

# ***Moving From A Mandated Environment To A Value-Oriented Culture Through Enhanced Performance Of VE***

**By:**

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## **Forward**

Strategic Value Solutions, Inc. (SVS) was hired to facilitate a workshop focused on a special United States Army Corps of Engineers Headquarters' initiative to answer the ultimate question of "What is the function of value engineering?" The workshop was an intensive 3-day effort that used function analysis tools and techniques, almost exclusively, to drill down on the subject question. The workshop was attended by Jeffery Hooghouse, AIA, DBIA, CVS, (Chief Value Officer, HQUSACE), Benjamin Robertson, PE, CVS (USACE Louisville District Value Engineering Officer), Kyle Schafersman, PE, CVS (SVS), John Robinson, PE, CVS-Life, FSAVE (SVS), and Ryan Robinson, EIT, AVS (SVS). This paper represents the findings and deliverable resulting from the workshop. This deliverable was created as the collaborative effort of all workshop participants and was authored by Kyle Schafersman, John Robinson, and Ryan Robinson.

## **Introduction**

The value engineering (VE) industry has a very big problem. There is a stigma in some circles of the design and construction industry that VE is only performed because it is mandated. Generally, mandated tasks are not seen as desirable activities and more frequently interpreted in a negative perspective. This leads many to ask the question "Why do we have to do value engineering?"

This paper will attempt to answer this question along with additional questions asked below. This paper is intended to provide support to the Value Engineering (VE) Community of Practice (COP) in communicating with Project Managers (PM), designers, managers, stakeholders, consultants, and others on the specific purpose of value engineering and why it is uniquely different than any other planning or design process currently employed in the project delivery process.

Even though there is a public law, presidential directive, and numerous documents stating policies and regulations for the use of value engineering, the COP is continuously challenged on why VE has to be accomplished and specifically why does it have to be

conducted in accordance with the SAVE International® VE Job Plan using a multidisciplinary team, led by a Certified Value Specialist (CVS), in a workshop format.

In general, many senior managers, project managers, and designers do not understand why value engineering is required when the planning and design process generates alternatives to decide on the best approach to meet the stakeholders' needs within the available budget. Furthermore, there are multiple reviews throughout the project development process to make sure the project stays on schedule and on budget. So what additional benefit do we gain by using VE? Isn't the intent of VE already being accomplished by the planning, design, and review processes?

To answer these questions, we contemplated several other questions such as:

- What makes VE uniquely different from other planning, design, and technical review processes?
- What distinguishes VE from other problem solving techniques?
- What has to be done and/or accomplished for "IT" to be considered VE?
- How does someone substantiate "IT" was accomplished properly?

The underlying intent was to more clearly define and spell out what specifically constitutes performing value engineering in lieu of relying on others to define it. The objective of this workshop was to explore these philosophical questions and develop a response using the most important and powerful tool from the very methodology being studied. That critical tool was function analysis. It was important to the workshop participants to use the tools of the industry to communicate the goals and findings of this analysis.

Beyond the clarity obtained on the function of value engineering, the team also explored the obstacles to moving from a mandated environment (negative perspective) to a true value-oriented culture (positive perspective) through enhanced performance from the VE Program.

## **What makes VE uniquely different from other planning, design, and technical review processes?**

### ***Value Methodology Standard***

The SAVE International® Value Methodology (VM) Standard and ASTM Standard E1699-14 state that the following components are required for every value engineering study:

1. Execute the specific six-step VM job plan in a workshop setting where the VM job plan provides an organized and structured process to analyze the project and develop alternatives to satisfy the functional requirements of the project
2. Use a multidisciplinary team

3. Use a qualified team leader to facilitate the VM Job Plan (a CVS is recognized within the industry as qualified to facilitate this process)

### ***Function Analysis***

Function analysis is the heart and soul of the VE process and is the key activity that differentiates the VE process from other problem solving or improvement practices. Function analysis is the process of identifying what must be accomplished as opposed to how it is accomplished. During this phase of the VE job plan, functions are identified that describe the expected outcomes of the project under study. Function analysis also defines how those outcomes are expected to be accomplished by the original design. Functions are defined in a two-word pairing comprised of an active or descriptive verb and a measurable or descriptive noun.

This identification and naming convention of functions enables a more precise understanding by limiting the description of a function to an *active verb* that operates on a *measurable noun* to communicate what work an item or activity performs. This naming convention also helps multidisciplinary teams to build a shared understanding of the functional requirements of the project.

