares his insights in his review of three books from James M. Higgins, who writes about the latest ways to improve through innovation. As Michaels points out, humans are victims of perceptual habits. Reading these books can allow us to overturn and unleash our creative powers.
Value engineering is a program-survival tool. First, I would like to tell you a short but relevant story about survival.

An eighteenth-century merchant-ship captain sailed the waters of the Atlantic in trade between Europe and South America. One year, he sailed straight into a hurricane. His ship was storm-tossed for days. Rigging was lost; sails were shredded. Below deck, water barrels broke loose and were smashed. All freshwater stores were lost.

Finally the ship found its way to calmer waters. The damaged ship and dazed crew were hopelessly lost and drifted for days with no land in sight; the lack of fresh water was becoming critical.

One morning, the crew spotted the sails of another ship. Desperately they signaled to the other ship.

"Help!" they signaled. "We need water!"

To their shock, the following reply came back: "Cast your water bucket where you lie!"

Clearly, their rescuers didn't grasp their plight. The crew signaled again. "We need fresh water!"

Again the answer was, "Cast your bucket where you lie."

The other ship just didn't understand that they needed help! Again, they clarified their message. "Crew dying of thirst—need fresh drinking water." Again the reply was, "Cast your bucket where you lie."

Finally, in desperation, the captain ordered a water bucket lowered over the side. When they retrieved the bucket, the captain and crew were astounded: The bucket was full of fresh water. How could this be?

What the captain did not know was that just over the horizon was the mouth of the Amazon River, streaming fresh water into the Atlantic Ocean.

The means of their survival was at hand all along; they just hadn't known it.

As president of SAVE International and a certified value specialist, my message is, "Cast your bucket where you lie." You have what you need to reduce cost, improve performance, and ensure survivability, and you have the opportunity to learn about growth through value management.

An effective VM program will improve value and profit. It will reduce costs and improve performance of your items, systems, processes, and facilities. A successful VM program promotes growth through the use of the value methodology. The value methodology is function-based. It is an organized systematic approach to problem solving. There is a job plan that the value practitioner follows.

The first step is the information phase. During this phase, the value practitioner gathers all of the facts pertaining to the issue to be studied. But practitioners make no judgments at this point; they continue through the job plan and reserve judgment until the evaluation phase of the job plan.

Because they are fact finding, value practitioners don't make hasty decisions. One example of what can happen when one makes a hasty decision is shown in the story of the young executive who was on his way out of the company office building when he saw a new employee standing in front of the shredder with a letter in his hand. The new employee had a confused look on his face, so the executive stopped and asked what the problem was.

The new employee said, "Well, my problem is the fact that the president of the company just gave me this to take care of, and I don't know how to operate the machine."

The executive smiled and offered to help. The new employee thanked him and handed him the letter. The executive put the president's letter into the machine, turned it on, and watched the machine grab the letter and shred it to pieces.

The new employee said, "Gee, thanks. Oh, by the way, the president only needs one copy."

This is why gathering all pertinent data in the information phase of the value methodology job plan is important.

Managers manage—they solve problems. But with nothing but problems on their hands, over time some managers begin to avoid problems. And one of the best ways to avoid problems is to stick with a course of action that is tried and true. In other words, if it's not broke—don't fix it.

That's the easy road to ruin.

It is the nature of people to oppose change. But managers who are true leaders embrace change. Program survival and program growth depend on effectively managed change—change that lowers cost and improves performance, or in other words, improves value.

Jack Welch, chief executive officer of General Electric, recently stated in an interview, "When I try to summarize what I've learned since 1981, one of the big lessons is that change has no constituency. People like the status quo. They like the way it was. When you start changing things, the good old days look better and better."

Value management causes change. When you conduct a value study, you are demonstrating by your actions that you understand the need for creative, constructive, targeted change—not change for the sake of change.
The Value Engineering Change Proposal (VECP) program in the Department of Defense (DOD) focuses efforts on increasing value. I suggest that you submit VECPs. Contractors are entitled to a VECP clause in any contract with the government that has a value in excess of $100,000. Perhaps you can reinvest a portion of your savings to do more value work!

An effective VECP program requires effective leadership. When value management becomes part of your everyday way of doing business, you will have an effective value program.

Value management as part of your everyday business can also be an effective tool to motivate employees.

Many employees tell me they know ways to improve operations, but that management isn’t interested. Again, quoting Welch, “We’ve restructured our industries. Our businesses have better leaders than before. Our people have learned the value of their jobs, and the principle that job security comes from winning. Some of the most passionate pleas for worker productivity I’ve ever read have been made by tough union leaders.” Employees want to be employed—and they know their jobs.

A VM program, with training and studies, sends a strong message to employees that they are important, and it’s a great vehicle to harness and channel employee knowledge, ability, and motivation.

Value management as part of your everyday business will reduce costs. In the context of a VM program, reducing costs does not mean lower performance or decreased organizational capabilities. Using the value methodology ensures that cost is reduced as part of increasing value, not reducing performance or capacity. This involves value-based decision making, with a “win for all” goal.

Value management with value-based decision making will build customer loyalty. It shows you care about value and what your customers get for their money. Frankly, competing solely on cost is short-sighted. Compete on value; that’s what customers want. Your customers don’t care how much you downsized your organization. They do, however, care that they get value for their money.

It takes more skill to improve value than simply to reduce cost. And increasing value is hard work. If it were easy, everyone would do it. If you improve value and your competition doesn’t, you will have the advantage.

Ford Motor Co. has a full-time staff of 100 value practitioners, though I’m told that Ford doesn’t advertise that fact for competitive reasons.

The value methodology is simple in concept, but where applied correctly, it yields phenomenal results. You can use the methodology to increase the value of most straightforward facilities and maintenance operations or sophisticated systems. If you have the program-management skills to make available the training and guidance necessary, everyone in your organization can use the value methodology.

Many people equate the value methodology with the value engineering clause in the Federal Acquisition Regulation. As a matter of fact, the VE program has been successfully used in the DOD for more than 40 years. During that time, billions of taxpayer dollars were saved. In fiscal year ’95 alone, the DOD’s VE program generated more than $700 million in savings.

The VE incentive clause is an important part of the DOD’s VE program, but it does not mandate the use of the value methodology. The value methodology is not an acquisition regulation.

The original function of the VE incentive clause in the FAR was to provide, as the name implies, incentive for contractors to use the value methodology.

Perhaps some of us have lost sight of that. Now I will take a chance and speak on behalf of any DOD acquisition executive and tell you that they will accept proposals to reduce cost submitted under the VE incentives clause without regard to your use of the value methodology. They want to reduce cost, and that’s the way it should be. On the other hand, I will state with equal confidence that, over the long term, a value program in your organization—a program that applies the value analytical methodology—is the best way to consistently generate increased value. We in the value business use the phrase “win for all,” because a program that yields consistent increases in value likewise produces consistent and considerable financial benefits to you, your customers, and your employees. Everyone wins.

The value methodology, and the DOD’s VE program-management structure, are there for you to use. Remember, cast down your bucket where you lie!

REENGINEERING

A recent article on the front page of The Wall Street Journal was titled “Next Big Thing—Re-Engineering Gurus Take Steps to Remodel Their Stalling Vehicles.” The gist of the article was that simply cutting staff through re-engineering processes too often yielded unintended and negative results. Too often, too much was cut and cut in the wrong places. The costs, not only in financial terms, but also in human terms, were often high. Why? The focus was on cost, and the founder of the re-engineering movement admitted this was a mistake: “I was reflecting my engineering background and was insufficiently appreciative of the human dimension. I’ve learned that’s critical.” He went on to say, “The real point of this is longer-term growth on the revenue side. It’s not so much getting rid of people. It’s getting more out of people.”

Determined people, focusing on value, will improve value consistently. That’s the formula for improving your products, profits, and organization, as well as ensuring program survivability and growth.

Focus on value, and your organization and customers benefit. In addition, your employees will benefit: Increasing value implicitly incorporates the human dimension the re-engineering gurus admit they missed. Trained staff members are a vital resource to any organization. Treat them as a cost, and you clearly reduce cost by reducing employees. Treat them as an asset and work to increase the value of their efforts to the organization, and everyone wins.

