APPLYING VALUE ANALYSIS TO A VALUE ENGINEERING PROGRAM

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Ken L. Smith, PE, CVS
Value Engineering Manager
Washington State Department of Transportation

ABSTRACT

The Washington State Department of Transportation (WSDOT) has been performing value engineering studies on transportation projects since 1984. Our fifteen years of experience with value engineering has seen large variations in the success of the value engineering program. The variations of this program make it an ideal target for process improvement.

What better way to prove the value of a process than taking that process and applying it to the program that governs it? This paper documents how a simple seven-point value analysis job plan (Investigation, Speculation, Evaluation, Development, Presentation, Implementation, and Audit) was applied to the WSDOT value engineering program.

In less than one year, this exercise has helped yield our organization nearly 1.5 times more savings than the total from the entire previous history of the program. It is highly recommended that any organization with a formal value engineering program duplicate this exercise in an effort to achieve similar results within their own program.

INTRODUCTION

This paper was written to remind value practitioners and value engineering managers of large organizations that there is always room for improvement, even in value engineering or value analysis programs.

Value Engineering (VE) or Value Analysis (VA) has withstood the test of time and has proven worldwide that it not just the “flavor of the year.” We have all seen many management techniques come and go, but value engineering continues to improve and grow. As with any process it requires maintenance to survive.

The Washington State Department of Transportation's (WSDOT) value engineering program has had its share of ups and downs. One would hope that others will learn from the successes and failures that we have experienced in our program, which are discussed in this paper.

Value Engineering in Government

As with any large organization, striving for excellence must include doing more with less. Value engineering is a tool that helps us accomplish this goal.

Many companies gauge the success of their value engineering program by the dollars saved. In the private sector, dollars saved equate to profits realized. In government we prefer to refer to our successes as cost avoidance. Most of the transportation projects that we perform value engineering studies on are not funded until after the design is complete. The cost avoidance on these projects allows us to program more projects for the same precious tax dollars, thus moving us closer to our goal of doing more with less.

Total Quality Management and Value Engineering

In late 1995, WSDOT began a quality movement. We trained all of our managers and employees in Total Quality Management (TQM). As we began implementing process improvements and using interdisciplinary teams and tools from TQM, we realized that we were missing out by not continuing the value engineering program.

Theory

It is this author's theory that the reason the value engineering program experienced variation was due to its mismanagement, lack of continuous value engineering training, improper selection of team members, improper use and development of final value engineering reports, and inappropriate timing of the studies performed. This paper will reveal the facts and findings to support this theory. It will also unveil what we did to revive the value engineering program to produce record years in the implementation of value engineering recommendations.

History

WSDOT has over 7,000 employees and an operation budget of over $3 billion per biennium. We have been performing value engineering studies on transportation projects since 1984. Each year we are required to report our progress at the end of the fiscal year (October) to the Federal Highway Administration (FHWA). The historical facts presented in this paper are a summary of these annual reports.