### ***FAST Diagram***

There are various techniques that can be used to further enhance the function analysis phase of the VM job plan. The most recognized and widely used technique is a graphical mapping approach known as the *Function Analysis System Technique* (FAST), which allows understanding of how functions are related to each other. The resulting FAST diagram allows quick visualization of the logical relationship between functions.

The FAST diagram is structured such that moving to the right of any function answers the question, "How are we accomplishing this function?" Moving to the left of any function answers the question, "Why are we accomplishing this function?" Elements that are vertically connected occur "When" or as a consequence of the function it is connected to on the horizontal path. The functions between the two dashed lines, called Scope Lines, represent the functional elements which are within the scope of the VE Study.

### ***Function of Value Engineering***

This workshop used function analysis and specifically the FAST diagramming technique to understand, analyze, and communicate the function of value engineering in terms of the functions that must be accomplished in order to have accomplished value engineering. The product of this function analysis process directly responds to the questions asked at the beginning of this paper.

The following text will explain the FAST diagram developed during the workshop in a narrative format that explains and defines the terms being used. While the two-word format is very effective in a workshop setting, some context is necessary to fully understand the meaning of these functions, if you were not a participant in the workshop. The actual FAST diagram is included following this narrative.

Reading from left to right, the diagram states that the higher order function or the mission that must be accomplished and the intended function of value engineering is to improve projects. Many of the projects being designed and constructed are already good, but there is always room for improvement.

Specifically, the function of value engineering is to make these improvements by optimizing value. Optimizing<sup>1</sup> is defined as to make the best or most effective use of a situation, opportunity, or resource. Value is optimized by maximizing the function to resources (F/R) ratio. Maximize<sup>1</sup> is defined as to make as large or great as possible. So, to maximize this ratio, a VE study needs to achieve the required functionality of the project while minimizing the resources necessary to deliver that functionality. The VE process accomplishes this by challenging the proposed solutions. For the purposes of this FAST diagram, challenge<sup>1</sup> is defined as to dispute the truth or validity of (i.e. to question, to take issue with, to contest, etc.). This is not intended to in any way criticize the solution but rather it is fundamental to the creative process. If you approach a problem with an assumption that the solution you have is the best possible solution, then it would be virtually impossible to find a better way. Therefore, when solutions are challenged, the VE team is looking for opportunities to improve the value of the project.

When asked how VE challenges solutions, the answer leads to three separate function-logic paths. These three distinct paths are to expand solution-set, understand objectives, and supplement knowledgebase. The first and second function-logic paths (expand solution-set and understand objectives) are required to meet the standard for VE, and the incorporation of the third function-logic path, supplement knowledgebase, is highly recommended. These functions must be completed and documented to state that VE has been accomplished.

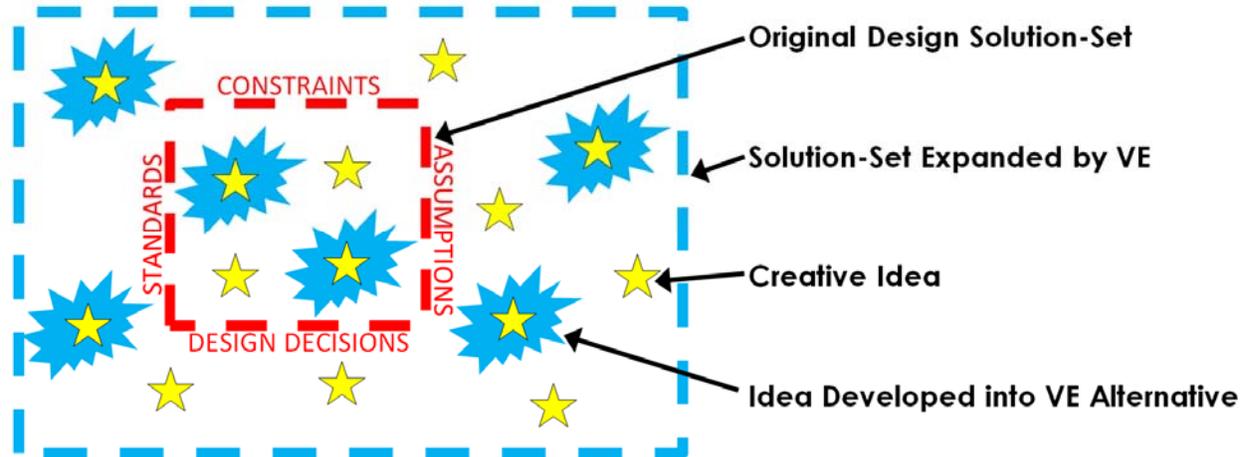
The first function-logic path states that the VE team must understand the project objectives and understand the rationale for why the original design is the way it is. To gain this understanding, the VE study must extract knowledge from design documents, as well as design and stakeholder personnel. This knowledge is extracted by forcing communication, which is caused by forcing interaction between the VE team and design team. This knowledge is also extracted by stimulating thought. Thoughts are stimulated by catalyzing discussions. Catalyze<sup>1</sup> is defined as to cause an action or process to begin. This implies the VE team and the design team must exchange information regarding the project, preferably in both written and verbal format.