Everything has a cost. If we focus on cost, that’s all we’ll see. Value management is different. If you apply the value methodology, you will improve value as an outcome. That’s what I call value-based management, and it’s a good management strategy.
The article in *The Wall Street Journal* also reviewed some candidates for what it called the "Next Big Thing," the next management fad.

The article explained: "Another big re-engineering player, Booz, Allen & Hamilton of New York, thinks it has one: 'Value Engineering.' This new model is the result of a 14 month overhaul that began after a survey of clients discovered that most wanted strategies for growth, not more ways to fire people. 'It focuses more on growth and revenues than traditional business-process redesign,' says Booz, Allen Senior Vice President Gary L. Neilson."

We can smile at that, but I would suggest to you that one of the biggest management consulting firms in the world may, perhaps, have hit on something: A 14-month study, by some of the best business minds available, concluded that value matters. The firm concluded that increasing value is important and used the phrase "value engineering." This suggests that maybe a structured, even engineered, approach to analyzing value is the way to go. I suggest to you that it is value management.

But I hope, at this point, you know that. To return to our metaphor, you know where you are, and now you know there's fresh water all around you. All you need to do for program survival and growth is to cast your bucket where you lie. The DOD's VECP program is complete and ready to use, covering personnel, regulations, and lines of communication.

SAVE International, "The Value Society," is a professional society ready to help by providing you opportunities to interact with a network of value practitioners from all over the world.

You have all you need for program survival and growth potential. It's called value management. I invite you to cast your bucket where you lie, and start filling it with the abundance of knowledge available.

**ENDNOTE**

1. This ship-and-water story was adapted from a historic speech delivered by American educator Booker T. Washington in Atlanta in 1895.

Joseph V. Lambert, CVS, is president of SAVE International, "The Value Society." This article is adapted from a speech Lambert gave at the Department of Defense/Electronic Industries Association/SAVE International Symposium held in Washington, D.C., March 25, 1997.

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**Wanted: Your Submissions**

If you have a case study or a presentation on the value methodology, share it with other value practitioners. *Value World* is looking for original articles on value engineering for upcoming issues. You can also submit reprints or abstracts from other journals or periodicals, if you obtain permission from the copyright holder(s).

Each issue of *Value World* will follow a specific theme, featuring articles related to that theme. The submission schedule for the next three issues is as follows:

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*Submission guidelines appear on page 7. Articles that do not meet these guidelines may not be used in Value World.*
Pacesetter Project Performance With Value Improving Practices

Nick J. Lavingia, Ph.D., P.E.

ABSTRACT

Industry benchmarking has shown that the difference in cost and schedule between best and worst projects can be as much as 40 percent, and the total cost of ownership over the life of the plant can be astronomical. In today's competitive business environment, this could mean a difference between a profitable company and an unprofitable one. This paper discusses proven techniques that can help achieve consistent Pacesetter Project Performance.

INTRODUCTION

For any project management system to be successful, it needs to follow a structured project management process (PMP). A PMP is a process that facilitates the optimal use of resources (people, money, and technology) over the life of a project to maximize value. The desired outcomes of this process are to select the right projects by improving decision-making and to improve project outcomes through excellence in execution (see Figure 1).

The six phases of PMP, as shown in Figure 2, are: business planning, preproject planning, design and procurement, construction, commissioning and start-up, and operations. The ability to influence project success diminishes rapidly over time.

VALUE IMPROVING PRACTICES

Value improving practices (VIPs), in conjunction with a systematic PMP, can help achieve Pacesetter Project Performance. Implementation of VIPs can optimize cost, schedule, performance, and safety aspects of a project. Figure 3 shows the benefits of pre-project planning and VIPs that, together, can help attain Pacesetter Project Performance. Independent Project Analysis, Inc. (IPA) has developed correlations between relative capital cost, pre-project planning, and VIPs, based on its extensive database of hundreds of projects from several companies (see Figure 3).
The optimum time for implementing all the VIPs is in the pre-project planning phase. The VIPs are summarized in the rest of the paper.

Technology Selection
A formal, systematic process by which a project searches for new technology that may be superior to that currently employed is called technology selection. The new technology may give competitive advantage to the company. This process also can be used for equipment and materials selection.

Project Facility Objectives
This practice establishes characteristics of the facility needed to meet business goals. It sets criteria for capacity, plant life, product quality, flexibility, marginal investment criteria, expandability, reliability, controls, and maintenance. This practice can be used to set a project philosophy for marginal investment decision making, design allowances, redundancy, sparing philosophy, and room for expansion.

Project Standards
Engineering standards and specifications can affect manufacturing efficiency, product quality, operating costs, and employee safety. However, sometimes the cost of a facility is increased by the application of codes, standards, and specifications that exceed the actual needs of the specific facility to be designed.

Value Engineering
Value engineering is a creative and organized method for optimizing the cost and performance of a facility. The purpose of value engineering is to improve decision making in design and construction and to obtain the lowest life-cycle cost without reducing quality. A multidisciplinary team headed up by an independent VE consultant identifies items that may not add value or are not aligned with the basic project objectives.

Design to Capacity
Equipment often is specified with a design factor. This factor can result in oversized equipment and can be compounded as the design passes from one engineering discipline to another and then to the supplier. This factor can add investment cost, but may not provide a return if this extra capacity is not fully utilized. This practice reduces the excess "fat" that does not meet project objectives.

Reliability Modeling
Reliability modeling is the use of computer simulation to explore relationships among maximum production rates and design and operational factors such as quality, yield, production transitions, maintenance practices and requirements, safety and environmental concerns, and capacity. This tool can help determine the value of sparing, bypass, and alternative operating modes contemplated in the design and factor it into the life-cycle cost.

Process Hazards Analysis
Process hazards analysis must address:
- Hazards of the process
- Identification of any previous incidents
- Engineering and administrative controls applicable to the hazards and their interrelationships
- Consequences of failure of engineering and administrative controls
- Facility siting
- Human factors
- Qualitative evaluation of possible failure of controls on the employee

Constructability
The Construction Industry Institute (CII) defines constructability as "The optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives." Analysis of the design is usually performed by experienced construction managers to reduce costs or save time in the construction phase.

Predictive Maintenance
Predictive maintenance is an approach to maintaining a plant whereby equipment is monitored and repairs effected as indicated before failure. Predictive maintenance makes use of advances in sensor and instrumentation technology to monitor characteristics such as heat, lubrication, vibration, cracking, noise, or presence of corrosion products and consistently incorporates them into the project design.

Equipment Supplier/Contractor Alliances
Equipment supplier alliance is defined as a project-specific, long-term, mutually beneficial relationship between the owner and one qualified supplier of highly engineered equipment. With this process, the supplier is involved up front, developing a long-term association based on performance, trust, respect, and commitment.

The same process can be used for contractor alliances.

Zero Injury Techniques
The CII's "zero injury techniques" produce excellent safety performance on construction projects. They are applicable to large and small capital and maintenance projects and all sizes of contractors, regardless of labor affiliation. The techniques generally are compatible with other safety programs that may be used at various facilities.

The CII has identified the following five high-impact zero injury safety techniques:
- Safety pre-project/pre-task planning
- Safety training orientation
- Safety incentives
- Alcohol/substance abuse program
- Accident and incident investigation
SUMMARY
With the implementation of a structured PMP and application of VIPs, a company can achieve consistent Pacesetter Project Performance more quickly, cheaply, and safely than the competition.

REFERENCES
Chevron Corp., Project Resources Company. San Ramon, Calif.
Construction Industry Institute. Austin, Tex.

Nick Lavingia is a project management consultant at Chevron and provides consultation and training to project professionals worldwide. He has more than 22 years of project engineering and management experience in the chemical, petroleum, and air pollution control industry and received Chevron's Chairman's Award for implementing value engineering throughout the corporation. He holds a B.S. and M.S. in chemical and petroleum-refining engineering and a Ph.D. in engineering economics and management from the Colorado School of Mines.

