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**Value Engineering: A Comparison of Government and
Automotive Application Techniques**

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ABSTRACT

Value Engineering (VE) is an organized effort directed at analyzing the function of a product, service, or process to achieve the lowest total cost of effective ownership while meeting the customer's needs. A comparison as to how VE is applied and to what extent is made between the automotive industry and the Government using the Program Executive Office Ground Combat Systems (PEO GCS) as a standard. Both the automotive industry and the Government use common VE techniques to conduct VE studies. Both use VE to manage functionality to yield value to the customer. Neither the Government nor the automotive industry sacrifices the quality of the product or its reliability in the name of cost. Both the auto industry and the PEO employ a systematic team approach to analyze and improve the value of a product, facility design, system, or service. Applying systems engineering principles helps ensure successful execution of the PEO GCS VE program. The auto industry uses VE more widely and more successfully because of the cultural acceptance of VE, the wide-spread application of its principles, and the motivation to be profitable and survive. Formalizing and integrating the PEO's VE process helps the organization meet its program and budget objectives in the current austere economic environment.

INTRODUCTION

Shrinking government budgets and the reduction in hostilities in the Middle East have created additional challenges for PEO GCS in the judicious use of funding for ground combat vehicle programs. VE offers an organized discipline directed at analyzing the function of a product, service, or process to achieve the lowest total cost of effective ownership while meeting the customer's requirements. This paper compares the application of VE within the auto companies to the Government's program executive offices. The surrogates used for the comparison are Ford/Mazda and PEO GCS and training received from the Society of American Value Engineering and the Defense Acquisition University.

In 1996 Congress passed the Defense Authorization Act which mandated, "Each executive agency shall establish and maintain cost-effective value engineering procedures and processes." [1, 2, 3, 6] PEO GCS established a high-level VE standard operating procedure (SOP) to document

a systematic process flow that governs activities at the project management office (PMO) level. PEO GCS uses its Systems Engineering and Integration Office (SEIO) infrastructure to facilitate VE activities. PEO GCS also leverages outside resources to enhance PEO GCS support of VE projects and documentation of cost saving/avoidance results. The Army Materiel Command (AMC) and the Program Executive Office for Simulation, Training, and Instrumentation (PEO STRI) play a role in the successful execution of the VE program.

PEO GCS' core mission is managing the life cycle of integrated acquisition, technology, and logistics efforts for ground combat systems. PEO GCS operates as a cost center. PEO GCS leadership plays a vital part by providing strategic objectives and annual VE cost reduction targets to drive VE program success. By operating as a cost center, certain cultural and financial barriers exist when developing and implementing VE studies. Some members of the PEO management team view VE as a task that takes away from important management duties and responsibilities.

PEO GCS draws upon several techniques to overcome barriers including: creating a positive climate for change with more upper management emphasis on VE, making the job a team effort, respecting and effectively using the chain of command, installing processes and procedures, and identifying and empowering key personnel to support and guide the VE effort. PEO GCS's objectives focus on increasing the value function through reducing the cost of the product or service.

PEO VE CHALLENGES

Cultural Acceptance

A cost center manager's natural tendency is to concentrate on accomplishing the tasks at hand rather than budget conservation irrespective of the industry. VE is viewed as an additional task that has little to do with managing an organization. The PEO is providing additional employee exposure to and training for VE. Defense Acquisition University, which is an education arm for the PEO, offers on-line training support. For the PEO VE is driven through management emphasis on strategic objectives and cost savings/avoidance targets, similar to most cost centers.

Continuity

The PEO addresses the value proposition by concentrating on cost reductions, mostly in the form of cost avoidance. The use of an integrated life cycle management system helps reduce the stove-piped approach to product development and release; however, there are still barriers as a product is handed from one organization to another as it goes through the development and production cycle. Different type of VE may occur during the various development phases but common information repositories do not exist to facilitate VE actions and continuity.

VE Resources

Many critical resources used to promote the VE process exist outside of PEO GCS. Timing for workshops and in-depth, organizationally aligned project support are inhibited because of conflicting organizational objectives. The external centers of excellence have a tendency to reduce the PEO's feeling of VE process ownership but PEO GCS creates greater resource leverage by using PEO STRI and AMC assets.

In contrast, an auto company minimizes external leveraging and aligns strategic objectives across its organization. An auto company harmonizes its organizational resources for studying, developing and implementing for VE projects.

Staff groups such as those supporting VE initiatives are usually the first to go during economic downturns. Although the PEO does have the same concerns for

profitability and survivability as the auto industry, it may be faced with the same drastic actions to meet impending budgetary constraints.

VE Applications

The PEO focuses on existing products and ignores other opportunities to apply VE methodologies. The PEO does not invest in indigenous skilled subject matter experts and skilled facilitators needed to conduct the workshops involved in new product VE efforts, benchmarking, and commonality. The PEO relies on trade-studies and contractor analysis to accomplish VE analysis in developing cost reduction opportunities for new products.

Contractors and Common Parts

Commonizing components and subsystems into families of products offers cost and complexity reduction opportunities. The PEO does not manufacture the products it provides to the Warfighter. The PEO deals with a diverse, usually non-collaborative supply base. Prohibiting government-orchestrated workshops without including all potential suppliers impedes commonization of components and subsystems in purchased systems. Where the auto companies can leverage their manufacturing capability and supply base to take advantage of synergies in the value stream, the PEO is hampered by an arms-length approach to the supply base and contractual terms which may not always be conducive to taking the best VE strategic approach.