In addition to extracting knowledge, the function of understanding objective is also accomplished by analyzing functions. When functions are analyzed, the VE team is able to identify what the project is doing. More importantly, analyzing functions identifies what the project must do to be successful. Function analysis is the most critical component of the entire process.

The second function-logic path states VE also challenges solutions by expanding the solution-set. <sup>1</sup>In mathematics, a solution set is the set of values that satisfy a given set of equations or inequalities. For the purposes of this FAST diagram, solution-set is defined as a group of alternative concepts that all accomplish the functional requirements of the project. VE expands the solution set by challenging criteria, challenging constraints,

challenging the status quo, testing assumptions, and challenging design decisions to create a bigger box of solutions to consider. This concept is illustrated in Figure 1 below. These challenges imply that everything is an option during the creativity phase of VE. Constraints, assumptions, and design decisions should be poked and prodded by the VE team to fully examine and validate their inclusion in the project, and if they withstand the added scrutiny, then they can be maintained within the design as justified. If constraints, assumptions, and design decisions are not deemed justifiable, then the VE team should develop alternatives to remove them from the project.

Figure 1



The third and final function-logic path states that solutions are challenged by supplementing knowledgebase of the project development team and stakeholders. The knowledgebase is supplemented by infusing expertise and expanding knowledge. This means the VE team needs to draw on facts, information, and skills acquired through experience or education, beyond the knowledgebase of the design team that conceived the original solution. Albert Einstein is quoted as saying "you can't solve your problem with the same level of thinking that created the problem." This implies that an outside or fresh thought process is required to see the problem from a different perspective with the goal of identifying other possible solutions. The infusion of VE team members into the project from outside of the design team will supplement the knowledgebase and eventually flow back to the highest order function of making projects better.

*"you can't solve your problem with the same level of thinking that created the problem"*

