Adding Value to Lean, Six Sigma, DFMA, and TRIZ with the Value Methodology

Canadian Value Symposium 2014

Hosted by the

Canadian Society of Value Analysis

Toronto Eaton Chelsea

November 17-18, 2014

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Introduction and Background

- Many organizations today have tried to utilize various *Value Improving Practices (VIP)* such as *Lean*, *Six Sigma*, *DFMA,* and *TRIZ,* but few have succeeded in *combining* these with the *Value Methodology* for a '*winning*' approach to optimize projects.

- These organizations will have some **early success** with one of these '*practices*', but then after some period of time will *loose momentum*, and start looking for the next more *'promising practice'*, and then after a few years, *repeat the cycle*.

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Introduction & Background, Cont.

- The new trend in government and business today is to incorporate *Lean*, *Six Sigma*, etc. with the *Value Methodology* into a *combined toolbox* to *optimize* organizational and business success.

- The introduction of the *Value Methodology* into the *government*, *construction*, and *manufacturing* sectors globally over the last few years has been a *powerful winning combination* that has *optimized project value* and brought organizational success.

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The Value Methodology in Government:

OFFICE OF MANAGEMENT AND BUDGET

Office of Federal Procurement Policy

Value Engineering

AGENCY: Office of Federal Procurement Policy, Office of Management and Budget.

ACTION: Notice of Final Revision to Office of Management and Budget Circular No. A–131, "Value Engineering".

SUMMARY: The Office of Federal Procurement Policy (OFPP) in the Office of Management and Budget (OMB) is publishing final revisions to OMB Circular A–131, Value Engineering, to update and reinforce policies associated with the consideration and use of value engineering (VE). VE is a well-established commercial practice for cutting waste and inefficiency that can help Federal agencies reduce program and acquisition costs, improve the quality and timeliness of performance, and take greater advantage of innovation to meet 21st century expectations and demands. The revisions are designed to ensure that the Federal Government has the capabilities and tools to consider the use of VE for new and ongoing projects, appropriate.

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VE can permit programs to continue delivering the same, or an even higher, level of service for less money—a critical capability for managing in a fiscally austere environment.

Industry first developed VE during World War II as a means of continuing production, despite shortages of critical materials and labor, by analyzing functions to generate alternative materials or systems to accomplish the required tasks at a lower cost. The Federal Government subsequently adopted this tool as a mechanism to incentivize contractors to continually think of ways to drive greater efficiency in their production methodologies by allowing them to share with the Government in the savings generated by their value engineering change proposals.

Over the past several decades, a number of agencies have successfully integrated the use of VE analysis into their management activities. These agencies have reported life-cycle savings through the use of VE in a broad range of acquisition programs, including those involving defense systems, civil works, transportation, construction, engineering, environmental, and manufacturing projects. According to recent reports of VE activities submitted to OMB, VE has generated billions of dollars in savings and cost avoidance. For example, the Department of Defense (DOD) reported cumulative savings of over $10 billion in FYs 2011 and 2012.

management attention and questions about its applicability to performance based contracting and other buying practices have resulted in VE not being considered in situations where it could have helped agencies save resources. The revisions being made to the Circular are designed to clarify the role of VE in helping agencies meet twenty-first century demands and deliver better value to the taxpayer.

B. Circular Revisions

On June 8, 2012, OMB's OFPP issued a notice in the **Federal Register** of proposed changes to Circular A–131 (See 77 FR 34073, available at *http://www.whitehouse.gov/sites/default/files/omb/procurement/a131-circular-changes-draft.pdf*), which proposed revisions that would:

- Reflect present-day buying strategies and practices by explaining that VE can be used with other management improvement tools, such as lean six sigma, and clarifying that consideration of VE should not exclude services, such as those acquired with performance-based specifications, and construction, including projects where design-build methods are used;
- Adjust the threshold for considering the application of VE, primarily to take into account inflation;
- Reduce the number which agencies are requ OMB, update the reporti include a description of the