ORGANIZATIONAL MISSION COMPARISON

A comparison of the two mission statements reflects the focus of each organization. Ford modified its mission statement in 2010. The Ford mission statement reflects the impact of the U.S. automotive market collapse and recovery response of the American auto makers.



Ford Motor Company Mission

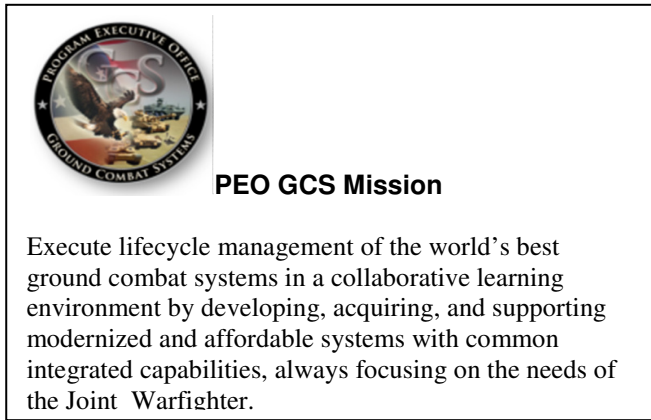
One Ford, One Team, One Goal

ONE TEAM: People working together as a lean, global enterprise for automotive leadership, as measured by: Customer, Employee, Dealer, Investor, Supplier, Union/Council, and Community Satisfaction.

ONE PLAN:

- Aggressively restructure to operate profitably at the current demand and changing model mix
- Accelerate development of new products our customers want and value
- Finance our plan and improve our balance sheet
- Work together effectively as one team [11]

ONE GOAL: An exciting viable Ford delivering profitable growth for all.



The needs of the customer or Joint Warfighter are the focus of each organization's efforts as reflected in their mission statements. The PEO is driven to meet Warfighter while achieving budget objectives as a cost center. While the PEO concentrates on modern, affordable systems, U.S. auto companies are motivated by profit and survivability to improve products and services in terms of cost, quality, speed to market, and performance. Some foreign auto makers are also motivated by political and ideological agendas.

VALUE ENGINEERING (VE) PROGRAM APPROACHES

PEO GCS' goal is to improve its ability to execute the mission smarter, faster, better, and/or at less cost on a sustained basis. The Continuous Performance Improvement (CPI) Program, which is managed by the SEIO, provides PEO GCS with a structured approach for analyzing how work is currently accomplished and how processes can be improved to do the job more efficiently and effectively. PEO GCS has documented its strategic approach for developing a culture of continuous improvement in the areas of reliability, process cycle times, costs (in terms of less total resource consumption), quality, and productivity. PEO GCS categorizes performance improvement for projects undertaken into Lean Six Sigma, Non-gated, and Value Engineering (Figure 1).

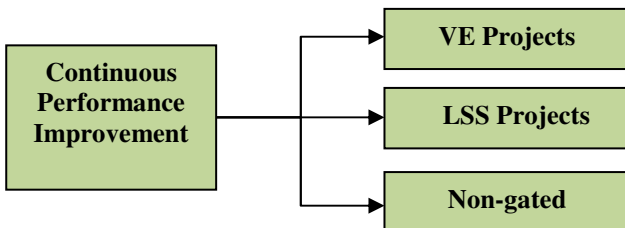


Figure 1 Project Category Breakdown for Development under Continuous Performance Improvement

Rather than having a unique structure for administration of each category the SEIO takes a synergistic approach by using common practices, human resources, and organizational structures.

Gated/Lean Six Sigma Projects

Gated/Lean Six Sigma (LSS) projects are data-driven, problem-solving studies combining value stream mapping and a statistical process improvement roadmap consisting of Define, Measure, Analyze, Improve, and Control (DMAIC) phases. A value chain analysis is conducted to on the product and the supporting process flow. This methodology is used when the solution to a problem is not readily apparent and focuses on satisfying customer requirements. Gated/LSS projects seek to minimize waste by reducing unneeded process steps and controlling variation.

Non-gated Projects

Non-Gated/Just Do It projects address a problem that has a logical solution. A team focuses on the best method for implementing a known solution, rather than determining the root cause of the problem and a solution. These projects are considered Non-Gated projects.

Value Engineering Projects

VE is an organized, systematic approach directed at analyzing the function of systems, equipment, facilities, services, and supplies for the purpose of achieving essential functions at the lowest life cycle cost consistent with required performance, reliability, quality, and safety. The implementation of the VE process on a problem typically improves the return-on-investment (ROI) by increasing performance, reliability, quality, safety, durability, effectiveness, or other desirable characteristics. One misconception is that VE is nothing more than a cost reduction usually involving trade-offs between performance and cost.

VE FOCUS

VE is used to manage functionality to yield value to the customer or Warfighter. Neither the Government nor an auto company will implement a cost reduction if it compromises quality or product reliability. Any change providing less than the performance required by the customer or user is not acceptable; any change providing more should be avoided, unless there is no cost penalty.

VE Administration

Using a function-oriented systematic team approach to identify, analyze, and improve value in a product, system or service fits well within the PEO's and an auto company's business model. An auto industry uses VE to shorten the time-to-market period. Although the Government currently emphasizes reducing product cycles for defense vehicles, the Government does not employ VE for that specific purpose.

Auto companies apply a programmatic approach to VE. The auto companies establish many different disciplines and operational areas that contribute to the VE effort. Auto companies use VE as part of the benchmarking effort to analyze competitive products' key features, functions, costs and customer appeal. Auto companies also seek commonality to take advantage of economies of scale and to reduce complexity. As with the PEO, automotive companies perform VE studies on existing products to yield better value to the customer. The automotive companies also perform VE studies for new products early in the life cycle.