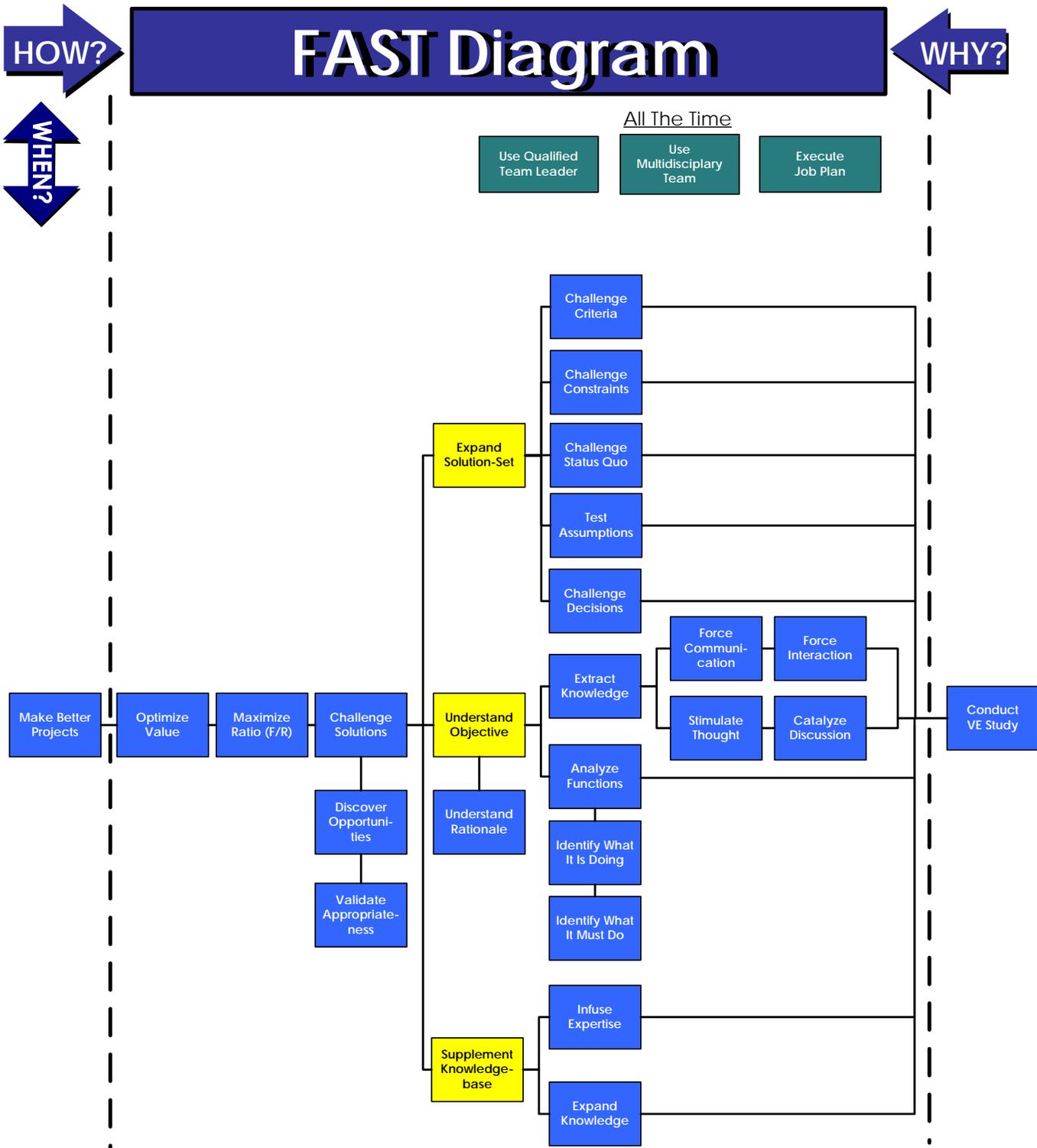
*Albert Einstein*

## What distinguishes VE from other problem solving techniques?

This concept of "challenging" is key to understanding what makes value engineering unique. To understand why this is important it is first important to understand some key characteristics of planning and design practices.

1. In the late 1980's to early 1990's, the construction industry adopted a new mindset toward customer care. This even involved instituting that project stakeholders should be referred to as "customers". This was established as a result of a major Total Quality Management (TQM) initiative. At that time the mantra was that the customer is king and that corporations and employees should do everything in their power to give the customer what they want. This initiative changed the culture of project management and created a mindset that makes the stakeholder's project expectations irrevocable; they are what they are and we need to find a way to make it happen.
2. Stakeholders and designers must make certain assumptions through the project development process. Many of the more significant assumptions are made at the earliest stages of development. Over time, these assumptions are accepted as facts even though no one has actually tested the validity of the assumption. It is just accepted. Similarly, the stakeholder or design team will establish or identify a constraint, often self-imposed. Again, the validity of this as a project constraint is often not tested. Sometimes constraints can change or be removed as a project progresses and the design does not adjust accordingly. These assumptions and constraints often play a major role in establishing limits on the proposed solution.
3. There is a common misperception that when a consultant is hired, they are already paid to provide the best solution. This is not true for multiple reasons:
  - a. Owners today put so much pressure on fee proposals that for consultants to make any money they have to identify an acceptable solution with minimal investigation into alternatives. For economic reasons, consultants often proceed with the first solution that meets the stated criteria.
  - b. Owners hire consultants based on their experience in designing projects as similar as possible to the project they desire. Therefore, the owner and the designer are already biased on what the "right" solution looks like. Therefore there is little to no exploration of alternatives or challenges to the owner's design criteria.
  - c. Consultants also have a mindset about customer care that the customer is king and that the way you make a happy customer is to give them exactly what they want. The mindset is that customers do not want their decisions or their expectations to be challenged or questioned. The consultant will make sure the end solution will work but it may not be the best solution.

