

2nd Asian Value Engineering Conference – 2012
INDIAN VALUE ENGINEERING SOCIETY (INVEST)

VALUE ENGINEERING the DMAIC way

N.C.Narayanan

CMD, SSA Techknowlogies

NC. Narayanan, known as ‘NC’, is the Founder & Chairman of SSA Group of companies based in India. It was founded in 1999 and provides business solutions for improving the competitiveness of any enterprise. He founded SSA Techknowlogies in 2008 with a missionary zeal of sharing his product design wisdom for developing Indian industries and strengthening their New Product Introduction (NPI) systems. NC’s vision for SSA was (and is) to create a result-oriented consulting resource at an affordable price, focusing on ROI for its clients. NC is a Gold Medallist in mechanical engineering and has earned his MS (Research) in Finite Element Method (FEM) from IIT, Chennai. In his 30 years of Design career, NC has held many senior level positions, such as Chief Designer at Lucas-TVS and Head of Lighting Technology in Crompton Greaves Ltd. He founded SSA with a missionary zeal to make “Made in India” synonymous with Quality.

ABSTRACT

The paper demonstrates an improvised methodology for VE by combining the philosophy of six sigma and VE. This approach provides an interface to the attributes Critical To Customer (CTQ’s) with the product functionality to ensure that VE efforts aligns with the customer. CTQs with importance rating will help the designers to evaluate the functional worth in a systematic way. This enables the value specialist to evaluate each functions keeping the customer in perspective. This approach also helps the designers to avoid possible omission of a functionality which is important for the customer. This method combines the numerical rigor of six sigma by creating a new system for functional worth analysis. The RDMAIC (Recognize-Define-Measure-Analyse-Improve-Control) frame work of six sigma is applied to VE enabling the value specialist to use standard templates along with Gate reviews.

INTRODUCTION

Traditionally, designers develop their new products in a “Product-Out” approach where in the designer incorporates the functionality that he/she feels important (rather than customer) or implements a new technology and invariably the new product fails in the market. The success rate of new products is as low as only 35% world wide. Even while VE is undertaken on these products for cost reduction or value enhancement, invariably the needs of the customers are not factored leading to customer dissatisfaction. In another words the VE also follows the “Product-out” approach.

In DFSS (Design For Six Sigma), a “Market-in” approach is suggested to identify the latent and stated needs of the customer before the Concept designs is undertaken for functionality. The DMAIC approach for VE suggested in this paper aligns with the “Market-in” philosophy of DFSS recommended in the IDENTIFY phase of IDOV methodology.

The value definition of six sigma as proposed by Mikel J Harry identified factors contributing to the value of the product. They are UTILITY, CONVINIENCE, LIFE and COST. **Figure 1** shows how they are related to one another. The process of VE proposed in this paper shall help the value specialist to capture the perceived value as per the attributes cited above. This new method for VE introduced a numerical method for value assessment based on customer importance rating rather than relying on the VE team’s judgement.

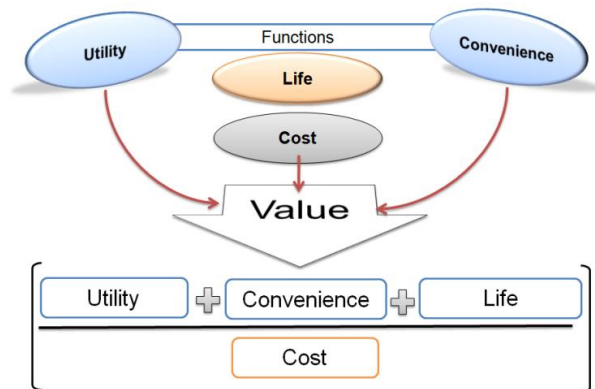


Figure 1: Relation of Value

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After rigorous research and numerous analysis for 2 years, the authour developed the 6 phase methodology of a new approach to VE and titled as VE^{DMAIC} (Value Engineering^{DMAIC}). One more value adding step added in the new methodology VE^{DMAIC} is “Recognize” phase in which the VE specialist selects the right product for VE. One more value adding approach added in the new methodology VE^{DMAIC} is structured in the new phases as below:

R - Recognize
D - Define.
M- Measure
A-Analyze
I – Improve
C – Control

This method is designed to facilitate application of VE both in engineering as well as service process design. VE^{DMAIC} was tested on consumer goods like a pen and desk telephone and the results were astonishing with saving upto 25% of overall manufacturing cost.