For new products the environment is less certain and information gaps exist in terms of customer requirements. The auto industry invests more in skilled, proficient personnel and an organizational structure to adequately conduct full-scale VE studies. [12]

Design Related Issues

The auto industry and PEO GCS use VE to address design related issues. The PEO directs contractors to use best practices for specification adherence and project management oversight. Both the auto industry and the PEO use VE functionality, lean and six sigma principles and high quality standards to determine best practices. The best practices are translated into production through product engineering and manufacturing standards. In both cases traditional thinking and customary practices are challenged:

- Purchasing a small, fuel efficient car does not mean that the customer forgoes leading edge "infotainment systems"
- A light-weight infantry fighting vehicle does not have to be tracked.

Time pressure is different for automotive and combat vehicle production and delivery. Because of the relative sense of urgency the auto industry uses VE more than the Government to reduce the time-to-market for a product. [12] While the auto industry's new vehicle cycle is approximately 5 years, a ground combat vehicle new vehicle cycle for development and release for production is much longer. For the PEO new vehicle and product changes are more dependent on the international political climate and the current or anticipated type of military conflict. The Government resolves time-to-market issues by

allocating additional funding for the production of combat vehicles, as demonstrated with Mine Resistant Ambush Protected (MRAP) vehicles.

Maintainability is the measure of an item's ability to be kept in a specified condition or restored to a specified condition when maintenance is performed by skilled personnel, using the correct procedures and resources. Maintainability affects the total cost of ownership and is closely monitored within the auto industry and the PEO. VE is used to address maintainability both early and later in the life cycle. The PEO uses systems engineering practices to reduce risk and help control the consequence and severity of the risk to the contractor through specification requirements and maintenance contracting.

Internal Issues

The PEO applies the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System and system engineering principles to translate customer demands into specifications, meet safety and compliance requirements, and correct products with known problems. The auto industry uses the same type of phased, milestone-driven integrated system for product development, release, production and sustainment activities.

Because manufacturing is part of an auto company's core business, VE is more likely to be used to determine corrective actions for products with known problems. Auto company managers are responsible for improving profit margins while Government project managers are responsible for affordability. The PEO uses VE as part of its CPI project portfolio to meet cost reduction targets set by higher headquarters. The auto industry also employs a portfolio of cost reduction tools to meet its objectives.

Marketing Concerns

The PEO provides ground combat systems for the Department of Defense. Its mission is to satisfy the Warfighters' representatives by developing, acquiring, and supporting modernized and affordable systems with common integrated capabilities. To realize affordable systems and achieve life cycle cost objectives, the PEO must make trade-offs to ensure minimum threshold specification requirements are met or exceeded. Auto companies examine pricing strategies, whether market-based or cost-plus. Auto companies consider the impact of e-commerce on the health of auto company dealerships as they wrestle with various marketing and sales techniques in a saturated, global market. In the auto industry companies evaluate and protect a product's "appeal value," the relative worth a customer places on the product in the marketplace. Appeal value or sales potential cannot be compromised.

In today's market automotive vehicle sales require an increased emphasis on economies of scale and complexity

reductions on a global basis. As with the auto industry the PEO seeks to reduce the logistical footprint because of its far-reaching operations. Commonality is more difficult in the PEO because it has less influence on designs and component and subsystem choices. Both the PEO and the auto industry are concerned with protecting the environment, advancing new technologies and materials, and monitoring quality compliance. For an auto company high vehicle quality is a market mandate. For the PEO high vehicle quality saves lives in combat.

VE STUDY TECHNIQUES

VE uses technology selection factors to synthesize solution alternatives with the functions to determine how the alternatives will perform. The VE analyst evaluates alternative solutions and considers trade-offs. If a solution is acceptable, then it is described in terms of system elements. The elements may include human capital, equipment, facilities, technical data and computer software.

A more comprehensive, detailed approach for conducting VE studies may be found in the Society of American Value Engineers (SAVE) International Value Methodology Module I, Value Engineering Workshop and the Defense Acquisition University course entitled, “Value Engineering”. These courses highlight some fundamental approaches to performing a VE study. [8, 10]

VE Study Execution

For more complex VE studies, the auto industry and the PEO use cross-functional teams usually with core membership consisting of a trained VE team leader, a cost analyst, subject matter experts (SMEs) and key stakeholders as shown in Figure 2. Other members are added to and subtracted from the team depending on the expertise needed to adequately study the VE proposal.

Figure 2 Core Composition of VE Study Team

If the PEO sponsors a workshop, the incumbent contractor is prohibited by law from participating unless other potential contractors are invited since it would give that contractor an unfair competitive advantage. As another limitation, the PEO has access to the contractor’s technical data only if it is jointly developed or purchased.

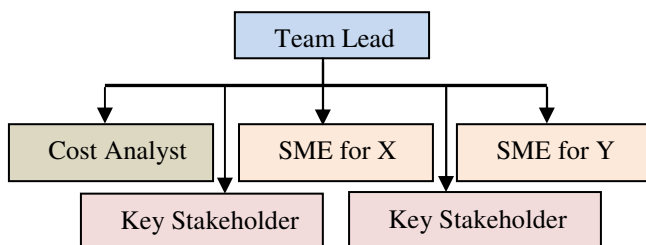
Vertical integration as seen in auto companies enhances involvement of key stakeholders in the VE study. Auto companies may include contractors in auto company-sponsored workshops and usually have unrestricted access to technical data as a common business practice.

Job Plan

Using the SAVE International Job Plan shown in Figure 3, the team applies a phased methodology to determine the most appropriate solution(s).