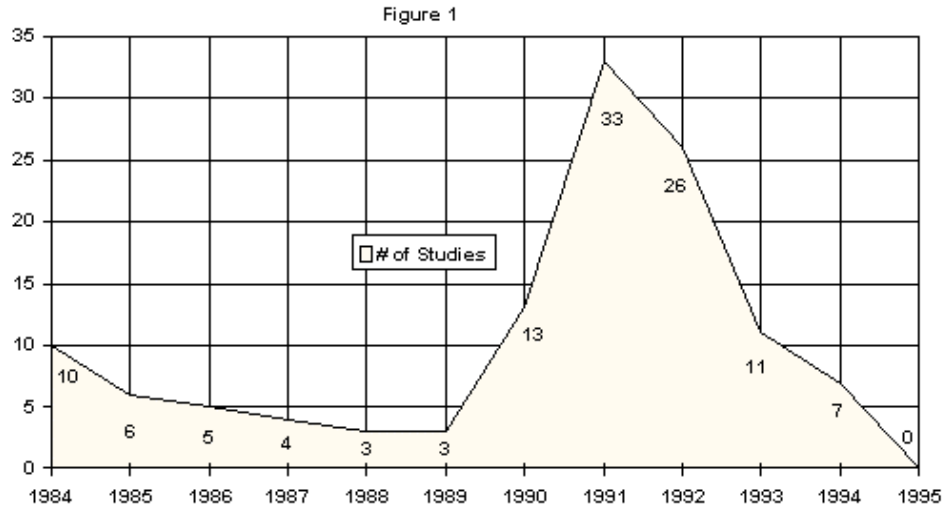
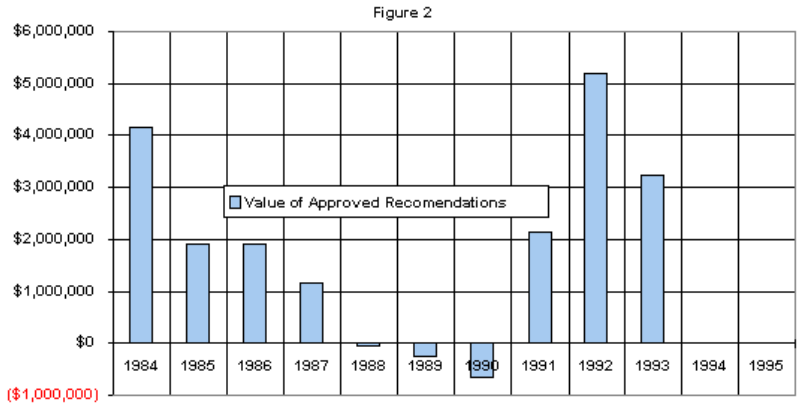


Figure 1 illustrates a steady increase in the number of studies performed from 1989 to 1991, with 33 studies in 1991. It then began a rapid decline to 1995 when no studies was performed. During this eleven-year period (1984-1995), 121 VE studies were performed.



The value of approved recommendations is a net value. It includes the cost of the studies and training. Figure 2 illustrates that the cost avoidance we realized from these 121 studies was just over $15.6 million. That was less than an average of 3 percent of the original projects costs. As you can see from the graph, the cost of the studies and training actually exceeded the value of the recommendations implemented, resulting in a net loss for the program from 1988 to 1990.

RESEARCH

Methodology

The objective of my research was to gather facts on why our value engineering program is not as successful as it should be. I was also looking for improvement opportunities and what could be done to prevent future breakdowns in our program. I began the process of

applying the proven value engineering job plan to our value engineering program. The job plan I followed was: Investigation phase, Speculation phase, Evaluation phase, Development phase, Presentation (Awareness) phase, Implementation phase, and Audit phase.

INVESTIGATION PHASE

I began my research by asking the questions of what caused the decline in the number of value engineering studies and why were the implementation rates low? I gathered input from our customers, team leaders, team members, design teams, managers, and other state departments of transportation with successful value engineering programs. I also requested advice from a certified value specialist. I then took this information and began reading every value engineering publication I could get my hands on. As I continued my research, I found that most our problem areas had already been addressed in papers published in the SAVE proceedings; specifically in a series of papers by Theodore Fowler, CVS, published from 1994-1997. The knowledge gained from these proceedings clearly showed that our program was doing all of the right things wrong.

Customer Feedback

The state of Washington is divided into six different geographical regions. The information I gathered from these regions varied in degrees of support and non-support. It became obvious that I could categorize the feedback into five functional elements. I will refer to these functions throughout the rest of this paper in each phase of the previously described job plan.

- Management support
- Trained teams
- Team composition
- Final reports
- Timing of studies

Management Support

We have always had excellent executive management support for value engineering. In 1995, executive management hired a certified value specialist consultant to develop a value engineering policy to provide guidance to the regions on the intent and proper use of value engineering in the department. Unfortunately, as of October 1996 this policy was not distributed to the regions for implementation. In the late 1980s, a value engineering policy directive was implemented without the process ownership of the regions. This directive met with a great deal of resistance, which explains some of the variation shown in figures 1 and 2.