Submission Guidelines

Text
1. Submit manuscripts as 3 typed, double-spaced paper copies for peer review.
2. A computer file of the final copy of accepted manuscripts is requested on a high-density 3-1/2" computer disk as an ASCII file.
3. All material should follow The Chicago Manual of Style, with references in the following format: Author(s). Title. City: Publisher, Date, Page(s).
4. All submissions should include the phone and fax numbers and, if applicable, e-mail address of the corresponding author.
5. A 25- to 50-word biography of the author should be included at the end of the article. Please note that telephone numbers and street addresses will not be included.
6. All material is subject to copyediting.

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Lift-Slab Construction Method

Natalya Ivanova

ASC COMPETITION

Every year for the last three years, the Associated School of Construction organizes a student competition. Student teams from construction programs of different universities pretend to form construction companies. They have 24 hours to prepare and submit a project manual for a real-life project that includes a construction estimate, a schedule, project planning, an approach to problem areas, and information about the company.

Eighteen hours later the students must make a presentation to the judges, who usually are the owner, architect, and construction company that built the real-life project. During the presentation, students introduce their companies and try to convince the judges to award a project to them by talking about their project approach and control.

In spring 1996, a team from Pittsburg State University in Pittsburg, Kansas, participated in the Third Annual Associated School of Construction Regional Competition (Commercial Building Division) in Nebraska City, Nebraska. The team consisted of five seniors (Brian Foredyce, William Manis, Dustin Sheridan, Dave Liles, and me) and a junior (Tom Carter) who were majoring in construction engineering technology or construction management and a coach, Scott Amos.

About three weeks before the competition, we were sent a brief outline of the problem. We knew that it was going to be a precast office building built on top of a parking garage in the downtown area of a major Midwest city. The new building would be connected with the existing building by an atrium. The owner had limited finances and strict deadlines. Additional problem areas were a tight job site, traffic control, and labor availability. The problem emphasized the need for value engineering proposals and alternate structural design.

RESEARCH

Once we received the problem description, our research work started. The team gathered a lot of information about parking garages, offices, and approaches to limited job site space. We came across many interesting ideas.

An engineering firm from Nevada designed a structural net to mount a tower crane on top of an existing parking garage during the construction of the Flamingo Hotel in Las Vegas. They saved job-site space and kept the parking garage in operation, managing to maintain normal tourist traffic.

We also explored the idea of reducing the time when the crane was needed on the job site and maintaining normal traffic in the downtown area by renting helicopters. There is a precedent of using helicopters in the construction of the Opryland Hotel in Nashville to lift materials onto the roof for atrium and skylight construction. The cost of renting the helicopter is $4,000 a day, plus $60 per 1,000-pound lift. The round trip for the helicopter takes about two minutes.

Then the coach introduced a VE methodology and suggested we use it. To solve the problem, we needed to analyze functions. Based on the limited information we received, the FAST diagram is shown in Figure 1.

![FAST Diagram](image)

The main functions are to reduce cost, satisfy the client, and build the structure. Brainstorming and coming up with ideas was a difficult stage. We researched construction magazines and textbooks, and tried to apply known construction practices to our situation. We primarily looked at different methods for constructing the building. At first the alternatives were: cast in place, steel with exterior insulation finish system, or specified precast. Then we came across a small paragraph in the Construction Methods book that mentioned the lift-slab method.

According to our research, there are two companies in the United States that erect buildings using this method. One of them is Texstar Corp. in San Antonio, Texas. Texstar sent us information about lift-slab costs, duration, and equipment. We also received a prospectus that listed the projects that were constructed using this construction method and a slide show that documented different stages of lift-slab construction on different projects.

The research in these construction magazines gave us the following information. Before 1978, there were several companies in the United States that were performing lift-slab construction. Then, in 1978, a huge accident occurred during construction of a project (LeAmbience Plaza apartment complex in Massachusetts).
During the lifting process, slabs collapsed and 28 construction workers were killed. Lift-slab construction was immediately banned in some states, and three companies went out of business. The ensuing investigation showed that a mistake in the column connection design caused the tragedy: During the lifting, a top slab slipped over the connection, increasing loads to the other connections, which they did not withstand. The investigation resulted in safety regulation changes. Nobody is allowed to work underneath the slabs when lifting is in process, and the connections should be designed to carry twice the actual load. The credibility of the method was reestablished.

**LIFT-SLAB METHOD**

The lift-slab method, as shown in Figure 2, consists of the following:

1. Structural columns are erected and slabs are cast at ground level with two layers of a bond-breaking compound between them. This eliminates form work and shoring, because all that is needed is edge forms. Elimination of form work reduces cost and duration of the project.
2. The lifting process begins with the top slab. Hydraulic jacks, mounted at the top of columns, lift the slabs one at a time with a rate of about three feet per minute.
3. Cast slabs are lifted and secured at their temporary positions.
4. Column extensions are erected and lifting continues.
5. Slabs are lifted to their final positions and secured permanently.

The following projects were constructed by Texstar using the lift-slab method:

- Urbco; Greenburg, New York
- La Reserve Hotel; White Plains, New York
- The Center at Purchase; Purchase, New York
- Delta Inn at Whistler Mountain; British Columbia, Canada
- Loraine Overpass; Big Spring, Texas
- Heritage House; White Plains, New York
- Stanford Plaza Hotel; Stamford, Connecticut
- Sea Watch Condominiums; Old Orchard Bench, Maine
- Skytop; Greenburg, New York
- Corporate Office Building; Cos Cob, Connecticut
- Microsoft World Headquarters; Redmond, Washington
- Bowman Avenue; Harrison, New York
- Tower of the Americas; San Antonio, Texas

Figure 3 is a picture taken from a Texstar brochure that shows a project using the lift-slab method. Some slabs already are lifted in their final position, and some still are in the process of lifting. While the column extensions are erected, the work of putting the walls on the first floor starts.

**COMPETITION PROBLEM**

When we arrived in Nebraska City, we learned that our project was H&R Block Headquarters, located on 44th and Main streets in Kansas City, Missouri. The project was to be completed in 12 months, and the budget was limited to $10.5 million. The site was very tight, plus the city would not allow closure of Main Street to traffic. In addition, there was a hospital near the site, so a crane would cause problems for the emergency helicopter that had to fly above the site.


**LIFT-SLAB APPLICATION**

Within the next 24 hours, we prepared a construction estimate and schedule for the lift-slab and precast methods. The information obtained from Texstar was used to price lift-slab construction. In our presentation, we proposed using lift-slab. We pointed out that it had the following advantages:

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**A lot of people in the industry still think about value engineering as the substitution of cheaper materials.** We learned that we need to look at the functions of the product, analyze what we have and what we desire to have, research different ways to develop a product, and agree on the relative importance of product characteristics to judge the alternatives.

(1) **Building a quality structure.** The list of lift-slab projects demonstrated that this method was successfully used for constructing office buildings.

(2) **Reducing project duration.** The project schedule made when using the lift-slab method indicated that overall project duration could be reduced by one month, compared with the original precast variant. In addition, it would allow phased move-in of the owner one floor at a time, starting with the first floor.

(3) **Reducing project cost.** Switching to the lift-slab method and substituting exterior precast walls with EIFS would result in savings of approximately 10%—$1 million.

(4) **Solving space constraints.** If the lift-slab method were used, a lower-capacity crane could be required. The crane could be kept on the site only to lift steel columns in place and lift mechanical top units on the roof. (But, if RTUs could be lifted with the helicopter, we would not have to keep the crane on the site after erecting the columns.)

We also acknowledged the disadvantages of the proposal:

(1) **Requirement of redesign and approval.** If the lift-slab method were used, the building would need to be redesigned. However, the interior layout would allow us to put additional columns along interior walls so the owner would not lose parking or office space. The approval of the building could take time. (It was accounted for in the proposed schedule.)

(2) **Requirement of special equipment and skilled personnel.** As was mentioned earlier, only two companies in the United States have the equipment and experience to perform lift-slab construction. We proposed to subcontract the structural part of the job to one of them: Texstar Corp. In addition to the equipment and skilled personnel, Texstar has its own engineering staff to help in building redesigns.