The five phase structured approach, combined with proven VE tools and methods, help facilitate finding solutions to problems and reducing costs while improving performance and quality. VE may be used in a wide range of areas. A few examples are as follows:

- Procurement
- Hardware
- Training
- Operations
- Software
- Logistics
- Services
- Testing
- Transportation



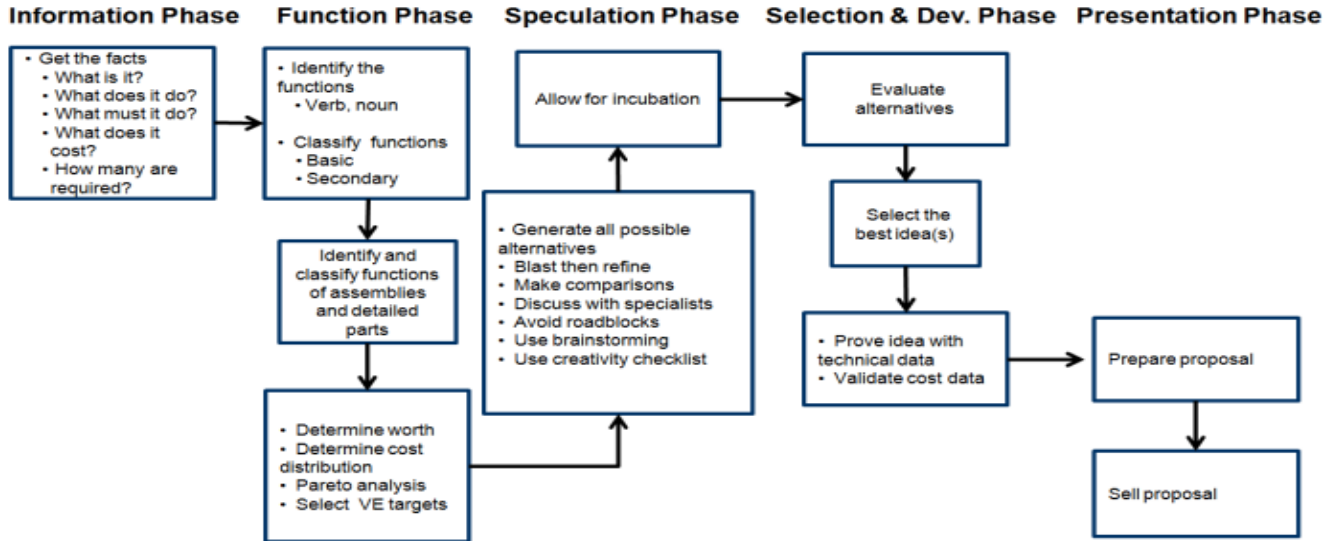
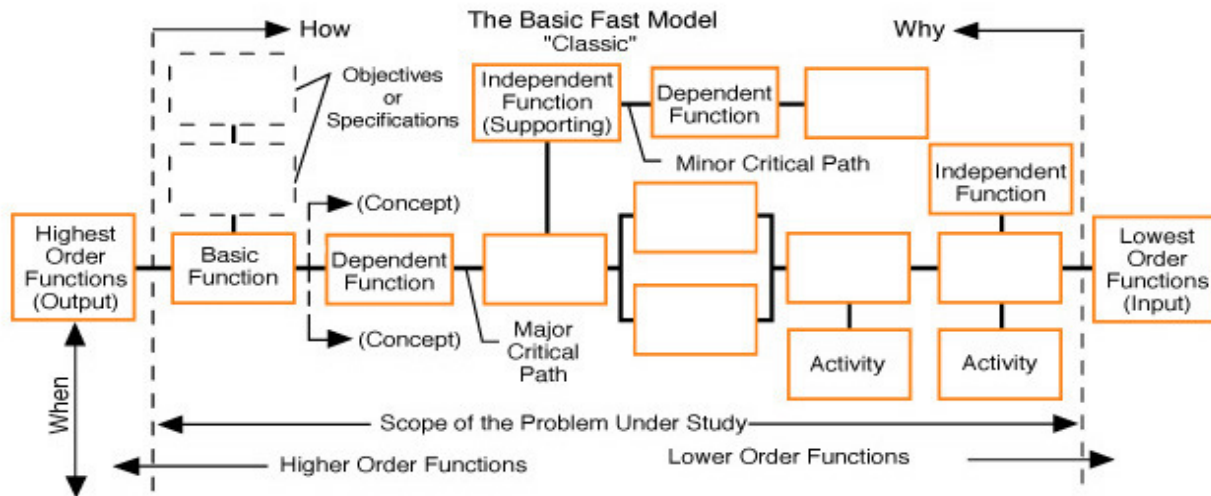


Figure 3 SAVE International Job Plan Phases and Process Steps [8, 9]

Functional Analysis System Technique (FAST)

FAST builds on value analysis by linking verb-noun functions to describe systems. An example of a basic FAST diagram is shown in Figure 4. The diagram has both a vertical and horizontal components. Participants with different skill levels use this technique to communicate the functional flow and to identify and resolve issues. A graphical display helps focus the team on the questions of HOW and WHY a function is performed and how the

functions are interdependent. As a further explanation analysis determines HOW something works while synthesis clarifies WHY something works the way it does. WHEN is the vertical component. WHEN is not time oriented, but it reflects the cause and effect of the units. IF may be substituted for WHEN to make usage clearer. An example of a basic FAST diagram is shown in Figure 4.



The fundamental tool used for defining, modeling and analyzing functions is the Function Analysis System Technique (FAST).