Since 1994, the department has had five different value engineering program managers. The assignment of value engineering manager was rotated around to employees within the Headquarters Design Office. These employees already had full time positions, and

were unable to give the amount of time commitment required to support a program of this magnitude. This explains, in part, why the 1995 policy was not implemented.

The major hurdle of management support was at the low- to mid-management levels. As I was gathering information from these managers, I was hearing statements like: "Our design team already performs internal value engineering on every project we work on." "I have an excellent design team, why do I need a group of so called experts to come along and in one week try to tell me what we have done wrong when my experts have worked the project for months." "We don't need a value engineering study, we have a very competent plans review process." "Every value engineering study we have performed has either ended up costing more or caused us to delay the advertisement date."

Trained Teams

The teams were sometimes made up of whoever was available, instead of using proper experts and team members trained in value engineering. Experts who had VE training were overused at first and these valuable team members reached burn out from carrying full time jobs while serving on multiple teams. Due to lack of VE expertise, functional analysis was not always used to its potential.

A database of trained employees exists. The database is sorted by discipline and geographic location. No updates to the database have taken place in the last several years. Some of the employees in the database have retired or moved on and are no longer available. Several of the trained employees have promoted into the management ranks and are not available for value engineering studies. The database is in obsolete software that is no longer accessible given the level playing field software that we use today.

Most of the employees trained as team leaders have not lead a team for several years or are no longer available to lead teams. No employees of the department are certified value specialists. We have an on-call consultant agreement contract to use certified value specialists for team leaders.

Comments from the regions and specialty groups consisted of: "I can not meet my schedules if my best employee is off at some value engineering study." "For every week that I have one of my employees at a value engineering study, I need to bring a consultant on board to cover the workload for that week." "I have already paid my dues on value engineering studies. I am not interested in donating any more of my time on someone else's project."

Team Composition

There is a gentlemen's agreement between the department and our local agencies (cities counties, and other agencies) that we will donate expertise to their studies and they will participate on ours.

We would go out of our way to assemble teams of people who were not involved in the project in any way. The project engineer and design team members familiar with the project were not allowed to participate on the value engineering team.

Final Reports

The team members did not have ownership of the final report. It was often written by the team leader without the consensus of the team. The final report would often be delivered several weeks after the study. In one case, the final report was not transmitted until nearly one year after the study. Late reports have often hindered the implementation of recommendations.

Timing of Studies

Studies were often performed very late in the design/plans preparation stage. Design teams were reluctant to implement recommendations due to potential setbacks and the possibility of missing promised advertisement dates. The cost of redesign would often offset the cost avoidance of implementing the recommendation. By performing a value engineering study past the 30 percent design stage, the value engineering team was faced with so many constraints already set by agreements that it limited the value engineering team's ability to achieve any breakthrough recommendations.

Lessons Learned from Others

The WSDOT historical findings were very consistent with what Mr. Fowler stated in his first paper of the series, *Forward to the Basics: Create-By-Function*, published in the SAVE proceedings in 1994. "Any problem-solving system will identify 5%-10% in potential cost savings. Those that have not been trained to expect more from VA are often satisfied with such pathetic, or at most prosaic results. A properly operated VA study will typically identify and implement changes worth 25% to 35% in potential cost savings." These are very strong words, but in a nutshell they describe the WSDOT value engineering program average from 1984 to 1995.

Mr. Fowler's second article of the series, published in the SAVE 1995 proceedings, titled *Don't Second Guess the Designer*, set some team rules that state: Team members whould include people whose present responsibilities include the project under study. One team member, most commonly the project engineer, must be the key person.

Mr. Fowler's fourth article of the series, published in the SAVE International Conference proceedings of 1997, titled *Have the Team Write the Report*, states that the team of experts should be responsible for writing the report and presenting the findings.