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**THE VALUE OF GAINED EXPERIENCE**

While working on the competition problem, we learned a lot through research and contacting people from the industry. This expanded our knowledge on construction methods and practices, construction management, cost control, and safety. We improved our presentation and communication skills, became more comfortable with computer software such as PowerPoint and Suretrak, and developed teamwork skills.

Most importantly, we realized what value engineering means and what it can do. A lot of people in the industry still think about value engineering as the substitution of cheaper materials. We learned that we need to look at the functions of the product, analyze what we have and what we desire to have, research different ways to develop a product, and agree on the relative importance of product characteristics to judge the alternatives.

We also realized the importance of selling one's solution. The judges (representatives from J.E. Dunn Construction Co., H&R Block, and BNIM Architects) were not familiar with the lift-slab method; therefore, they were convinced that it was not a realistic option. However, I believe that if the project had not yet been built and the money already spent, the lift-slab proposal would have received more attention and may be applicable for a future project.

Overall, the experience of participating in this competition and preparing VE proposals was a big step toward becoming a professional in construction management and planning.

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Value Engineering and
Performance-Based Service Contracting

Paul N. Romani

This year the government will spend more than half its total procurement budget on services. American businesses will be the recipients of these funds. However, in stance and style, “business as usual” seems to be the predominant contracting credo. Neither intensified competition nor advances in technology have much altered conventional government contractor-supplier relationships for generations. The statement is not waterproof. However, the literature of the field is strongly corroborative. Stasis can exist just so long before change becomes inevitable. This is the year it will begin. The government has committed its contracting corps to performance-based service contracting (PBSC). Few businesses have heard of it; fewer still have practiced it. For firms experienced in value engineering, an unprecedented opportunity has presented itself.

This article will: 1) share the author’s concern for the lack of study, ingenuity, and analysis about the nation’s service industries vs. those engaged in production; 2) review PBSC; 3) suggest a consultative VE model for negotiating in the service sector of the economy.

MANUFACTURING ORIENTATION

Recent publishing successes in business have focused largely on quality improvement and cost control in smokestack industries—manufacturing. The Machine That Changed the World, by James P. Womack, Daniel T. Jones, and Daniel Roos is the authoritative text on just-in-time inventory control. The New York Times Magazine has said that the fundamentals of the system described in this text “are applicable to every industry across the globe ... [and] will have a profound effect on human society—it will truly change the world.” In Reinvesting the Corporation, John Naisbitt and Patricia Aburdene impart that their book fills the need to describe “an important new trend most observers have missed: increasingly severe labor shortages that will create a tight labor market for the rest of this century.” Jerry Bowles and Joshua Hammond, authors of Beyond Quality: New Standards of Total Performance That Can Change the Future of Corporate America, postulate that “those companies that will survive in the 1990s see quality as a means, not an end. These companies are built on solid foundations of continuous [product] improvement.”

It is baffling that not one of these prophetic texts includes the word “service” in its index—either as a noun or verb. Why not? The point is critical. First, serving the consumer well is the best way to ensure repeat business.

Quality should not be confused with service. Drucker differentiated them best in Innovation and Entrepreneurship: Practice and Principles: “Quality in a product or service is not what the supplier puts in. It is what the customer is willing to pay for.”

Secondly, on a macroeconomic level, it is the service sector of our economy that is supplying most of the job growth—not only in retail sales, but in information processing, waste disposal, banking, medical care and research, and dozens of other service industries. All told, the service sector accounts for more than 75 percent of the nation’s jobs and 72 percent of the gross national product. By the year 2000, the figures will be 92 percent and 85 percent, respectively. Omission of the word “service” from business texts may result from difficulties inherent in quantifying it. That is, measuring progress in lowering inventory levels, waste minimization, and reducing production logjams are relatively uncomplicated when compared with gauging performance in service industries. Unfortunately, it is the latter area that may prove more crucial to our nation’s vitality in the years ahead.

It is astonishing how quickly the distinction between service and nonservice companies has blurred. For example, 77.5% of General Motors’ work force is white-collar and salaried, with only 22.5% blue-collar and hourly. At Mobil, 61.6% of the staff is white-collar; at General Electric the figure is 60%; and, at DuPont, 57.1%. IBM has the top white-collar percentage at 91.5%. Management pundit Theodore Levitt has declared: “There are no such things as service industries. There are only industries whose service components are greater or less than those of other industries. Everybody is in service.”

PERFORMANCE STANDARDS

The government has undertaken initiatives to improve its acquisition process with a key goal being improvement in the way it contracts for services. Specifically, it is developing: 1) standardized procurement documents that enable it to ensure full compliance with contract terms; 2) methods to guarantee that the taxpayer pays for only high-quality work at the lowest cost feasible; and 3) performance measures that agencies may adopt to evaluate the success of their procurement systems. Instructions appear in Directive M-96-25, titled Measuring Up—Procurement Performance Measures and a Best Practices Campaign for a World Class Acquisition System. Issued by the Office of Federal Procurement Policy on May 16, 1996, its initial purpose was to assist agencies in choosing general performance measures for internal planning purposes that met their individual needs. However, the Office of Management and Budget (OMB) has identified PBSC reform as critical. Results of PBSC progress are
The government's emphasis on service is difficult to overstate. It will spend about $115 billion on services this year. This is more than half its total spending on procurement. The essential point is that service organizations will be the beneficiaries of this spending, and they are doing little to help their own cause. By default, they may end up accepting certain constraints and contract provisions with which they do not agree. This is a prime area for business-government collaboration if ever one existed. There exists no better method to foster the kind of relationship that will be needed to get design and development results early in service areas than joint government VE-oriented contracting efforts.

An example that demonstrates the government's concern in the service area is inventory management. After reviewing current practices throughout the private sector, the General Accounting Office (GAO), in its 14-volume High Risk Series produced for Congress in February 1997, recommended several initiatives to help the military services eliminate waste on excess supplies. The initiatives follow: 1) use "just in time" practices to shift responsibilities for storing and managing items to suppliers; 2) shift responsibility for managing items to suppliers through the use of long-term agreements with only a few key suppliers; 3) use direct delivery practices that bypass the need for intermediate handling and storage; and 4) eliminate paperwork and speed up purchasing by using electronic ordering systems and bar coding.

Why the concern? According to the GAO, in September 1995 the Department of Defense (DOD) had $69.6 billion in "secondary inventory" on hand. The GAO estimated that this was more than double the DOD's needs to support either reserve or current operating requirements. This figure does not include the millions of dollars spent each year to manage and maintain these levels of "insurance items."

Ten days before he was inaugurated for a second term, President Clinton invited his cabinet to a meeting at the Blair House. The session's theme was improving government management and reestablishing the customer orientation of government agencies. One by-product of the meeting was a 43-page paperback book titled The Blair House Papers, which was developed as a guide. On page 40, the president recommends the following: "Use 'just-in-time' inventories. This eliminates warehousing systems, saving staff resources and warehouse space." Thus, service is on the mind of everyone concerned with return on investment.

Imaginative contracting officers trained in value engineering probably would have added the following to the GAO's list of solutions: 1) repair items promptly after they break; 2) reorganize the repair process to bring all resources required—tools, support equipment, personnel, and inventory—together in one location to avoid duplication; 3) use local distribution centers and integrated supplier programs to improve "just in time" programs; and 4) use third-party logistics providers to manage logistics functions. That is, contract out when cost considerations are favorable or the skill levels of present employees are not satisfactory. This is not an exhaustive list, but one to demonstrate the breadth of a value engineer's considerations when faced with such challenges.

An ideal start would be to turn the contractor-supplier relationship into one of "market price minus" from "supplier cost plus." The tool used most commonly in the world of production to accomplish this is value engineering. Savings generated by suppliers through VE cost-reduction proposals are shared with them. In some cases, the amount earned this way has lined the pockets of suppliers with hundreds of thousands of dollars. And they are pure profit dollars.