Figure 4 Function Analysis System Technique Diagram [8, 9, 10]

System Engineering Process

A system engineering approach gathers customer input requirements to analyze the necessary functions to meet customer needs. As a comparison the system engineering process, as seen in Figure 5, considers mission objectives, environment, and constraints to perform a functional analysis of the product, process, or service under consideration. Measures of effectiveness serve to identify progress toward the desired objective. After synthesizing

the analysis a determination is made as to whether the alternative will work. If the alternative works, the team assesses whether trade-offs are possible without sacrificing customer requirements. The final solution is reviewed to confirm that it is acceptable and translated in terms of specifications for equipment, personnel, facilities, computer software, technical data and other system elements.

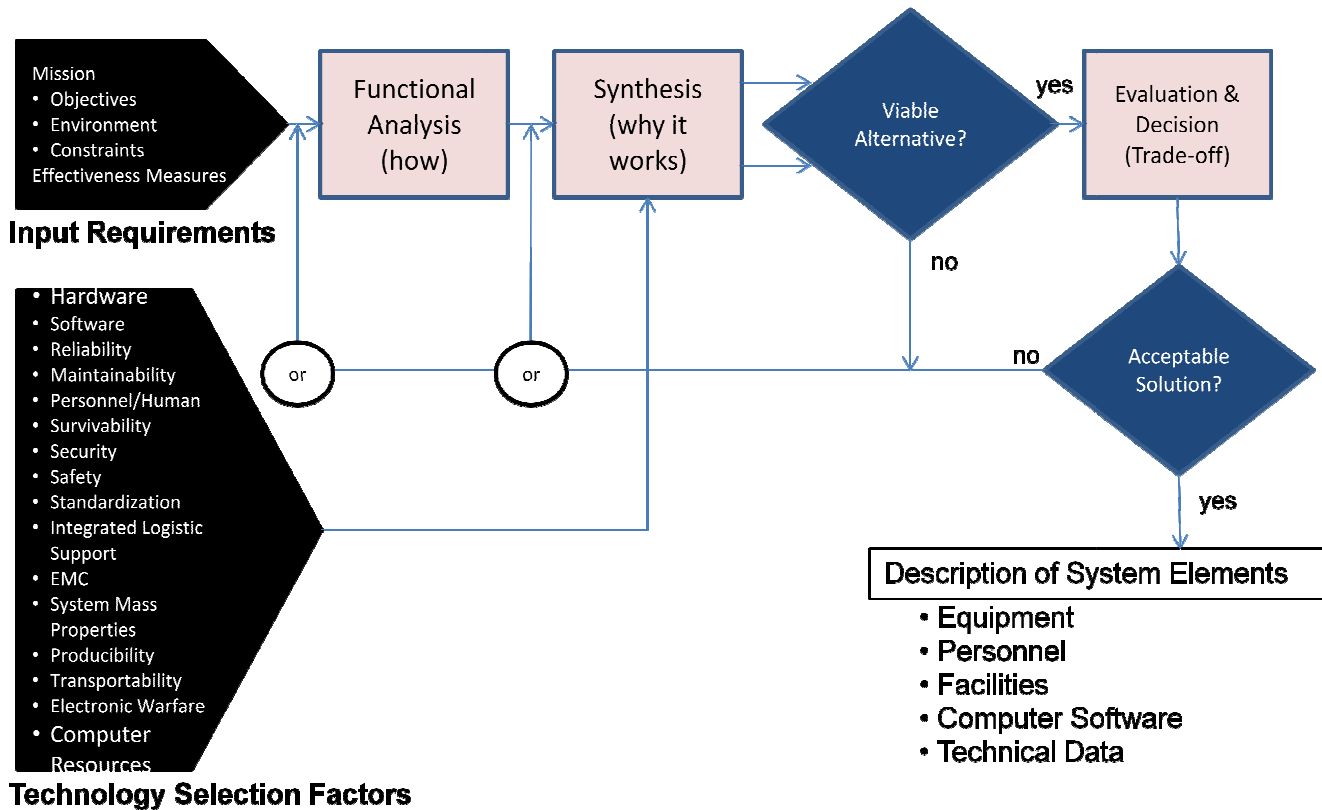


Figure 5 Systems Engineering Process for Product, Process, and Services Improvements [8, 9]

VE PROCESS

The PEO manages the VE process at a high level using an SOP and process flow diagrams (see Figure 6) with links to other systems engineering processes to guide the user. A manual workflow provides process steps and tasks to conduct a VE project study. VE project progress is tracked within the PEO and to a lesser extent through the Army Materiel Command using the Value Engineering Management System. Coordination with the TACOM Life Cycle Management Command (LCMC) VE Coordinator provides a conduit to log, monitor, and register VE project results to document the progress toward meeting the PEO’s annual VE objectives set by the TACOM. [7] Structured processes, such as a SAVE International value

methodologies, are highly recommended. The PMOs’ SOPs and work instructions provide a more detailed VE approach reflective of their respective organizations.

Similar to the PEO, the auto companies manage their VE effort at the lowest level practicable and use the same relative methods and controls. VE objectives are allocated and cascaded to the strategic business units. Managers are graded on the success of their VE programs, which are reflected in balanced scorecard measured improvements. Auto companies use cross-functional management support for VE with benchmarking functional groups and subject matter expert groups in program management, advanced engineering, logistics, finance, manufacturing and other

stakeholder groups. VE successes may go directly to the bottom line of the SBU financial statements.