Figure 3

F.A.S.T Diagram

WSDOT Value Engineering Program

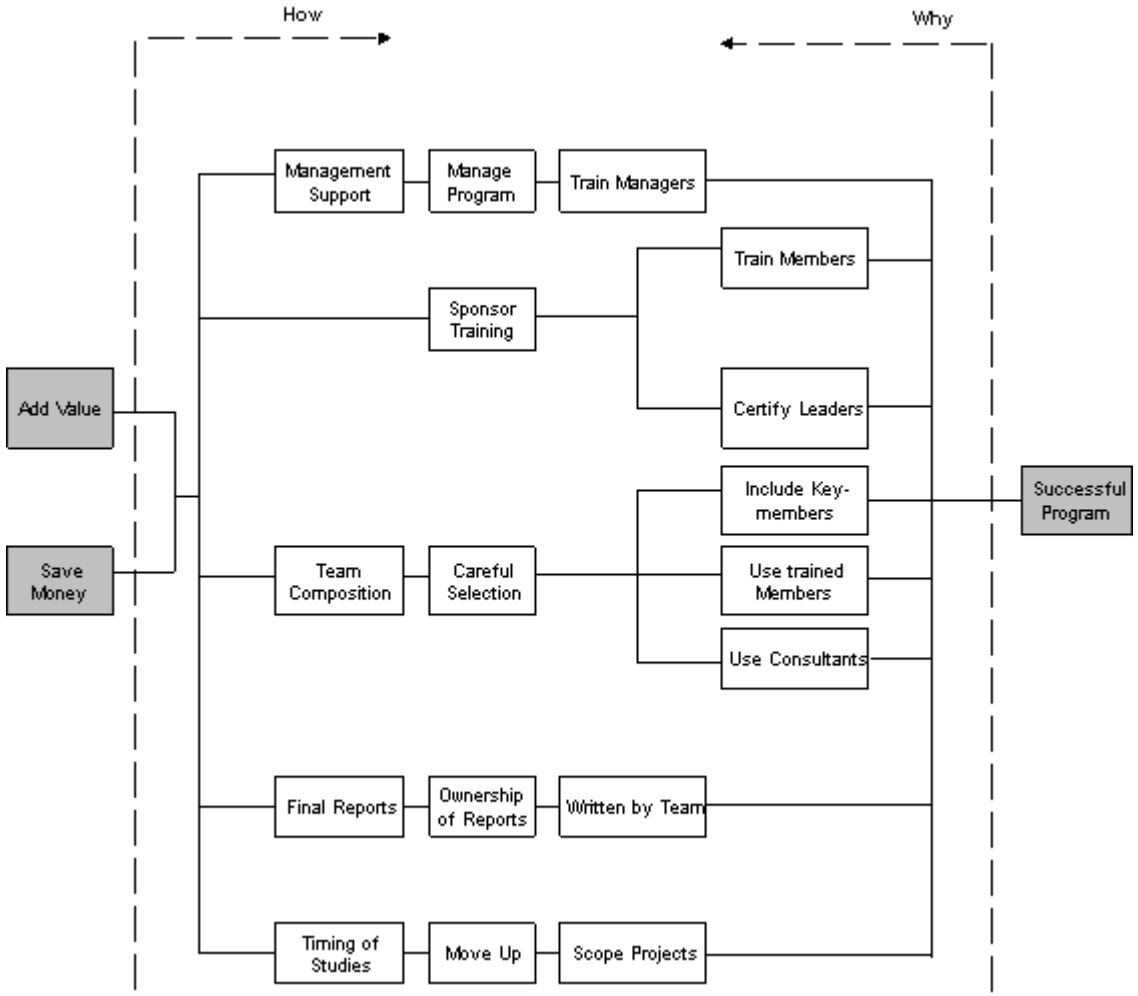


Figure 3 uses the Functional Analysis System Technique (FAST) to diagram the functions identified during the investigation phase. This diagram is the functional analysis of how the program should work. When you read this diagram from left to right, it describes *how* the functions should perform. As you read the diagram from right to left, it describes *why* the functions perform.