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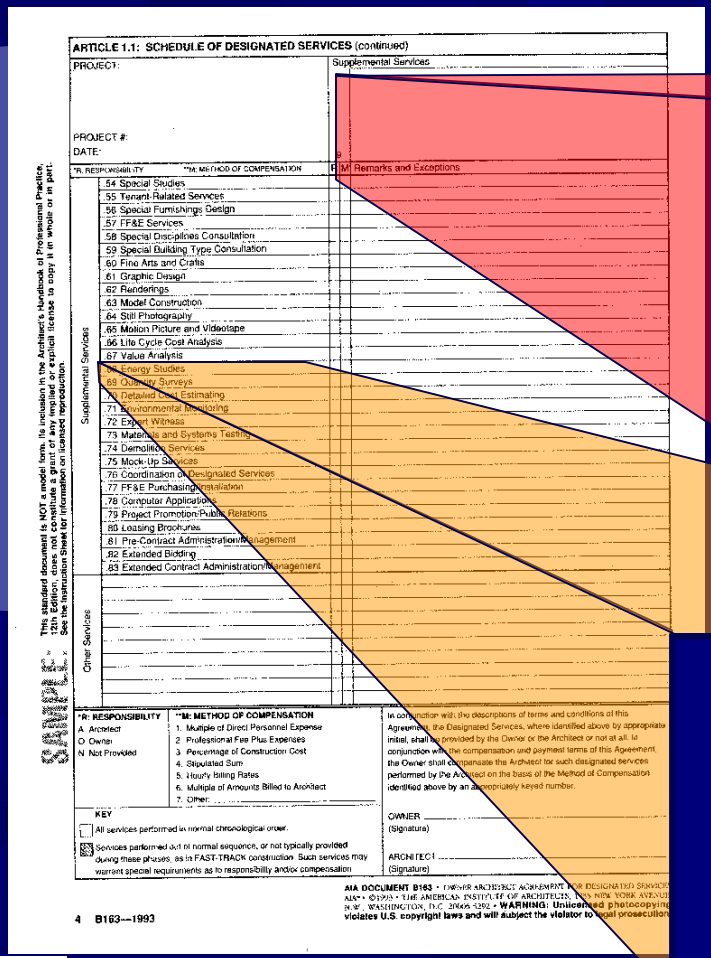
The Value Methodology in Construction:

Architect's Handbook of Professional Practice: AIA-B163



ARTICLE 1.1: SCHEDULE OF DESIGNATED SERVICES (continued)

PROJECT:

PROJECT #:

DATE:

Supplemental Services

*R: RESPONSIBILITY	*M: METHOD OF COMPENSATION	R	M	Remarks and Exceptions
Supplemental Services				
	54 Special Studies			
	55 Tenant-Related Services			
	56 Special Furnishings Design			
	57 FF&E Services			
	58 Special Disciplines Consultation			
	59 Special Building Type Consultation			
	60 Fine Arts and Crafts			
	61 Graphic Design			
	62 Renderings			
	63 Model Construction			
	64 Still Photography			
	65 Motion Picture and Videotape			
	66 Life Cycle Cost Analysis			
	67 Value Analysis			
	68 Energy Studies			
	69 Quantity Surveys			
	70 Detailed Cost Estimating			
	71 Environmental Monitoring			
	72 Expert Witness			
	73 Materials and Systems Testing			
	74 Demolition Services			
	75 Mock-Up Services			
	76 Coordination of Designated Services			
	77 FF&E Purchasing/Installation			
	78 Computer Applications			
	79 Project Promotion/Public Relations			
	80 Leasing Brochures			
	81 Pre-Contract Administration/Management			
	82 Extended Bidding			
	83 Extended Contract Administration/Management			
Other Services				

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*R: RESPONSIBILITY
A Architect
O Owner
N Not Provided

**M: METHOD OF COMPENSATION
1. Multiple of Direct Personnel Expense
2. Professional Fee Plus Expenses
3. Percentage of Construction Cost
4. Stipulated Sum
5. Hourly Billing Rates
6. Multiple of Amounts Billed to Architect
7. Other:

In conjunction with the descriptions of terms and conditions of this Agreement, the Designated Services, where identified above by appropriate initial, shall be provided by the Owner or the Architect or not at all. In conjunction with the compensation and payment terms of this Agreement, the Owner shall compensate the Architect for such designated services performed by the Architect on the basis of the Method of Compensation identified above by an appropriately keyed number.