Another option is to structure service contracts in a "contracting for results" mode; that is, a system that emulates management by objectives. Payments then could be tied to the accomplishment of specific objectives. By focusing on the work to be performed, rather than how it is performed, suppliers using value engineering would have the freedom and the incentive to be creative and would adopt the most efficient means of performance. Inherent in this approach is that the contract lays the basis for a cooperative relationship, one that is fundamentally different from the adversarial relationships between most sellers and buyers today. It becomes a framework that makes the parties to it want to work together. Such instruments have been commonplace in Japan for many years. Frank Gibney discusses them cogently in Miracle by Design.

CONSULTATION, NOT CONFRONTATION

By working with government to change its philosophy in this way, i.e., stating expectations in performance terms, the atmosphere conceivably could become more conducive to a shift, over time, from cost reimbursement to fixed-price contracts. Such contracts are more likely to result in the timely submission of quality deliverables within budget constraints. Thus, the system is win-win for both the supplier and the funding agency. If VE provisions then were made an integral part of all service contracts, not just given lip service, even better results would accrue to the contracting parties. Total overall costs would drop, with the supplier sharing the savings according to a known, predetermined ratio. An improved program would evolve if part of the savings generated by performance contracting could be retained by the agencies achieving them to reward creative employees and to help agencies expand other productivity-enhancing technologies.

Like morale, the results of a service-contract action can be difficult to quantify or determine. Due to its nature, morale often must be estimated indirectly by measures such as tardiness, absenteeism, grievances, and complaints. On service contracts, measuring results often is accomplished by reviews of price, quality, productivity, and timeliness. Unfortunately, it is possible to provide a service that meets these criteria and still is deficient. A result is that disappointment reigns.

To provide superior services, what suppliers often need is an
improved understanding of the customer's needs. This information should be provided even if it means releasing proprietary materials that previously were not divulged to the supplier. In turn, the supplier should be prepared to provide the contracting officer with detailed information about costs and production techniques. Thus, I envision a model in which the contract itself, although important, is not allowed to destroy the faith and mutual trust that underpins it. These are prime elements in a smooth working relationship. To sum, the contract should not be the thing in itself; it should be a natural outgrowth of explanation, understanding, and consultation. Ways to cut costs and make a reasonable profit can be explored together, with VE incentives available to reward both parties if costs are reduced to a point lower than initially agreed upon and if deliverables meet functional requirements.

In “Business is Enough of a Trial; Why Go to Court?” James F. Henry, president of the Center for Public Resources, reviews the wisdom of sharing information to settle disputes between companies as alternatives to protracted litigation. In these “minitrials,” groups of executives from disputing companies consult to settle conflicts. Initial results of this method, which is still in a somewhat exploratory phase, have been excellent. Companies using the minitrail report that they have significantly reduced costs, retained important business relationships, avoided unwanted publicity, and minimized the delays and uncertainties of judicial decisions.

Without a fundamental shift away from power-based bargaining relationships, it is almost impossible to evaluate service contracts based on performance. By agreeing on new ground rules for joint cost analysis, price determination, and profits, government contract personnel will continue to play by the old rules. Without a new scenario to follow, service suppliers’ objectives will be to shift the advantage to their side. One way to do so is to bring a new technology to the negotiating table at the last moment. The government then can only guess at the price or threaten to buy elsewhere. The win-win situation described above turns to lose-lose. The taxpayer suffers the biggest loss. More than likely, the supplier loses a client and the contracting officer gets neither the best service nor the best price for this secretiveness. Productivity will increase and quality will improve only when openness becomes an integral part of the service-contracting process. And the best tool devised to date for achieving functional requirements at minimal cost is value engineering. When applied as described, it will come close to reaching the potential its early practitioners and theorists envisioned.

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**Books**


**Articles**


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Value Analysis and the Facility Program

Charles A. Shrive, P.E., C.S.I.

Value analysis was originally developed in the manufacturing industries 50 years ago. Thirty years ago it began to be applied to construction, under the name “value engineering.”

Value analysis attempts to establish the minimum cost for delivering required functions. In many cases, it is viewed as mere cost reductions, but there is a significant difference between the two. Cost reduction treats value as a simple inverse of cost: the lower the cost of a solution, the higher it is valued. It aims to reduce the cost of present components.

Value analysis considers that value is the ratio of worth to cost. Rather than simply finding a lower-cost solution independent of requirements, value analysts look at functional worth for solutions that perform better or for less cost without compromising function. Value analysis aims to provide user-required functions at lower cost.

It sounds straightforward, and in many ways it is, but value analysis is a detailed procedure. Its application to construction is complicated by the delivery process, the unique nature of most facilities, and the involvement of different participants at various phases of the process.

**FIRST, FOLLOW FUNCTIONAL REQUIREMENTS**

Most construction value-analysis implementations begin with a breakdown of an engineered facility into components related to identifiable functions. Each of these elements is analyzed to determine, first, if it is a candidate for further analysis and, second, which alternatives would increase the value of the selected elements.

One version of this methodology is seen in an ineffectual standard published by the American Society for Testing and Materials (ASTM) in response to pending federal legislation requiring value analysis on certain public projects. That standard, ASTM E 1699-95, includes the following set of procedures:

Using the most current, preliminary estimate, presented by the project team, the value analysis leader develops the capital cost model, which organizes initial construction costs by element and trade. (see [Unisformat II])

Using [this] cost model ... the value analysis team develops target estimates for each system and subsystem or functional grouping; and establishes these targets based on its collective experience as the least cost necessary to perform the function. Areas that show a significant difference between the design professional’s cost estimate and the target estimate are those which present opportunities ...

Identify and define the functions of the building project or subsystem; then define the functions of each building element using an active verb and a measurable noun ...

After defining the functions of the project, relate these functions to cost ...

The [value analysis] team then collectively sets a target cost, or the worth, for each function.

Similar procedures are given for life-cycle costs. The output is a set of one or more alternatives that achieve the required functions at lower cost (either capital or life cycle) than the “target cost” established in the preceding procedure. The basic flaw in this approach is that it dissects an existing design and attempts to infer functionality of its elements, rather than starting with the required functions for the facility and then examining the elements that deliver those functions. Function analysis should occur before design solutions are considered.

The standard does briefly suggest that its procedures can be used during “the earliest stages of design ... to analyze predesign documents, for example, program documents and space planning documents.” There are no follow-up provisions in the standard to implement this suggestion, an unfortunate omission.

During the programming phase of an engineered facility, the users are most in touch with the required functions of the facility they are proposing. The programming process identifies space requirements, spatial relationships, environmental concerns, and functional requirements. User expectations of those functions and the relative level of performance of each are drawn out and documented.

At this point, function analysis can be performed by breaking down functions into a hierarchy, resulting in a series of independent functions for which design solutions may be proposed. Several tools have been developed by value analysis over the past 50 years to support such a process. Following this procedure allows us to focus on functional requirements first, rather than becoming confused by experiences with specific construction features that provide the required functions.

As design solutions are proposed, they should be organized in a way that is more familiar to design professionals than functional breakdowns. In building design, UniFormat™ classifies building systems and their components based on function, boundaries,
patterns, or other systematic features. In other areas of engineered construction, there are breakdowns of systems that commonly provide a familiar model for design.

**DON'T STOP AT THE PROGRAMMING PHASE**

Value analysis should be performed during each phase of design, construction, startup, and operation. The emphasis and details will differ in each phase, but the basic goals are the same. The process should begin with user requirements documented in a facility program, move to a functional analysis based on those requirements, and finally propose design solutions that are mapped to the functional needs. This provides a framework for continued value analysis throughout the life cycle of the facility.

Rather than simply finding a lower-cost solution independent of requirements, value analysts look at functional worth for solutions that perform better or for less cost without compromising function.

The phase at the beginning of facility design, when the programming process is the primary activity, may be called “programming,” but it is important not to confuse the phase with the process. The programming of an engineered facility is a process that continues through design, construction, start-up, and operation. User requirements change during each phase of the facility’s life cycle, so the user’s program, whether documented or not, is constantly changing.