SPECULATION PHASE

Management Support

- Implement 1995 policy
- Stabilize the value engineering manager position

- Educate mid-managers on the benefits of performing value engineering studies
- Have executive management mandate mid-manager use of value engineering

Trained Teams

- Sponsor training classes for team members
- Sponsor training classes for team leaders
- Invite local agencies to training

Team Composition

- Use trained team members
- Include design team members on studies
- Require project engineer on study
- Use consultants on teams

Final Reports

- Have team write the report
- Give the completed final report to owners on the last day of the study following the presentation

Timing of Studies

- Move studies earlier in the design process
- Use the value engineering team to scope the project.

EVALUATION PHASE

Idea	Advantages	Disadvantages
Management Support		
Implement 1995 policy	• Will provide guidance to the regions • Describes program • Raises awareness	• May meet with resistance if not presented correctly
Stabilize the value engineering manager position.	• Consistent support of program	
Educate mid-managers on the benefits of performing value engineering studies.	• Get understanding of benefits	• Time consuming to travel to each region
~~Have executive management mandate mid manager use value engineering~~	• Will boost program	• Will cause unnecessary resentment to program

Trained Teams		
Sponsor training classes for team members	• Provide larger pool of team members to choose from	• cost
Sponsor training classes for team leaders	• Provide larger pool of team members to choose from	• cost
Invite local agencies to training	• Provide larger pool of team members to choose from	• Cost
Team Composition		
Use trained team members	• Better results from studies	• Need to train more members
Include design team members on studies	• Will increase the implementation rate of recommendations	• May stifle the creative process of the team
Require project engineer on study	• Will increase the implementation rate of recommendations	• May stifle the creative process of the team
Use consultants on teams	• Provide larger pool of team members to choose from	• Cost
Final Reports		
Have team write the report	• Accurate report with team consensus	
Give the completed final report to owners on the last day of the study after presentation	• Immediate documentation for evaluation by the design team	• Will require technical writer on team to input results as they are developing
Timing of Studies		
Move studies earlier in the design process	• Higher rate of implementation • Less constraint on the team	• Less information for the team to evaluate
Use the Value Engineering team to scope the project	• Eliminate re-design • Better starting point for design team to work from • Will accelerate project through development	• Little or no information for the team to start with • Nothing to compare cost to measure VE program success

Table 1

DEVELOPMENT PHASE

The following are recommendations to improve the Value Engineering program.

Management Support
- Begin implementation of the 1995 value engineering policy by sending a draft out to the region project development engineers. Incorporate their comments and adopt their policy at the statewide project development engineers meeting.
- Create a value engineering manager position at the appropriate management level to attract and retain a competent manager.
- Present the value engineering principles and educate project development engineer and their assistants at the statewide project development engineers meeting.

Trained Teams
- Step up a number of team member training classes available through the University of Washington's Transpeed program and encourage local agencies to attend.
- Provide a SAVE module 1 training class for at least sixteen new team leaders to begin the certification process.

Team Composition
- Create five- to six-member teams from trained experts with the proper disciplines. Include the project engineer.
- Develop an on-call consultant contract to use as required to create expert teams.

Final Reports
- Have the team, not just the team leader, write the final report and hand it over to the project owners at the completion of the presentation.

Timing of Studies
- With the coordination of the region value engineering coordinator, schedule studies prior to the 30 percent project development stage.
- Develop a pilot program to test and evaluate performing value engineering to scope projects.

PRESENTATION PHASE

Management Support
Once a year all of the project development engineers and their assistants meet in one central location for a conference. These are the managers that have the ultimate say of what projects require a value engineering study. I used this forum to pitch the advantages of value engineering. We also had a work session at this conference to finalize and incorporate the final comments to the draft policy that they had been reviewing. We adopted the policy at the end of this session. This gave them ownership in the policy.

In the summer of 1997, a presentation was made on the recent success of value engineering to our transportation commission and the executive management.

The top ten success stories of value engineering were placed on our Internet home page.

Trained Teams
Training classes were advertised on our automated training matrix system for employees and local agencies.