KEY

All services performed in normal chronological order.

Services performed out of normal sequence, or not typically provided during these phases, as in FAST-TRACK construction. Such services may warrant special requirements as to responsibility and/or compensation.

OWNER (Signature)

ARCHITECT (Signature)

AIA DOCUMENT B163 • OWNER-ARCHITECT AGREEMENT FOR DESIGNATED SERVICES
AIA® • ©1993 • THE AMERICAN INSTITUTE OF ARCHITECTS, 1735 NEW YORK AVENUE, N.W., WASHINGTON, D.C. 20006-5292 • WARNING: Unlicensed photocopying violates U.S. copyright laws and will subject the violator to legal prosecution.

4 B163—1993

Supplemental Services

Those services described in the schedule of designated services in the AIA Document B163 that are in addition to the generally sequential services (from pre-design through post-construction) of the architect, including such items of services such as renderings, value analysis, energy studies, project promotion, expert testimony, and the like.

Value Analysis consisting of the review during design phases of the cost, quality and time influences of proposed building materials, systems, and construction methods relative to design objectives in order to identify options for obtaining value for the Owner

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The Value Methodology in Industry:

Designation: E1699 – 13

Standard Practice for Performing Value Engineering (VE)/Value Analysis (VA) of Projects, Products and Processes[1]

This standard is issued under the fixed designation E1699; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers a procedure for defining and satisfying the functions of a project, product, or process (hereafter referred to as focus of study). Projects include construction of commercial and residential buildings and other engineered systems.[2] Products include components, systems and equipment.[3] Processes include procurement, materials management, work flow, fabrication and assembly, quality control, and services.

1.2 A multidisciplinary team uses the procedure to convert stakeholder constraints, needs, and desires into descriptions of functions and then relates these functions to resources.

1.3 Examples of costs are all relevant costs over a designated study period, including the costs of obtaining funds, designing, purchasing/leasing, constructing/manufacturing/installing, operating, maintaining, repairing, replacing and disposing of the particular focus of study (see Terminologies E631 and E833). While not the only criteria, cost is an important basis for comparison in a VE/VA study. Therefore, accurate and comprehensive cost data is an important element of the analysis.

1.4 This is a procedure to develop alternatives that meet the functions of the focus of study. Estimate the costs for each alternative. Provide the owner/user/stakeholder with specific, technically accurate alternatives which can be implemented. The owner/user/stakeholder selects the alternative(s) that best satisfies their constraints, needs and desires.

1.5 Apply this practice to an entire focus of study, or to any subsystem/element thereof. The user/owner/stakeholder can utilize the VE/VA procedure to select the element or scope of the study.

2. Referenced Documents

2.1 *ASTM Standards:*[4]

E631 Terminology of Building Constructions
E833 Terminology of Building Economics
E917 Practice for Measuring Life-Cycle Costs of Buildings and Building Systems
E1369 Guide for Selecting Techniques for Treating Uncertainty and Risk in the Economic Evaluation of Buildings and Building Systems
E1557 Classification for Building Elements and Related Sitework—UNIFORMAT II
E1765 Practice for Applying Analytical Hierarchy Process (AHP) to Multiattribute Decision Analysis of Investments Related to Buildings and Building Systems
E2013 Practice for Constructing FAST Diagrams and Performing Function Analysis During Value Analysis Study
E2103 Classification for Bridge Elements—UNIFORMAT II

3. Terminology

3.1 *Definitions:* For definitions of general terms related to building construction used in this practice, refer to Terminology E631; and for general terms related to building economics, refer to Terminology E833.