METHODOLOGY

Value Engineering^{DMAIC} consists of 6 phases, which have different steps within it.

Phase 1: Recognize Phase

Recognize business needs and selecting the product on which Value Engineering DMAIC method will be conducted.

Phase 2: Define Phase

Collecting the appropriate information of the product relating with cost and part specification

Phase 3: Measure Phase

Identifying and prioritizing the functions critical to customer requirements

Phase 4: Analyze Phase

Identify the root causes for improper value distribution from functional analysis

Phase 5: Improve Phase

Generation of alternate concepts for the functions of the product value to the product

Phase 6: Control Phase

Presenting the new proposal for the product with Target Cost and implementing it with proper monitoring and auditing for sustaining the benefits.

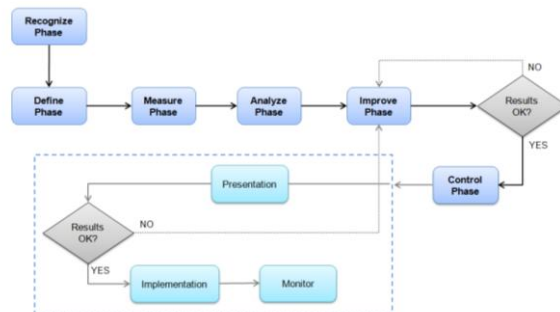


Figure 2 explains the phase wise flow.

METHOD FLOW

Recognize Phase:

As mentioned, this phase recognizes the business needs and selects the product on which Value Engineering is conducted. The steps associated with this phase are,

- Identify the product, which will undergo the value study.
- Compare the following aspects:
 - Market share value of all the products in the Company
 - Revenue generated from the products
 - Competitiveness of products in market
- Selecting and Maintaining close working relationship between the value team leader and the manager sponsoring a project generates Value.

Define Phase:

This phase focuses on collecting all the data related to product. This data consists of Voice of the Customer (VOC), Benchmarking, Key buying Factor, Critical to Quality specifications and Bill of Material.

- Initial process is to collect the VOC from direct interaction and Gemba study and document them.
- Benchmarking these requirements with the competitors adds value, as it reflects the current status from the customer demands. (Figure 3 – KBF)

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- This step is required to calculate the **WORTH** of the functions.
- Documenting the number of parts opens the picture of different functionality incorporated in the product and overall cost.
- The manufacturing cost is also calculated in this stage.

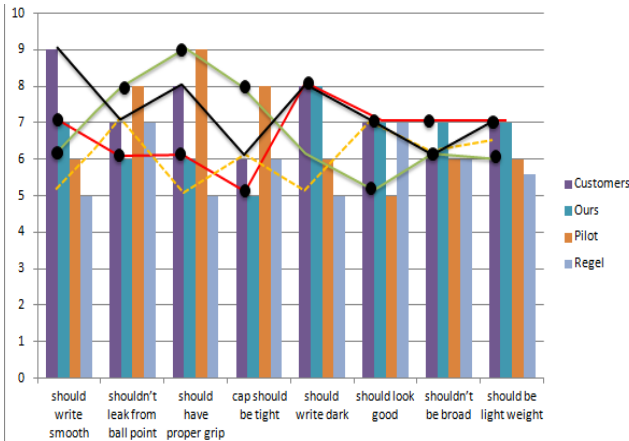


Figure 3: Key Buying Factor

Measure Phase:

Measure phase is the vital part of this Analysis on cost deduction. In this phase Value is calculated for each and every function by ratios of worth and cost. Objective of this phase is to,

- State the functions of all the parts
- Identify the functions required for the system to function using FBD, FAST.
- Compare the worth (Customer requirements) with functionality cost using Customer need-Function-Cost (CFC) Analysis, illustrated in **Figure 4**.
- Value Ratio (VR= Worth/Cost) of each component is calculated, after implementing this analysis.