Team Composition
The importance of team composition has been included in every presentation and support calls to or from the value engineering manager.

It is also included in the adopted value engineering policy.

Final Reports
Presented as an objective for the team at the beginning of each study.

Timing of Studies
The importance of timing of the study has been included in every presentation and support calls to or from the value engineering manager.

IMPLEMENTATION PHASE

Management Support
Begin October 1996 and continuous support will be required.

Trained Teams
Beginning the fall of 1996 and offering team member training classes every six months for two years and once a year there after.

Team Composition
Beginning the fall of 1996 and continuing for each study thereafter.

Final Reports
Winter of 1996-1997 and continuous support will be required.

Timing of Studies
Winter of 1996-1997 and continuous support will be required.

AUDIT PHASE

Management Support
All of the recommendations were accepted and implemented as planned.

Trained Teams
Over 100 potential team members, both internal and external, have been trained. Additional team member classes have been set up in the system at approximately six month intervals. Fifty employees and potential team leaders have completed the SAVE module one workshop and two have completed module two. We currently have ten to twelve employees actively pursuing a certification in value engineering.

Team Composition
This has been the breakthrough in the program. Since we have implemented the recommendations we have enjoyed an enormous success in our program. Our completed studies are running with a better than 80 percent recommendations implementation rate. Our cost avoidance has jumped up to 20-30 percent of the original construction costs.

Final Reports
A computer program has been developed that helps the team complete the report and turn it over to the owners at the presentation. A technical writer has been included on the study team to help with this task. The teams have taken ownership of the report and have had their edits and comments included as the study progresses. This has been very successful for teams led by internal employees. The teams led by consultants have a five to ten day delay in delivering the final report.

Timing of Studies
The majority of our studies have been moved up earlier in the project development process. The regions are preparing schedules of projects that are proposed or are in the pipeline to help with the scheduling of studies. The pilot program for planning studies has been a success.

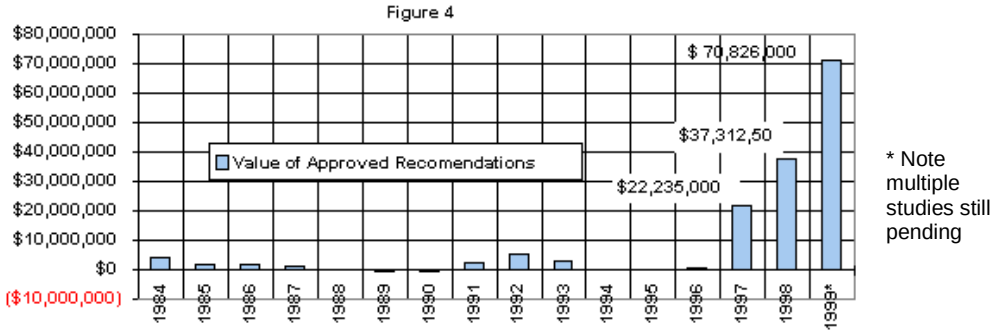


Figure 4 illustrates the dramatic improvement in the value engineering program. Since this analysis was performed, the department has implemented over 80 percent of the

recommendations made by value engineering teams and has enjoyed over $60.4 million in cost avoidance to transportation projects. One of the projects studied won the Association of American State Highway and Transportation Officials (AASHTO) value engineering award in 1997.

CONCLUSION

The exercise of applying value analysis to a value engineering program proves that the process is not just for projects. Value analysis can be applied to any process, program, or project. As long as the job plan is followed and you continue to ask the how and why of functional analysis, the potential for improvement is high.

With all of the recommendations implemented, we have realized an enormous improvement in our program. The department has implemented over 80 percent of the recommendations made, for a net cost avoidance of over $60.4 million.

The major breakthroughs for our success this year have come from the use of trained and certified team leaders, and from using well-trained key team members.

Several of the recommendations included in this paper require continuous support from customers and suppliers from all levels of the program. Without this continuous support, the program can easily slip back to its old ways.

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