3.2 *Definitions of Terms Specific to This Standard*

3.2.1 *value, n*—An expression of the relationship between function and resources, where function is measured against performance requirements of the customer and resources are measured in cost for materials, labor, and time required to

[1] This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.81 on

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Introduction & Background, Cont.

- Value Enhancing Tools to be discussed:
  - Lean
  - Six Sigma
  - Design For Manufacturing & Assembly (DFMA)
  - TRIZ
  - The Value Methodology
    - *Value Analysis*
    - *Value Engineering*
    - *Value Control*
    - *Value Management*

Introduction & Background, Cont.

- Each of these **Value Enhancing Tools** may be utilized at various stages of a project to ensure ***optimal success*** in the design and execution of that project.
- Knowing **which tools** to use ***when*** and ***how*** in an ***integrated*** approach is the ***key*** for the ***success*** of that organization or business.
- The purpose of this presentation is to **introduce** each of these tools, ***show integration points***, and how they may be utilized to ***optimize project success***.

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Understanding Lean Principles

What is *Lean*?

- ***Lean*** **is a set of** ***concepts, principles*** **and** ***tools*** **used to create and deliver the most** ***value*** **from the customer's perspective while consuming the** ***fewest resources*****.**
- **It is about reducing lead times and** ***delivering products or services*** **to customers when** ***they needed*** **with the** ***right quality*** **and** ***cost*****.**
- **It focuses on eliminating waste in** ***processes*** **and performing** ***value added*** **work.**

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Understanding Lean Principles, cont.

What are *Value* Activities?

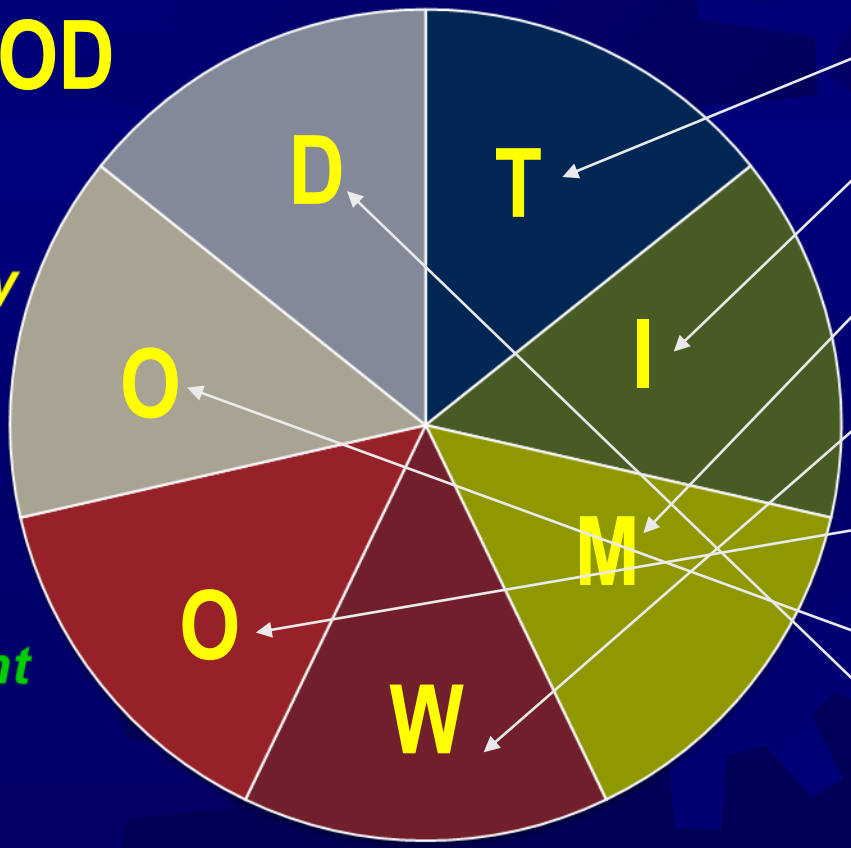
- **Value-added:** Activities that transform raw material or information into *what the client or customer is willing to pay for*.
- **Non-value-added:** Activities that take time, resources and space, but *do not add to customer requirements*.
- **Business value-added:** Activities that are *essential to running* the business - examples: Payroll, HR, Financial Reporting, etc.