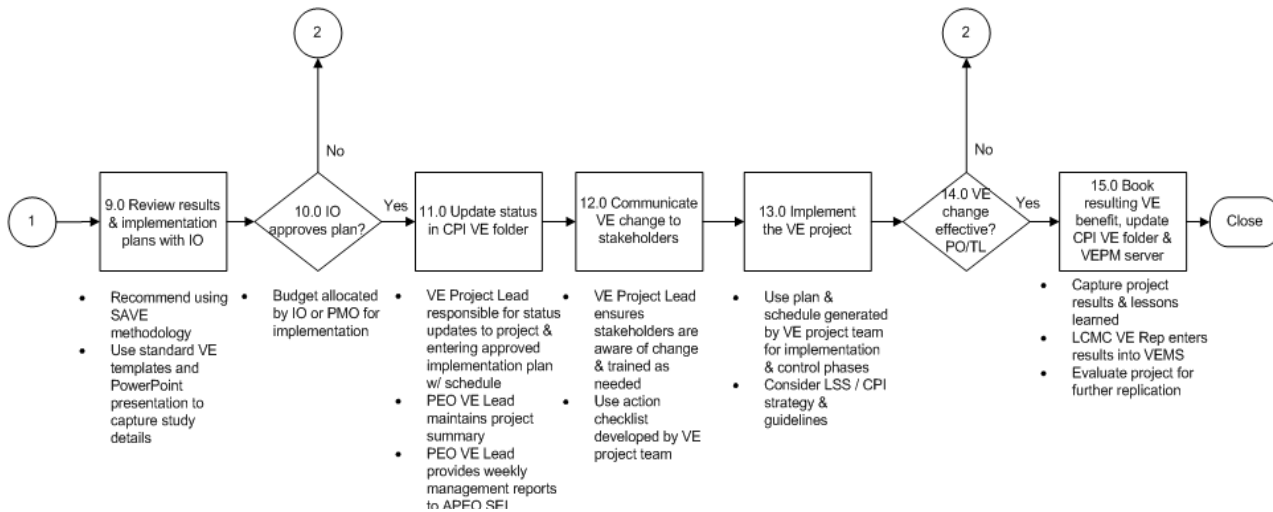
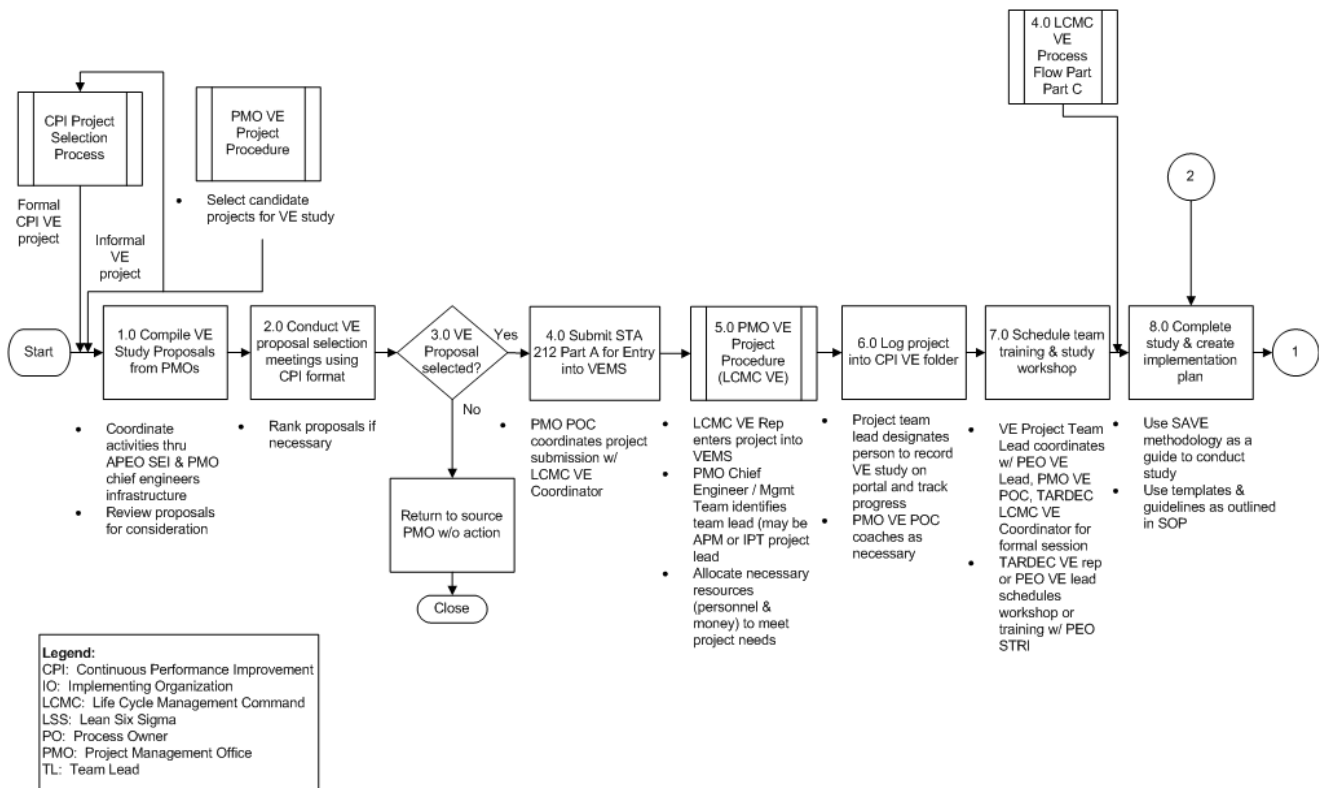