Competent value analysis, as well as quality management of design, construction, and operations, requires that decisions be based on current user requirements. Processes and formats should be developed for recording user requirements as they change to associate user requirements with key criteria related to design, construction, and operation.

These processes and formats need not be created entirely from scratch, but their development does suggest a paradigm shift in our approach to engineered construction. As always, a new approach will raise questions about liability, responsibility, costs, and fees—important issues that need serious attention.

Value analysis also adds some team members to the project, and defining roles is important. The most important role is that of the user.

**USER RESPONSIBILITY**

Value analysis focuses on the basic issues of function, worth, and cost. No matter how many players are on the team, it is the users who determine the required functions, what they are worth, and what cost is acceptable. Our processes and formats must focus primary responsibility on the user, particularly the owner, to set the foundation for design and the subsequent phases of the facility’s life cycle.

One of the significant weaknesses of the ASTM E 1699-95 is its assignment of responsibilities to various roles, such as the owner, design professional, and contractor. It is always dangerous to have these kinds of provisions in a standard, because its assignments may not coincide with the relationships defined in a contract on a specific project. Use caution when referring to or following this standard, and be sure to establish roles and relationships explicitly.

If done thoughtfully, coupling value analysis and programming gives us an opportunity to serve users in the establishment of the basic values that drive facility design. We must keep in mind whose values those are. The facility program underpins design-related procedures, such as quality management and value analysis, and serves as the vehicle for documenting and preserving the user’s values.

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The Value Engineering Equation and The Auto Industry—a Definition of ‘Cost’

Gerald Milkie

The traditional VE equation “Value = Function/Cost” has been used in the defense industry, the construction industry, and, more recently, the automobile industry to aid in evaluating proposals from VE studies. Because of the differences in the financial issues among these industries, the denominator “cost” should not be treated in the same manner among them.

For example, in the construction industry, the major cash outflows are generally in a few lumps to purchase materials, equipment, etc., then the major outflows for the labor during the construction period itself. The cash inflows consist of some deposits, a finite number of progress payments, and a major payment upon completion of the project. In the automobile industry, major outflows occur during the engineering/testing of a new model, then the purchase of tooling and other facilities/investment, followed by the variable outflow of cash for labor, materials, and component suppliers during actual manufacture of the vehicle. Cash inflows begin as the vehicles are sold and continue during the market cycle, proportional to the volume sold. After sales, some warranty outflows may occur. These cash flows in both directions are quite different from those of the construction industry.

In the automotive industry, the tendency or simplistic approach is to use the variable cost/vehicle in the VE equation when evaluating proposals. Because of the time value of money and the different manner in which cash flows in the automobile industry, a more rigorous method favors a different approach.

The theoretical cost model should include all life-cycle costs, including the costs of ownership. This would include, for example, the costs of scheduled maintenance for the vehicle, the expected costs of component repairs out of warranty, depreciation of the vehicle over time, and other postpurchase costs. However, such costs are difficult to pin down in advance, as a function of length of ownership period before resale or scrap of the vehicle, and vary considerably among purchasers of vehicles. Depreciation values are dependent not only on physical depreciation, but also on market forces that cannot be projected during the engineering phase of the vehicle when most VE studies take place. Perhaps a reasonable depreciation/mile figure coupled with a typical customer-miles-driven model could be developed and used in more sophisticated models.

For purposes of this analysis, the only postpurchase cost figures to be included in the cost model will be warranty and scheduled maintenance costs during the warranty period. There is an element of predictability in them. Furthermore, some market effects can be incorporated by defining the length of time of warranty coverage and comprehensiveness of the coverage; market effects can also be included for minimizing maintenance costs to the purchaser. Presumably, a manufacturer can put more money into the design cost to minimize warranty and maintenance costs and maximize customer satisfaction (and value). Thus, a rational basis exists for trading off among the various elements of the cost model.

Conceptually, the cost model of an automobile can be described as follows:

Total life-cycle cost/vehicle = variable cost/vehicle + investment/vehicle + warranty/vehicle + maintenance/vehicle

The investment element of this cost model can be broken down:

Investment/vehicle = tooling/vehicle + facilities/vehicle + engineering/vehicle

Other elements, such as time value of money being taken into account, can be further defined (NPV = net present value).

Tooling cost = NPV (cash flows for tooling)/total life-cycle volume
Facilities costs = NPV (cash flows for facilities)/total life-cycle volume
Engineering cost = NPV (cash flows for engineering)/total life-cycle volume
Variable cost = (Σ (monthly volumes x NPV monthly sales/vehicle))/Σ monthly volume
Warranty cost = (Σ (monthly volumes x NPV projected monthly warranty/vehicle))/Σ volume
Maintenance effect = (Σ (semiannual volumes x NPV semiannual maintenance/vehicle))/Σ volume

VOLUME EFFECTS

The incremental sales volume from improved value to the customer in reduced maintenance costs, lower selling price as a result of lower costs, or other feature improvements resulting from VE studies, etc., should be part of the analysis. Hard numbers may be somewhat elusive, although some marketing data for increased sales due to lower maintenance costs or some feature improvements may be available. In a sophisticated value model, the “before” and “after” value calculation can show these differences in volumes incorporated into the cost model.
INTEREST RATE TO BE USED

The interest rate implicit in the various cash flow figures needs careful examination. A time-honored debate in financial circles is the choice of interest rate for present value calculations. Future interest rates are also not much more than educated guesses. Corporate financial analysts should be able to provide reasonable numbers, which are better than not taking them into account at all.

The interest rate for different types of cash flow may vary. A company may have a different rate for the installment cost of payments to tooling suppliers than for component suppliers. The issue of what rate to use with dealers for warranty reimbursements, payments for vehicle purchases, etc., is ongoing. The further into the future, generally, the higher the interest rate, which reflects the greater uncertainty.

For the VE process, the net result is that the finance people on the team will have an expanded role. Happily, much of it can be done in advance to minimize the effect on the time spent during the VE workshop. The finance people, for example, can establish the appropriate interest rates for the different types of cash flows and come equipped with present-value tables and other appropriate time-value-of-money tables for the established rates and, thus, minimize the amount of time spent on number crunching in the workshop.

Working with the vehicle program and marketing people, the finance people can establish the time frames for the various cash flows before the workshop, enabling more “precalculation.”

COST MODEL

To bring home the concept, it is helpful to walk through an example. Let us assume that we have been in a VE workshop for a few days, have completed the brainstorming, and are examining an idea to T-chart for further evaluation (see Table 1).

Management probably would reject this idea, due to a variable cost increase, major investment increases, and only a slight increase in value. Every program has constraints on investment in tooling and facilities, for example. Seeing the raw increases in those numbers tends to predispose the decision maker against an otherwise good idea. By incorporating numbers into the value calculation, a more quantitatively based decision is possible.

Additional information, not usually sought in the typical workshop, provides more input for the complete value calculation. Marketing estimates that implementation of this idea will increase sales according to the schedule shown in Table 2. The increase is slight at first, but obsolescence later in the cycle is decelerated.

<table>
<thead>
<tr>
<th>Year</th>
<th>Old Design</th>
<th>New Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>200,000</td>
<td>201,000</td>
</tr>
<tr>
<td>2001</td>
<td>220,000</td>
<td>222,000</td>
</tr>
<tr>
<td>2002</td>
<td>250,000</td>
<td>258,000</td>
</tr>
<tr>
<td>2003</td>
<td>200,000</td>
<td>210,000</td>
</tr>
<tr>
<td>2004</td>
<td>190,000</td>
<td>200,000</td>
</tr>
<tr>
<td>2005</td>
<td>150,000</td>
<td>164,000</td>
</tr>
<tr>
<td>Total cycle</td>
<td>1,210,000</td>
<td>1,255,000</td>
</tr>
</tbody>
</table>

This sales increase affects the investment/vehicle calculation. It also improves incremental profit, which does not show up in the value calculation.

Applying the cost model to this example, we come up with the following results.