Understanding Lean Principles, cont.

The 7 Deadly Wastes - *Waste* is often *hidden* in the *process*, which makes it *difficult to detect*. Lean *breaks waste down* into specific categories to allow easier identification for focused improvement activities.

TIMWOOD

These are known as the *7 deadly wastes* because they are like *toxins in the work environment*



- Transportation
- Inventory
- Motion
- Waiting
- Overprocessing
- Overproduction
- Defects

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Understanding Lean Principles, cont.

1). Transportation Waste (TIMWOOD)

- **Manufacturing Example:**
  - *Excessive handling* of parts between 2 processes either in-house or at a supplier.
  - *Temporary storage* of parts requiring transportation later
- **Product Design Influence Example:**
  - *Extra parts* drive *extra handling*
  - All *finishing steps* drive *extra handling*
- **Process Example:**
  - Transporting *full* in one direction & *empty* returning
  - *Centralized mailboxes* vs. *desk drop for all employees*

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Understanding Lean Principles, cont.

2). Inventory Waste (TIMWOOD)

- **Manufacturing Example:**
  - Excessive *finished goods* inventory
  - Excessive *in-coming goods* inventory (either in-house or at supplier)
  - *Just-in-case* buffers between processes
- **Product Design Influence Example:**
  - *Eliminate extra parts* (even in raw material)
  - Especially *fragile* or *sensitive* parts with *high scrap rate* drive *excess inventory.*
- **Process Example:**
  - *Excessive* office supplies, cleaning supplies, etc.
  - More *personnel* than business requires

Understanding Lean Principles, cont.

3). Wasted Motion (TIMWOOD)

- **Manufacturing Example:**
  - *Unnecessary walking* of the operator to get parts/tools
  - *Excessive reaching* for tools or *changing* tools in same job
  - *Double handling* of parts by line or supply operators
- **Product Design Influence Example:**
  - *Long reach distances* and *multiple varieties* cause increased motion
  - *Assemblies* which require *adjustments* for proper alignment drive *unnecessary* motion.
- **Process Example:**
  - *Unnecessary* movement of due to *procedure*, *forms*, *paperwork*, *e-mails*, *approvals*, *signatures*, etc.
  - *Combine procedures* to *reduce motion*

Understanding Lean Principles, cont.

4). Waiting Waste (TIMWOOD)

- **Manufacturing Example:**
  - Waiting for a *machine to cycle*.
  - Waiting for *material* at a workstation *from storage, etc.*
  - Waiting for the *next subassembly* on assembly line
- **Product Design Influence Example:**
  - *Eliminate designs* which require *2 operators to work simultaneously* and drive *waiting time* as operators wait for each other to be ready to complete their portion of the assembly cycle.
- **Process Example:**
  - Eliminate *additional signatures* in a process unless truly justified (*re-define employee responsibilities*)
  - Optimize *business process* decision making

Understanding Lean Principles, cont.

5). Over-processing Waste (TIMWOOD)

- **Manufacturing Example:**
  - Holding part tolerances *tighter than required*
  - Inspecting incoming stock previously *inspected by a supplier*
  - Using an *expensive complicated process* or equipment when a *simpler approach* would work- extra automation
- **Product Design Influence Example:**
  - *Chrome plating* when the actual customer request is *"polished surface"*
  - Using *nonstandard material sizing* drives extra steps
- **Process Example:**
  - Requiring *additional forms* to be completed instead of *combining* or *eliminating* forms.