Analyze Phase:

As the name implies, Analyze phase investigates the potential causes which effect the product functionality, adding additional cost.

- This investigation technique identifies,
 - *Root cause of unwanted functions which is additional cost.*
 - *Magnitude of these problems.*
- This analysis also identifies the focus area by differentiating, Re-Engineering and Improvement on basis of VR of components.(**Figure 5**)

- **Re-Engineering** – If the VR is less than 1, it means that the cost invested is more than required (Worth) on that part/component. This implies that there is a cost saving opportunity on this part.
- **Improvement** – If the VR is greater than 1, it means that the cost invested is lower as compared to required (Worth) on that part. This implies that an opportunity exists to provide additional value to customer..

Improve Phase:

All the investigation is documented and the critical areas are identified and prioritized for improvements. This phase generates and selects concepts as solutions, to overcome the additional cost identified from the prior phase.

- Various concepts are generated using concept generation tools like TRIZ, Six Thinking Hats, SCAMPER.
- These concepts are selected by brainstorming in the criteria identified using tools like Analytical Hierarchy Process and Pugh matrix.
- Cost is the vital criteria for selection.
- If required, FMEA is also executed on the new designs

Control Phase :

This phase is the final stage of the value and cost improvement Analysis. Here, the Top management have to be convinced to implement the changes required for the product to function with higher productivity life and minimum manufacturing cost.

- All the concepts selected are implemented to build a prototype and reliability assessment is executed to calculate the product life.
- These assessments record the actual manufacturing cost associated with the improvements.
- The management is shown Benefit Analysis Table (BAT) which documents the **Cost Savings and /or Value enhancements** after conducting this Analysis and Improvements.
- The whole project is presented to the Top management for the approval.

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S.No	Customer Needs	Component	Body		Front Ferrule		Back Ferrule		Rubber Tube		Refill			Cap Cover	Cap Clip	Printing on pen						
			CR	WI	CR	WI	CR	WI	CR	WI	CR	WI	CR				WI					
		Stron Relation - 5 Medium Relation - 3 Low Relation - 1 WI = (IR X CR)	To hold writing		To retain refill		To support refill		To grip		To store ink		To mark on paper		To protect nib		To hold Pocket		To look good			
			CR	WI	CR	WI	CR	WI	CR	WI	CR	WI	CR	WI	CR	WI	CR	WI	CR	WI	CR	WI
	should write smooth		1	9	3	27	3	27	1	9	1	9	5	45	3	27	1	9	1	9	1	9
	shouldn't leak from ball point		1	7	1	7	1	7	1	7	1	7	3	21	3	21	1	7	1	7	1	7
	should have proper grip		3	24	1	8	1	8	5	40	1	8	1	8	1	8	3	24	1	8	1	8
	cap should be tight		5	30	1	6	1	6	3	18	1	6	3	18	1	6	5	30	1	6	1	6
	should write darker		1	8	1	8	1	8	1	8	1	8	5	40	5	40	1	8	1	8	1	8
	should look good		3	21	1	7	1	7	1	7	1	7	1	7	1	7	3	21	3	21	3	35
	shouldn't be broad		5	30	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6
	should be light weight	5	35	3	21	1	7	3	21	7	49	3	21	3	21	3	21	3	21	3	21	
	ink shouldn't finish	1	9	1	9	1	9	1	9	5	45	1	9	1	9	1	9	1	9	1	9	
		25	173	13	90	10	76	17	116	14	100	23	166	19	136	19	126	13	86	13	86	
Worth Sum	1155		14.98		7.792		6.5801		10.0433		8.658		14.372		11.775		10.91		7.446		7.45	
		28		7		5		5		10		10		5		20		12		3		
			0.535		1.113		1.316		2.00866		0.866		1.4372		2.355		0.545		0.62		2.48	