Throughout the planning and design process, there is no consistent approach to challenge the proposed solution to determine if it is truly the best answer for satisfying the functional requirements of the project. Even the various design review processes are focused on making sure the design does not have any technical errors. These reviews seldom suggest better ways to accomplish the design objective except for perhaps minor tweaks and adjustments. ***Value engineering is the only process with a specific purpose of challenging everything in order to identify ways to accomplish the project in a way that satisfies the required functions with the minimum expenditure of resources (i.e. money, time, etc.).***



Function of Value Engineering

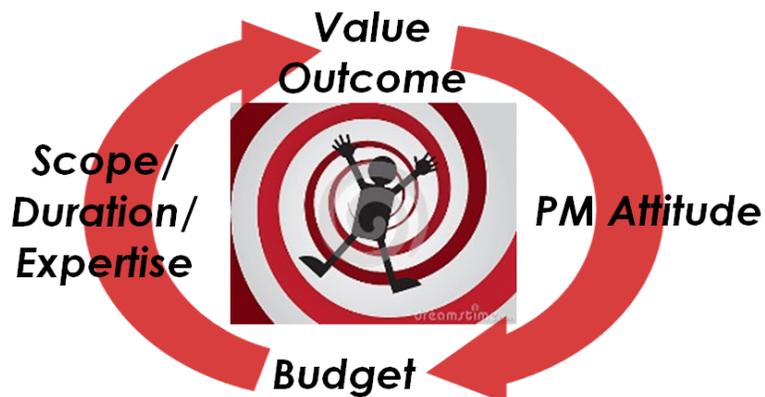
## What has to be done and/or accomplished for “IT” to be considered VE?

A common answer to the questions posed in the introduction would be “Follow the SAVE International® six-step job plan.” This job plan is required and must be followed for every VE study. This is non-negotiable. However, simply completing these six steps does not mean that the intent or the objective of value engineering (optimize value) has been accomplished. The laws, presidential directives, policies, et al, were not implemented to force people to simply use a specific process but rather to use the specific VE process to realize results that are only achieved when this process is used and used effectively.

While implementing the VM Standard (six-step job plan, multidisciplinary team, qualified facilitator) will satisfy the requirement to “check the box” on compliance with requirements, it may still fail to achieve the intent to “optimize value”, if there is not an expectation for performance from the VE study. Development of this performance criteria and communicating such to the VE teams will enhance the value engineering results received. A recent quality assurance review shows that, while there are pockets of good performance, the majority of the results are below what is necessary to demonstrate the value of the VE Program.

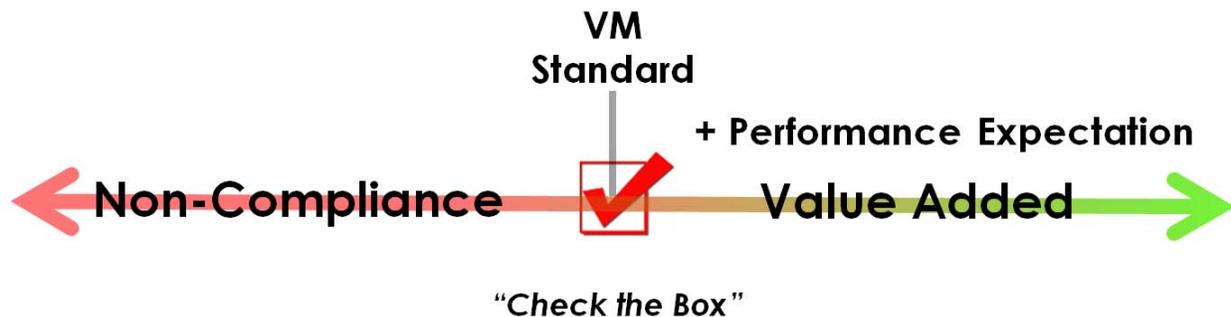
The “check the box” mentality that has developed in regard to the VE requirements has led to a decline in performance which has directly affected the value improvement opportunities resulting from these studies. This is illustrated in the influence diagram shown in Figure 2. If the project manager has a “check the box” attitude toward VE because they do not expect any valuable results, then they will establish a budget that minimizes their expenditure of project funds on this effort. The minimal budget affects the scope of the VE study specifically as it relates to the duration of the workshop, number of disciplines or subject matter experts on the multidisciplinary team, and the level of expertise of these individuals, including the expertise of the team leader (facilitator). These three scope factors largely affect the study outcomes. Then, if the study does not produce value adding results, the project manager’s decision to minimize project expenditures on this VE effort is validated in this self-fulfilling prophecy.