Understanding Lean Principles, cont.

6). Overproduction Waste (TIMWOOD)

- **Manufacturing Example:**
  - Running the production line *faster than required*
  - *Producing more parts* than needed by the next process
- **Product Design Influence Example:**
  - Overproduction can be influenced by *early (or extra) proliferation* within the process. *Early variation* can restrict flow, driving the use of supermarkets which contain products *not immediately needed*.
- **Process Example:**
  - *Providing more* information, data, or services *than can be absorbed* by the available infrastructure.
  - Running *ahead of schedule* without reason or value to the customer or client.

Understanding Lean Principles, cont.

7). Defect Waste (TIMWOOD)

- **Manufacturing Example:**
  - *Scrapping* parts/products unnecessarily
  - *Reworking* or *repairing* parts/products unnecessarily
  - *Discarding good parts* or *assemblies* unnecessarily
  - *Scrapping* of dunnage from supplier *over-packaging*
- **Product Design Influence Example:**
  - Minimize connectors *with high force to seat* that lead to a poor connection which passes internal tests but then fails during transit *resulting in warranty issues*
- **Process Example:**
  - Forms without the *correct information*, *mistyped*, or *incomplete* for proper timely processing
  - *Inaccurate* process to accomplish objective

Understanding 6 Sigma Principles

What is 6 Sigma?

- **6 Sigma** is a process to ***statistically*** improve a product or process by reducing ***failure modes*** thus enhancing both cost and quality.
- **6 Sigma** follows a very disciplined job plan most commonly called ***DMAIC***:

Define	Information Phase	Comparison to the Job Plan for the Value Methodology
Measure	Function Phase	
Analyze	Creativity Phase	
Improve	Evaluation Phase	
Control	Development Phase	

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Understanding DFMA Principles

What is Design for Manufacturing & Assembly?

- First, ***DFMA*** consists of ***2 different processes*** linked to ***optimize total product cost*** of design with respect to manufacturing capability:
  - **Design for Assembly** (DFA) – Evaluates the design of the product for ***ease of assembly***
  - **Design for Manufacturing** (DFM) – Evaluates the individual components for ***process optimization*** based upon the customer requirements
  - **DFMA** - The ***iterative*** approach of evaluating both ***design*** and ***process*** **variables** to **optimize** the most cost effective ***final product*** assembly

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Understanding TRIZ Principles

What is TRIZ?

- **TRIZ** (pronounced "Trees") is a Russian Acronym for the ***Theory of Inventive Problem Solving***.
- **TRIZ** is a ***structured brainstorming*** technique to solving ***inventive problems***.
- **TRIZ** was borne out of a Russian ***patent examiners observations***.
- **TRIZ** ***principles*** which were developed have been a key to **reliably** solve ***1000's of inventive problems***.
- **TRIZ** is ***not*** an ***invention machine***.

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Understanding the Value Methodology (VM)

What do Customers Want Today?

- Today's customers and clients *expect* the very best value for their hard earned money.
- True *value* may be *measured* in terms of a formula as illustrated below:

$$\text{Value} = \frac{\text{Performance of Required Funtion}}{\text{Cost to Acquire Function}}$$

where a *required function* is any 'work' or 'sell' function and where cost is the '*overall cost*' or the '*life cycle cost*' of that manufactured product. VM is all about *analyzing functions*.

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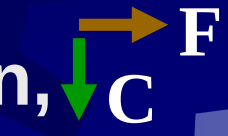
Understanding the Value Methodology, cont.