Figure 6 PEO GCS Value Engineering Workflow [13]

VE SOP

The VE SOP prescribes a workflow and methodology to develop proposals and conduct VE studies across the PMOs. The PEO conforms to Defense Authorization Act (Public Law 104-106) requirement that each executive agency must establish and maintain cost-effective value engineering procedures and processes. Using process management within the CPI process umbrella VE proposals are generated through the PEO and the PMOs using systems engineering linked processes. Proposals are generated through a project selection process. Study method recommendations are solicited from each of the PMOs. A list of the proposals is created along with descriptions of the conditions or opportunities for each proposal. Roles and responsibilities for key stakeholders in the process are identified. Communication networks are established to facilitate study workflow. [13]

VE Project Funding

In a cost center such as the PEO VE project funding is tasked from the PMOs and allocated as part of the operating budget. Management support and early VE project endorsement is a key element in the project's successful implementation. Budgeting within the PEO forecasts adequate funding to support the VE program to include project seed money, implementation costs and employee awards. Contractors usually are not included in the Government's incentive award program even though the contractors may provide the driving mechanisms for VE savings/avoidance. An auto company allocates a budget to support a VE program; often, the savings realized from the VE project implementation will fund the project. Within the automotive supply chain favored or tier-one suppliers are an integral part of the VE study for their subsystem or component and may either partially or totally fund VE projects.

CONTRACTOR VALUE ENGINEERING CHANGE PROPOSALS (VECP)

VECPs are proposals submitted to the Government by the contractor which may provide an overall cost savings or some other benefit to the Government. Guidance for developing VECPs is found in the VE Incentive (VEI) clause in the Federal Acquisition Regulation (FAR). FAR Parts 48 and 52.248 provide the definition, policies, procedures, and the steps involved in evaluating and approving the VECP. Initially, the contractor will invest capital to perform a feasibility study. The PEO will reimburse the development cost for approved VECPs. The PEO and its contractor will agree to the sharing of cost savings that accrue from VECP implementation. [4, 5] Current VE metrics only concentrate a contractor's ability

to institute cost savings without adversely affecting performance and quality.

Most auto companies have programs similar to the VECP. As well as including suppliers in auto company-sponsored VE studies, auto companies contract for mandated year-over-year price reductions to drive cost reduction efforts within the supplier's organization. Satisfying or exceeding cost reduction or product improvement objectives elevates the status of the supplier. Auto companies reward the supplier by giving them "most favored" status and primary consideration for new product development and future business.

COMPARISON ANALYSIS

Both the auto companies and the Government compete in terms of cost, performance, quality and schedule. In VE the value of a product or service is increased by either increasing the function and/or reducing the cost (Value = Function/Cost). Auto companies choose VE as a method to provide a competitive edge in the global market. As an example, the Japanese auto makers used VE to address both function and cost to successfully breach the U.S. market with fuel efficient, cost competitive vehicles which met specific market niches. The Government stresses affordability. The PEO is experiencing increasing budget constraints and introduced VE as one cost control initiative.

How do the auto companies and the Government compare in their applications of VE? Both the auto companies and the Government employ the same VE methods and tools. Government VE efforts are stove-piped with the PEO limiting its VE applications to existing products and contracts. In addition to existing product and contractual VE types, the auto industry applies VE for new products, product families and competitive analysis.

- Auto companies apply VE early in new product design process to reduce a designer's tendency to "gold plate" a product. Gold plating may be defined as creating a product or service that provides more functions or features than the customer needs or desires. The Government's role is to monitor and concur with subsystem and component specifications, not to develop them. The Government relies heavily on its contractors to design products that meet Government and Warfighter expectations.
- The auto companies and the Government conduct VE on existing products. The Government concentrates on the cost portion of the value equation while the auto companies also assess the functions that the product provides. In both cases

quality and performance are not sacrificed in the name of cost.

- The auto companies and the Government are concerned about complexity and logistical footprint reductions. The auto companies actively incorporate VE into developing product families and platform families to create common vehicle architectures using vehicle size classifications. Using common architectures creates the opportunity for cross-loading vehicle platforms on the same manufacturing line. The Government incorporates common architectures to a lesser degree. The Stryker family of vehicles is a prime example of product family design. Both the Government and the auto companies provide and support their vehicles globally. Standardizing VE vehicle architectures increases the likelihood of designers using common parts among platforms. An auto company design engineer employs this strategy to facilitate the use common parts over a wide range of vehicles. Common parts reduce complexity which reduces the number of part numbers needed in inventory, allows for economies of scale in manufacturing and results in a smaller logistical footprint. The Government is hampered in commonizing parts since it relies heavily of the prime contractor to commonize products and architectures without sourcing bias.
- Auto companies use VE in competitive analysis and benchmarking to develop a more in-depth understanding of the functions provided by competitors' products, how they make their products, the technologies involved, and the costs associated with those products. Auto companies also use VE to investigate products outside of what is considered indicative of typical automotive products, such as electronics applied in other market venues, aircraft, energy generation and other technology areas thought to be relevant to potential automotive use.
- Both organizations effectively include VE as part of their contracting strategy. They offer incentives and other awards to improve cost, durability, and reliability. The auto companies go further by incorporating mandatory year-over-year product cost reductions to highlight the need for continuous improvement in the methods and technologies used. The auto companies also give an elevated status to contractors who excel in supplying products based on a established evaluation system. Some foreign auto companies have established a family of companies or captive suppliers to exclusively provide parts to them at agreed upon price targets.