Figure 2



The negative impact on this influence diagram has been a significant contributor to the less than desirable outcomes of VE studies. To reverse this negative spiral, it is essential to focus the VE efforts on achieving its original intent of adding value through better outcomes. To do so requires moving beyond the “check the box” mentality by adding a performance expectation to the VE efforts. This concept is demonstrated graphically in Figure 3.

Figure 3



To “raise the bar” on the quality of VE being performed within the industry as a whole, it is critical that we clearly define expectations for performance and then hold those performing the VE study accountable.

### *Expectations of a Value Engineering Workshop*

- The VE team is appropriately configured for the size and complexity of the project:
  - The VE team is comprised of multiple disciplines and subject matter experts
  - The VE team has the disciplines necessary to address all of the key aspects of the proposed design
  - The VE team has a level of expertise and experience that is at least as much as the design team and preferably greater
- The design team must be present during the Information Phase, so the VE team can ask relevant questions of them that provide clarity on:
  - What the design is doing
  - Why it was configured as proposed (design rationale)
    - Why key assumptions and constraints were established
  - The VE team questions or challenges the validity or appropriateness of key decisions, assumptions, and constraints that have influenced the design solution
- During the Function Analysis Phase:
  - An appropriate amount of time is spent analyzing the functions of the project

- Functions are identified that create greater clarity among the VE team on the purpose and objectives of the project
  - The functions generated stimulate the VE team's creativity
  - The functions are unique and meaningful
- The Creative Phase results in a relatively large number of ideas through unconstrained brainstorming:
  - Function analysis is used as the basis for generating ideas during the Creative Phase (i.e. brainstorm on functions and not on systems)
  - Generate ideas that bring new ideas and solutions to the design team
  - Generate ideas that challenge assumptions, constraints, decisions, and the status quo
- The Evaluation Phase is conducted to selectively choose the best ideas to be developed into Value Alternatives to the proposed solution:
  - Techniques should encourage VE team consensus without being unduly influenced by stronger personalities on the team
  - The VE team should strive to select at least some ideas that bring new ideas and solutions to the design team
  - The VE team should strive to select at least some ideas that challenge assumptions, constraints, decisions, and the status quo
- The Development Phase should:
  - Provide adequate documentation of the Value Alternative to facilitate the decision making process by the design team and other Stakeholders
    - Clearly explain the context/rationale behind the idea; explain why the alternative is being offered; explain where the alternative is coming from; explain why the alternative is even a good idea
    - Clearly narrates the proposed change
    - Performs a comparative analysis between the original concept and the proposed alternative
    - Provides sketches that clearly communicate the proposed change
    - Provides calculations to support the feasibility of the change (when necessary)
    - Provides a cost comparison between the original concept and the proposed alternative as well as life cycle cost analysis
- The Presentation Phase should:
  - Engage the expertise on the VE team
  - Communicate the findings succinctly and effectively
  - Use professional, courteous, and respectful communication skills

- Avoid debating the merits of a Value Alternative since the audience has not had the benefit of reviewing the VE team's work

## **How does someone substantiate "IT" was accomplished properly?**

*"If you can't measure it, you can't manage it." – Peter Drucker*

Substantiate<sup>1</sup> is defined as to provide evidence to support or prove the truth of. To substantiate value engineering was properly accomplished the results of the VE effort must be measured. It is not the intent of this paper to specifically identify the performance criteria and grading scale to be used in evaluating a value engineering effort. The objective of this section of the paper is to broadly layout the functions that must be accomplished to make the statement that "IT" has been performed properly. To reach the conclusion that VE was accomplished, several key functions of the FAST diagram presented earlier need to be further examined. These key functions are most clearly stated in the three distinct function-logic paths which are expand solution-set, understand objectives, and supplement knowledgebase.

### ***Understand Objective***

To substantiate that the project objective has been understood within a VE effort, knowledge must be extracted and functions must be analyzed. Knowledge is extracted in a variety of ways including relevant, project-specific communication between the VE team and the design team. Critical project information will be uncovered when these two groups are forced to interact. These project-specific conversations catalyze or accelerate the discussion and result in the stimulation of thoughts. These thoughts often result in VE alternatives.