<table>
<thead>
<tr>
<th>Engineering/Testing Costs</th>
<th>NPV</th>
</tr>
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<tbody>
<tr>
<td>Monthly expenditures in 1997</td>
<td>$19,573.32 = NPV of $20,000 in monthly flows discounted at 4% (current year)</td>
</tr>
<tr>
<td>Per vehicle</td>
<td>$0.0162 = $19,573.32 / 1,210,000 (NPV/total cycle volume)</td>
</tr>
<tr>
<td>$243,358.79 = NPV of $250,000 in monthly flows discounted at 4% (additional in current year)</td>
<td></td>
</tr>
<tr>
<td>$0.1939 = $243,358.79 / 1,255,000 (NPV/revised total cycle volume)</td>
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<table>
<thead>
<tr>
<th>Table 1</th>
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</thead>
<tbody>
<tr>
<td>Sample Calculation</td>
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</table>

<table>
<thead>
<tr>
<th>Old Design</th>
<th>New Idea</th>
<th>Interest Rate</th>
<th>Time Frame</th>
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</thead>
<tbody>
<tr>
<td>Functional rating</td>
<td>345</td>
<td>355</td>
<td>5%</td>
</tr>
<tr>
<td>Variable cost/vehicle</td>
<td>$43.52</td>
<td>$43.65</td>
<td>4%</td>
</tr>
<tr>
<td>Engineering/testing</td>
<td>$20,000.00</td>
<td>$250,000.00</td>
<td>6%</td>
</tr>
<tr>
<td>Tooling</td>
<td>$700,000.00</td>
<td>$750,000.00</td>
<td>7%</td>
</tr>
<tr>
<td>Facilities</td>
<td>$200,000.00</td>
<td>$220,000.00</td>
<td>5%</td>
</tr>
<tr>
<td>Warranty/vehicle in first year</td>
<td>$10.50</td>
<td>$10.20</td>
<td>2%</td>
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<tr>
<td>Maintenance on vehicle/year</td>
<td>$30.00</td>
<td>$29.00</td>
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</table>
### Tooling Costs

<table>
<thead>
<tr>
<th></th>
<th>Old Design</th>
<th>New Idea</th>
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<tbody>
<tr>
<td>One-time expenditure in 1998</td>
<td>$622,997.51</td>
<td>$667,497.33</td>
</tr>
<tr>
<td>Per vehicle</td>
<td>$0.5149</td>
<td>$0.5319</td>
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</tbody>
</table>

$622,997.51 = NPV of $700,000 in a lump discounted at 6% (for next year)

$667,497.33 = NPV of $750,000 in a lump discounted at 6% (for next year)

$0.5149 = $622,997.51 / 1,210,000 (NPV/total cycle volume)

$0.5319 = $667,497.33 / 1,255,000 (NPV/revised total cycle volume)

Note that the incremental tooling is mitigated because of the timed discounting and cycle volume increase.

### Facilities Costs

<table>
<thead>
<tr>
<th></th>
<th>Old Design</th>
<th>New Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semiannual expenditure in 1998-99</td>
<td>$157,919.31</td>
<td>$173,711.24</td>
</tr>
<tr>
<td>Per vehicle</td>
<td>$0.1305</td>
<td>$0.1384</td>
</tr>
</tbody>
</table>

$157,919.31 = NPV of $200,000 in semiannual payments discounted at 7% (from 1999)

$173,711.24 = NPV of $220,000 in semiannual payments discounted at 7% (from 1999)

$0.1305 = $157,919.31 / 1,210,000 (NPV/total cycle volume)

$0.1384 = $173,711.24 / 1,255,000 (NPV/revised total cycle volume)

The mitigation effect, due to discounting and cycle volume increase, is even more pronounced in the facilities increment.

### Vehicle Warranty Costs in First Year

<table>
<thead>
<tr>
<th></th>
<th>Old Design</th>
<th>New Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarterly payments to dealers in 2000</td>
<td>$9.1321</td>
<td>$8.9535</td>
</tr>
</tbody>
</table>

$9.1321 = NPV of $10.50 in quarterly flows discounted at 5% (first year of sales)

$8.9535 = NPV of $10.20 in quarterly flows discounted at 5% (first year of sales)

Reduced "irritation factor" to customer should also be included in improved functional rating.

### Maintenance Costs

<table>
<thead>
<tr>
<th></th>
<th>Old Design</th>
<th>New Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semiannual expenditure in 2000</td>
<td>$28.4027</td>
<td>$27.4559</td>
</tr>
</tbody>
</table>

$28.4027 = NPV of $30 in semiannual payments discounted at 2% (first year of sales)

$27.4559 = NPV of $29 in semiannual payments discounted at 2% (first year of sales)

### Variable Cost

<table>
<thead>
<tr>
<th></th>
<th>Old Design</th>
<th>New Idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per vehicle</td>
<td>$33.9601</td>
<td>$33.9917</td>
</tr>
</tbody>
</table>

$33.9601 = NPV of sum of ($43.52 x semiannual volumes) discounted semiannually at 4% annual rate, divided by total cycle volume of 1,210,000

$33.9917 = NPV of sum of ($43.65 x revised semiannual volumes) discounted semiannually at 4% annual rate, divided by total cycle volume of 1,255,000

Assumes semiannual payments, but monthly payments are probably more accurate.

### Sum of Costs

<table>
<thead>
<tr>
<th></th>
<th>Total per-Vehicle Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Including maintenance (includes cost to customer, which is preferred in VE theory)</td>
<td>Old Design</td>
</tr>
<tr>
<td>Not including maintenance</td>
<td>$72.16</td>
</tr>
</tbody>
</table>

This is more conservative, but note that total cost picture shows lower increment when all factors are accounted for. Should the company choose to include first-year maintenance in the purchase price as a marketing feature, the cost to the company is lower and value to the customer is much higher.

### Value

<table>
<thead>
<tr>
<th></th>
<th>Value (= Function/Cost)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Including maintenance</td>
<td>4.781</td>
</tr>
<tr>
<td>Not including maintenance</td>
<td>7.886</td>
</tr>
</tbody>
</table>

Even though the value increase is on the same order as the original calculation based on variable cost only, it is a more reliable indicator of value because the denominator cost incorporates the total life-cycle costs and takes into account the time value of money. Thus, the proposal to management is a stronger argument for implementation by removal of some of the subjectivity in the assessment of the investment factors.
Call for Papers

The SAE Manufacturing Engineering Activity, in cooperation with SAVE International, “The Value Society,” invites paper offers for the third annual Value Engineering session on Value Based Decision Making for the 1998 SAE International Congress & Exposition, February 23–27, 1998, at Cobo Center in Detroit, Michigan. Topics include:

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  - Concurrent engineering and new product introduction
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2. A tentative title
3. The author's name, business affiliation and position, mailing address and telephone number

Offers should not have been published elsewhere unless an intersociety agreement governs; and, if accepted, contributors will not release their papers for publication through other media. Please note, however, that all authors are required to prepare and present their SAE papers using SI units only, except for a few special cases. These exceptions include situations in which a conflict exists with worldwide industry practice or in which government regulatory standards are in conflict with SI. Other than these exceptions, abstracts and manuscripts not in compliance shall be returned by the session organizer for modification.

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**Deadline for submitting paper offers is July 1, 1997; draft manuscripts are due September 8, 1997.**
Creativity and Innovation Trilogy

BOOK REVIEW

Jack V. Michaels, Ph.D., P.E., CVS


The author of these books, James M. Higgins, is a noted management consultant and professor of management at the Roy E. Crummer Graduate School of Business of Rollins College in Winter Park, Florida. He has the appropriate credentials for preaching that growth, let alone survival, in the increasingly complex marketplace of the future demands creativity and innovation with the utmost skill.

Higgins defines innovation as the way a firm or individual makes money from creativity. He views innovation as the only long-term sustainable competitive advantage that is equally essential in marketing and management, as well as in products and processes.

101 CREATIVE PROBLEM SOLVING TECHNIQUES

101 Creative Problem Solving Techniques is, as the subtitle states, a handbook of new ideas for business. The book first describes the basic creative problem-solving model and then illuminates the 101 techniques for unleashing individual and group creativity.

Readers will find a striking resemblance between Higgins' approach to creative problem solving and the VE job plan. The phases of the former are: environmental analysis, problem recognition, problem identification, making assumptions, generating alternatives, evaluation and choice, implementation, and control.