- A major difference between the auto companies and the Government is the cultural acceptance of VE. The auto companies ingrain VE into their business strategies, operating philosophy, and organizational infrastructure. Government managers assign VE cost reduction tasks. Most Government managers consider VE actions outside of what is considered normal management activities and employee job descriptions. The Government managers' task-only attitude results in less emphasis on business management improvement using VE methods.

A more comprehensive VE approach results in greater understanding of the cost and functions of products provided and ultimately, better value to the customer. The auto industry effectively uses the various types of VE to evaluate and increase the worth of a product or service. Lessons learned and benefits seen in the auto industry provide an incentive for the Government to more fully apply VE throughout the life cycle management process.

GOVERNMENT PATH FOWARD

The Government should do away with its stovepipe approach to VE. PEO GCS and other Government lifecycle organizations need to collaboratively broaden VE scope beyond existing products and contractual aspects of VE and become more active in benchmarking and new product design. PEO GCS requires a more assertive approach to influencing VE activities early in a program's life since the PEO is not vertically integrated into manufacturing and relies on the prime contractor to manage tier suppliers and their products. These actions include:

- Emphasize VE as part of the culture through VE targeting and budget reduction objectives.
- Introduce earlier involvement with independent benchmarking studies and new product VE analyses.
- Coordinate with the Government's overall defense acquisition organizations efforts to drive VE throughout the life of the product.
- Adopt a more schedule-oriented approach to new product development to reduce time to market.
- Task organization leadership to take a more hands-on approach to managing VE throughout the value chain and the product life cycle.
- Drive product commonality and reduce complexity by providing strategies, guidance, and directly influencing contractor studies.
- Create "plug and play" vehicle architectural opportunities for commonality and technology upgrades by reserving package space and standardizing connectors and fastening methods.

PEO GCS usually does not have total end-to-end project control within the Defense Acquisition, Technology, and

Logistics Life Cycle Management System. Many projects are transferred at later stages in the life cycle management process which preclude an early VE analysis by the PEO.

The Government's role is to monitor and concur with subsystem and component specifications, not to develop them; however, the PEO needs to leverage other Government development organizations and contractors to provide early VE design studies. The contractor may not always share the same VE objectives as the Government. PEO GCS should take an active role in influencing contractors to conduct VE activities as soon as practicable to impact favorable design and technology insertions. The Government must ensure that the contractor's VE process complements the Government's budgetary objectives, is effective, and results in the best overall value to the Warfighter.

SUMMARY/CONCLUSIONS

The PEO and the auto industry essentially use the same recognized methods and techniques in conducting VE studies. Both use other product and process improvement methods to analyze trade-offs among cost, quality, performance and schedule. Whether a cost or profit center, VE is an effective improvement discipline, especially when it is an integral part of the organizational culture. By introducing a more formalized approach, VE progresses from a reactive solution to an issue into a planned, managed process for improvement. Management uses organizational objectives, program reporting, milestone reviews, and organizational metrics to identify and monitor VE programs in both the defense and automotive markets. Project managers (PM) may exercise interventions using both internal and external resources to keep their programs on track.

Compared to the auto industry PEO GCS has more intrinsic barriers for developing and implementing VE studies. PEO managers are task-focused to meet Warfighter needs. The PEO program manager may not have the time or the resources to conduct an in-depth VE study to reduce cost when people's lives are at stake. For the PEO, the sense of urgency to save the lives of our Warfighters takes precedence. Time from concept to product fielding may be measured in lives lost rather than days.

The PEO is using a number of techniques to overcome cultural and resource barriers: making the VE a team effort, respecting the chain of command, installing processes and procedures, and identifying key people to support and guide the VE effort.

The PEO still has much to learn as it expands and institutionalizes different elements of the VE process although it has made strides forward have with respect to VE. PEO GCS must strive to use VE earlier in the life

cycle management process to provide better value to the Warfighter.

Time is money when developing products for the Warfighter. The Government cannot accept a leisurely, decade-plus new product cycle. If the PEO incorporates VE methods to reduce time to market, the Warfighter receives 'state of the art' products quicker and the Government avoids additional costs associated with prolonged development. The Government should adopt a more schedule-oriented approach to new product design and release with a goal not to exceed six years.

Formalizing and integrating the VE process within the PEO will not happen overnight. It will require more sophisticated infrastructure, cultural acceptance, and management emphasis. Using the VE benefits of lower costs, improved sustainment, reliability and durability, and common designs will facilitate the PEO meeting its budget objectives in the current austere economic environment.

REFERENCES

- [1] Defense Authorization Act: Public Law 104-106, section 4306. Value Engineering for Federal Agencies
- [2] 41 US Code 432. Value Engineering
- [3] OMB Circular A-131. Value Engineering, May 21, 1993
- [4] Federal Acquisition Regulation, Part 48. Value Engineering, 28 September 2006
- [5] Federal Acquisition Regulation, Part 52.248-1. Value Engineering, February 2000
- [6] DoD Directive 4245.8-H. Value Engineering, 17 March 1986
- [7] US Army Materiel Command Value Engineering Management System
- [8] Society of American Value Engineers (SAVE) International Value Methodology Module I. Value Engineering Workshop, expiration 28 February 2014
- [9] SAVE International Principles and Applications of Value Engineering
- [10] Defense Acquisition University Course CLE 001. Value Engineering
- [11] Ford Motor Company Website: <http://corporate.ford.com>

[12] "Value Analysis Value Engineering" by Nick Rich, Matthias Holweg, Lean Enterprise Research Centre, Cardiff, Unit Kingdom; dated January 2000

[13] PEO GCS Standard Operating Procedure GCS-SEI-SOP-021. Value Engineering