The second, and more important, answer to how objective are understood is the analysis of functions. The goal of function analysis to identify what must be accomplished as opposed to how it is accomplished. If a VE team understands what a project must accomplish, then alternative solutions can be brainstormed to satisfy those objectives. Without an understanding of exactly what a project needs to be successful, the VE process will not be able to develop alternatives to make it better.

The following questions need to be answered to substantiate the project objectives were understood within the VE effort:

- Was project-specific knowledge shared between the design team and the VE team?
- Does the function analysis communicate a clear understanding of the project?
- Are the functions appropriately descriptive to stimulate creative thinking?
- Do the functions accurately describe what the project must do, not how it is doing it?

## ***Expand Solution-Set***

To substantiate that the solution-set has been expended, project criteria and constraints must be challenged. The status quo and the old adage of “this is how we’ve always done things” needs to be called into question. The assumptions and design decisions need to be put under a microscope and fully examined to see if there is anything that is not absolutely required. Any of these elements that did not stand up to the additional scrutiny should directly result in VE alternatives. The following questions need to be answered to substantiate the solution-set was expanded:

- Did the VE effort contest the project development criteria?
- Were the project constraints and restrictions examined and deemed valid?
- Did the VE effort challenge the status quo?
- Did the VE effort attack the “we’ve always done it this way” mind-set?
- Were the project assumptions tested and validated?
- Have design decisions been challenged?
- Did the VE effort endorse the design solution being examined?

## ***Supplement Knowledge-Base***

To substantiate that the knowledge-base has been supplemented, a couple of key components must be satisfied. There must be an infusion of expertise into the VE effort. This implies the use of highly trained experts with extensive relevant experience as opposed to common or junior level practitioners within the field. Most commonly, this is accomplished by including top-notch subject matter experts from outside of the design team. In addition to infusing expertise, the VE effort must also expand the knowledge of the element under examination. This implies that wide and diverse understanding of other project types and concepts are included within the VE team composition. The following questions need to be answered to substantiate the knowledge-base was supplemented:

- Did the VE team represent independent thinking from the design team?
- Was the VE team comprised of experts and not just practitioners in the field of study?
- Did the VE team composition broaden the base of knowledge?
- Did the VE team composition bring in a new set of experiences?
- Was the VE team well versed in different types of projects with different types of solutions?

## **Conclusion**

The VE industry continues to face obstacles to moving from a mandated environment (negative perspective) to a true value-oriented culture (positive perspective) through enhanced performance from the VE Program. These obstacles stem from a “check the box” mentality that leads to poor performance and limited results. When VE is seen to waste more time and money than it saves, the industry will continue to be relegated to the mandated environment and only accomplished in the least painless and lowest cost manner. The opposite end of the spectrum is a value-oriented culture where project teams and owners go out of their way to incorporate VE into every project,

process, and system possible, regardless of mandate. To reach this value-oriented culture, the performance of VE and value practitioners needs to improve. A successful VE study needs to understand the objectives, expand the solution set, and supplement the knowledgebase. There needs to be real and measurable accountability applied to the execution of VE. Overall, the entire VE industry needs to raise the bar and the expectations we have for ourselves. If we do, then people may actually seek out VE instead of running from it.

<sup>1</sup>Definitions provided from Google website ([www.google.com](http://www.google.com))

## ***About SVS***

Strategic Value Solutions, Inc. (SVS) is a value consulting firm dedicated to providing value improvement services such as value engineering, value analysis, value planning, value management, constructability reviews, and related services. SVS brings over 25 years of experience in the value engineering industry to our clients. In that time, we have built a national reputation for delivering high quality, value-added results that consistently exceed the industry norms but more importantly exceed our clients' expectations. Our clients continually look to us for value engineering program guidance, for expertise on large and complex projects, and when exceptional communications skills and tact are required.

## ***About the Presenter***



Kyle Schafersman, PE, CVS is a VE Team Leader and Project Manager for Strategic Value Solutions with over 12 years of experience. He is a professional engineer and CVS. Kyle has facilitated over 170 value engineering studies relating to all aspects of construction and design, including over 50 transportation-specific VE studies. He was honored by SAVE International as the 2008 recipient of the Rising Star Award "for enthusiasm and embracing of the Value Methodology and demonstration of VM accomplishments within the past five years." Kyle is currently serving as the Chapter President for the MO-KAN-DO Chapter of SAVE International.

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