Customer Function Cost Analysis

Figure 4

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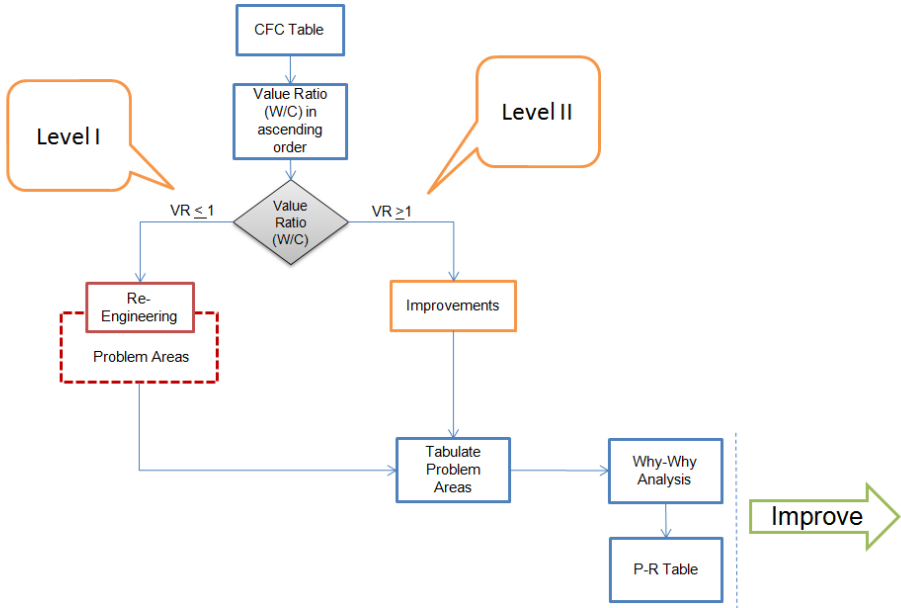


Figure 5: Analysis Investigating

On a Lighter Note



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VE ^{DMAIC}		Traditional VE	
Phases	Objective	Phases	Objective
Recognize Phase	To Identify the product to be developed and analyze the Market Value of products	Selection Phase	VE projects are chosen based on cost reduction requirements to improve profitability
Define Phase	Defines the VE objectives and VOC is collected to drill down to CTQs. Customer importance to functionality is obtained through VOC. The customers Stated and Latent Needs are captured. Part of QFD matrix is applied to get the customer perspectives.	Information Phase	To collect all the information of the product which undergoes Value Study
Measure Phase	Clearly establishes the ratio of functional worth using customer importance ratings. Focus areas are prioritized numerically.	Function Phase	To generate functional analysis on the part and understand the vital parts
Analyze Phase	To Identify the Root Cause for the imbalance of ratio of worth	Creativity Phase	To generate better ideas for the required functions
Improve Phase	To generate and select alternative and robust concepts for the required Functions with respective to Cost	Evaluation Phase	To select appropriate idea for the parts functions
Control Phase	To represent the proposed Solutions and compute the reliability of the product and Validate its performance with respective to the limitations. Risk analysis could be added to evaluate risk using DFMEA (Optional). Sustaining benefits are addressed.	Presentation Phase	To propose the selected idea to the top management for their decisions
		Implementation Phase	To implement the developments suggested by the top management
		Audit Phase	To monitor the developments made in the product

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CONCLUSION:

Value Engineering VE^{DMAIC} is the next generation of VA/VE approach that enhances the power of traditional VA/VE methods by interfacing with the customer, numerical evaluation for objectivity, tools & techniques for structured thinking by the VE specialists in that will enable the designers. The RDMAIC methodology aids the designers to manage their projects with intermediate gate reviews in standardized templates. The VE^{DMAIC} approach is also ideal for application of VE for service processes. This method will take the traditional VE to its next level of maturity.

END OF DOCUMENT