Higgins essentially devotes a chapter to each of these phases and punctuates the discussion with interesting recent case histories. The case histories range from the experience of Frito-Lay to the Chrysler Corp. The result is not only a readable and useful compendium on creativity and innovation, but a comprehensive work.

Value practitioners use brainstorming as the primary tool for creativity in workshops. Get ready for one of the most comprehensive dissertations on group dynamics that you will ever encounter. The subject is in Chapter 5 and occupies 59 pages of the book.

INNOVATE OR EVAPORATE

Higgins introduces the concept of an organization’s IQ, or its innovation quotient, in the second volume of the trilogy. The objective of Innovate or Evaporate is, as the subtitle states, to show you how to test and improve your organization’s IQ.

He gets your attention immediately in the preface with, “You can forget saying any eulogies for Japanese and European firms. Their deaths have been grossly exaggerated. Buoyed by recent successes against these firms, by increasing profits, and the fact that both Japan and Europe have only recently emerged from a trying economic period, too many U.S. firms are relaxing their competitive posture. Doomsayers are predicting a major loss of economic power for the Japanese, and many experts have written off most European firms because they are still having difficulty becoming globally competitive. Do not be fooled by these short-term aberrations.”

Higgins enumerates the 49 characteristics that an organizational culture needs to achieve strategic competitive advantage through innovation. These characteristics are discussed in the context of a “Seven S’s Model” that consists of strategy, structure, systems, style, staff, shared values, and skills. When these seven S’s are in place and properly aligned with each other, organizations succeed strategically.

He supports his conclusions with case studies of numerous organizations. Although he cites Hitachi, Merck, Toyota, BancOne, Sony, AT&T, Miliken, Kodak, Barnett Banks, Hewlett Packard, Intel, Johnson & Johnson, and Rubbermaid as very creative, he identifies 3M as the most innovative firm in the United States.

Why is 3M so successful? Because it has paid attention to innovation and created a culture that fosters it. Higgins uses six pages to extol 3M’s innovative accomplishments.

Detailed questionnaires are provided so you may measure your organization’s IQ as the basis for making improvements relating to products, processes, marketing, and management.

Higgins claims those IQ scores higher than 400 signify extremely innovative organizations. Scores below 100 may be injurious to organizational health.

ESCAPE FROM THE MAZE

Higgins says he primarily wrote the final book of the trilogy, Escape From the Maze: 9 Steps to Personal Creativity, for the person just getting started in the field of creativity. He offers seminars on creativity and innovation and, while reading the book, readers will feel that they are attending one of his seminars.

Higgins begins with an extensive checklist for gauging your
creativity that is guaranteed to capture your imagination before he unfolds the nine steps to personal creativity. These steps are: accepting your innate creativity, unlearning how not to be creative, expanding your problem-solving style, using creativity techniques, getting more in tune with the left brain, learning to suspend your left-brain style, improving thinking skills, practicing solving complex problems, and recording the ideas of your creative self. Value practitioners will relate to the enumeration of creativity blocks and idea killers.

At the end of each chapter, Higgins engages you in brain aerobics to increase your right-brain thinking skill and improve your left-brain, right-brain integration. In one of the brain aerobics, he talks about visualization, or “ideation,” as he calls it, as an important skill to learn in becoming more creative. He tells of American electrician and inventor Nikola Tesla, who was reciting a poem by Goethe at sunset when he saw a blinding vision of a magnetic field brought into rotation by a circle of magnets. This vision lead to the self-starting electric motor and the concept of alternating current.

Occasionally, Higgins uses so-called “brain breaks” to relieve the tension from concentrating on the fast and furious, albeit comprehensible, pace of his presentations.

Following is Brain Break 1. Without lifting your drawing instrument, draw four straight lines that connect all nine dots below.

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  ⬤ ⬤ ⬤
  ⬤ ⬤ ⬤
  ⬤ ⬤ ⬤
```

Having done that, connect all nine dots with three straight lines, again without lifting your drawing instrument. Having done that, connect all nine dots with two straight lines, also without lifting your drawing instrument. Finally, connect all nine dots with one straight line and, you guessed it, without lifting your drawing instrument.

Impossible, you say. Well, look at the answers in the book’s appendix. Higgins conveys the message that we are victims of perceptual assumptions, which we must overturn to unleash our creative power. Do not allow self-imposed constraints to limit your creativity.

**SUMMARY**

Higgins’ creativity and innovation trilogy will make a valuable addition to libraries of value practitioners. I recommend, however, that you read the books in the following sequence: *Escape From the Maze, 101 Creative Problem Solving Techniques,* and *Innovate or Evaporate.*

You can obtain the books from the SAVE International Bookstore. Each book costs $26 for members and $30 for nonmembers. See pages 22–23 for details.

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101 Creative Problem Solving Techniques: The Handbook of New Ideas for Business
By James M. Higgins, Ph.D.

Businesses and their managers, professional staff, team leaders and other employees are confronted with a host of challenges as they approach the 21st century. Change is occurring at an accelerating rate. The number of competitors is increasing dramatically. Business is globalizing. New technology is being introduced at a rapid pace. The workforce is increasingly diverse. There is a scarcity of certain resources, including highly skilled workers. There is a transformation occurring from an industrial to a knowledge-based society. Economic and market conditions are increasingly unstable, especially on a global basis. Constituents are more demanding. And, finally, the entire business environment is becoming more complex.

To meet these challenges and the opportunities they create, businesses are embracing creative problem solving and innovation as never before. To achieve effective and efficient levels of creative problem solving and the innovation that results, an organization must improve the creativity of its work groups and individuals, and it must create the right kind of organizational culture to turn that creativity into innovation.

One of the key ways in which individuals and groups can improve their creativity is by learning creativity processes—techniques that take advantage of innate intuitive and creative abilities, techniques that channel these abilities to create new or enhanced products or services, or create more effective and efficient organizational processes. This book describes the basic creative problem solving (CPS) model and then describes 101 techniques for unleashing individual and group creativity. These techniques follow the CPS model.

Managers, professionals, team leaders, and any other employees interested in improving their job performance or that of the work group, or—for that matter—the entire company, will find this book beneficial. This book is readily usable in company training programs. Organizational creativity training programs have grown rapidly in recent months, and this book is designed to meet the needs of such programs.

$30, nonmember; $26, member

Innovate or Evaporate: Test & Improve Your Organization's Innovation Quotient
By James M. Higgins, Ph.D.

Innovate or Evaporate is a book for managers, professionals, team leaders, team members, and anyone else concerned with increasing the competitiveness of an organization. It takes a cross-functional approach to increasing innovation, which is shown to be the key to competitiveness. It contains four questionnaires that test for an organization's prowess at product, process, marketing, and management innovation. It then provides lengthy discussions of the questions from the questionnaires and numerous global examples of how firms satisfy these requirements. For most questions, the author compares U.S., Japanese, and European firms.

$30, nonmember; $26, member

Escape From the Maze: 9 Steps to Personal Creativity
By James M. Higgins, Ph.D.

This book was written primarily for the person just getting started in the field of creativity, the person who wants to understand the key steps involved in becoming more creative. For the person experienced in creativity, Escape offers the first overview of the major streams of thought in the field. This overview will assist those experienced in creativity to understand other perspectives and to open the possibilities for the expansion of their own creative skills.

$30, nonmember; $26, member

About the Author:
James M. Higgins, Ph.D., is an author, consultant, professor, and entrepreneur. He is the author of six college texts on strategy, management, and human relations.

Dr. Higgins is professor of management at the Roy E. Crummer Graduate School of Business at Rollins College in Winter Park, Florida, and is an experienced consultant, working with people and firms since 1985 to increase levels of innovation as well as solving particular problems. He also consults with organizations on strategic planning and behavioral areas such as motivation, leadership, communication, and stress management. His clients have included firms such as several divisions of Walt Disney Companies, Sun Trust Bank, Skopbank (Helsinki), and Florida Info-Management Services. He has been a consultant since 1973.
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