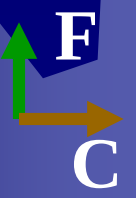
VALUE may be *Improved* by:

- ***Reducing*** cost while ***improving*** function,

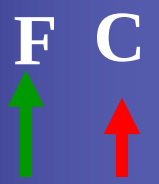
- ***Reducing*** cost while ***maintaining*** function,



- ***Improving*** function while ***maintaining*** cost,



- ***Improving*** function while ***increasing cost*** by a proportionally ***smaller*** amount (will only work if customer will pay increase), ***or***



- ***Reducing*** function while ***reducing*** cost by a proportionally ***greater*** amount

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Summary of the Value Enhancing Tools

- **Lean** is used mostly to optimize projects or processes by ***reducing waste***.
- **6 Simga** is used to ***statistically*** improve projects or processes.
- **DFMA** is used to optimize ***product design*** with ***manufacturing capability*** in mind.
- **TRIZ** is used when an ***innovative solution*** is required for a project, process, or product.
- The **Value Methodology** is used to optimize projects, processes, services, facilities, and products using ***function analysis***.

How the Value Methodology Optimizes Lean

- Generally, ***lean principles*** work with the **existing process** to **reduce waste** and **seldom questions** if that process delivers **high value**.
- The ***Value Methodology*** can ensure your organization has the ***right process*** to begin with by employing ***function analysis***.
- A well selected ***multi-disciplined team*** guided by a ***value professional***, (a ***CVS***), will ensure that ***performance*** and ***cost*** are balanced by employing ***function analysis*** to deliver the absolute ***best value*** to your client or customer.

How the Value Methodology Optimizes 6 Sigma

- ***Six Sigma*** **also generally seeks to** ***reduce variation*** **in an existing or new process but really** ***doesn't challenge*** **if that process is the** ***right process*** **to achieve** ***high*** **customer value.**
- **Again, the** ***Value Methodology*** **can ensure your organization has the** ***right process*** **to begin with by employing** ***function analysis*****.**
- **The** ***CVS*** **hired will seek to understand the** ***'Voice of the Customer'*** **for the** ***service*** **or** ***process*** **which you are responsible for providing to ensure** ***optimum life cycle value*****.**

How the Value Methodology Optimizes DFMA

- **DFMA** can optimize new and current ***products*** with ***respect to manufacturability***, however, by incorporating the ***Value Methodology***, an assessment can be made as to whether the ***right*** product or process ***is being offered***.

- Once the ***Value Methodology assessment*** is completed with the right ***multi-disciplined team*** led by a ***CVS***, then the organization can become ***more confident*** that the ***DFMA analysis*** will yield the ***best value*** for the customer.

How the Value Methodology Optimizes TRIZ

- **TRIZ** actually uses ***functions*** (called useful functions and harmful functions) in a diagram to ***understand contradictions*** and then uses ***various innovative principles*** to resolve those contradictions which many times results in a ***unique solution*** not previously thought about.

- Thus having an ***understanding of the Value Methodology*** and how to **develop good functions**, will allow one to solve a problem by thinking '***outside the box***' as the solution may already be in existence from ***another*** field of study.

Summary and Conclusion

- Organizations today should use a *combination* of **Value Improving Practices** to *optimize* projects, products, and processes thus ensure *best value*.
- The **Value Methodology** will enhance:
  - The use of *Lean* principles
  - The use of *Six Sigma* principles
  - The use of *DFMA* principles
  - The use of *TRIZ* principles
- Powerful *business gains* are possible when the **Value Methodology** is **combined** together in organizations with *CVS value practitioners*.

Personal Resources Available to *Add Value to your Project*

- *40-hour Module I Workshop* – *Approved SAVE International®* Workshop conducted *at your facility* on either a new or existing project which needs *value improvement.*
  - *Associate Value Specialist* (*AVS*) Certification available
  - Examination preparation included
  - *Permanent Workbook* distributed to all team members
- *3-Day Module II Seminar* – *Approved SAVE International* Seminar at your facility to *prepare candidates* for *successful* preparation and completion of requirements to pass the *CVS certification examination*
- *3-Day VE non-certification Workshops* – Workshop held at your facility to *increase value* of your project.
- *Value Improving Practices Workshops* – Will train in all VIP's
- *Value Consulting* at www.BoltonValueConsulting.com or

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