Enhancing Value of Slit Housing using Value Engineering – A Case Study

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Abstract— This paper presents the concept of Value Engineering in a well articulated manner which can be easily perceived. The model of Value Engineering and its different phases are explained in brief which can be implemented for the optimization of any product. Each part of the Value Engineering job plan is discussed and executed to get the detailed information about the product. A case study has been discussed and an analysis has been carried out by this process to achieve the product optimization. Various tools are used for the analysis of the product while evaluating the product at the functional level. With the systematic approach and critical analysis, the final product turns out to be a successful showcase of Value Engineering.

Index Terms — Case Study, Creative Worksheet, Decision Matrix, Functional Analysis, Job Plan, Value Engineering (VE).

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1 INTRODUCTION

Value Engineering (VE) which is a professionally applied, function-oriented, systematic team approach used to analyze and improve value in a product, design, system or service and process – a methodology for solving problems and/or reducing costs while improving performance/quality requirements. VE can be understood also as a systematic method to improve the value and optimize the life cycle cost of a function or a facility [1], [3]. This paper outlines the basic frameworks of Value engineering and presents a case study showing the merits of Value Engineering in a company manufacturing medical instruments.

The Society of American Value Engineers International, or SAVE, uses the broad term "Value Methodology," defined as "the systematic application of recognized techniques which identify the functions of the product or service, establish the worth of those functions, and provide the necessary functions to meet the required performance at the lowest overall cost."

The paper is organized in several stages. The first stage defines the concept of value engineering. Several definition are given making the concept more cohesive and explaining the need of VE in the present scenario where cost optimization has become a critical need for every industry to survive in this competitive environment. Second stage defines the VE job plan which should be followed for analyzing any product. In the third stage a case study has been presented which helps us reach to a concrete solution of the problem discussed here and in the last stage the conclusion and future scope of Value engineering have been provided.

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2 DEFINITION

Value Engineering is the systematic application of recognized techniques by multi-disciplined team(s) that identifies the function of a product or service; establishes a worth for that function; generates alternatives through the use of creative thinking; and provides the needed functions, reliably, at the lowest overall cost. Value Engineering may be defined in other ways, as long as the definition contains the following three basic precepts:

a. An organized review to improve value by using multi-disciplined teams of specialists knowing various aspects of the problem being studied.
b. A function oriented approach to identify the essential functions of the system, product, or service being studied, and the cost associated with those functions.
c. Creative thinking using recognized techniques to explore alternative ways of performing the functions at a lower cost, or to otherwise improve the design.

It involves an objective appraisal of functions performed by parts, components, products, equipment, procedures, and services; and so on anything that costs money [2].

3 VALUE ENGNIEERING AS A PROCESS

VE process consists of three main phases that are: pre-study, value study and post-study. The VE job plan is a systematic plan to make sure that the VE analyzing team understands customer requirements and develops a cost-effective solution. Park [4] has said: "No matter how many steps there are, the process is always the same, analysis, creativity, evaluation and development. A key point in organizing the VE effort is the use of the job plan or value study. The information phase is a fact-finding phase. The purpose is to accumulate all the factual information available in regard to the proposed area of study. The function analysis phase is the heart of the Value Methodology. Mudge [5] has formulated that function analysis is based on two major parts: define a function and evaluate the function relationships. The VE team evaluates the ideas generated in the creativity phase using one of a number of tech-

niques, many of which depend upon some form of weighted vote. This stage forms a crude filter for reducing the ideas generated to a manageable number for further study [6]. The purpose of the post-study is to assure the implementation of the approved value study change recommendations. Implementation tasks are made by the VE team, the organization's own personnel or together [7].

4 FIVE PHASES OF VE PROCESS

a. Information Phase - During this phase, the VE team gathers as much information as possible about the program requirements, project design, background, constraints, and estimated/projected costs. The team performs functional analysis of systems and subsystems to identify high cost areas. The project designer provides additional design data and participates in the initial VE team conference.

b. Speculative/Creative Phase - The team uses a group interaction process to identify alternative ideas for accomplishing the function of a system or subsystem.

c. Evaluation/Analytical Phase - The ideas generated during the speculative/creative phase are screened and evaluated by the team. The ideas showing the greatest potential for cost savings and project improvement are selected for further study.

d. Development/Recommendation Phase - The team researches the selected ideas and prepares descriptions, sketches, and life cycle cost estimates to support the VE proposal (VEP) recommendations.

e. Report Phase - The team presents the VEP's to the company during an oral presentation at the conclusion of the workshop. Shortly after the completion of the VE workshop, a preliminary VE report encompassing the entire VE effort is prepared by the VE team leader and submitted to the company. [8], [9]

5 CASE STUDY

In this paper we have discussed a part of the company Labotron India Pvt. Ltd. located in Ambala which produces medical instruments. The part considered is Slit Housing on which the value engineering job plan is applied. This company is one of the top quality manufacturers of the medical instruments and is a well-known name in the medical industry. Many of the products developed here are conforming to the international standards. It is an ISO certified company for the manufacturing of medical products.

The process of Implementation of Value Engineering is discussed as follows:-

a) PLAN FOR PRODUCT SELECTION

Product selected is Slit Housing which is used as a component in assembly of microscope in the field of eye inspection at moisture free environment. The present specifications of this part and its material used are costlier than the average industry cost. This product is chosen because of the increased competition from dif-

ferent manufacturers in the same category.

Value of this product can be increased by maintaining its functions and reducing its cost by changing its design, changing the material and process.

b) OBTAIN PRODUCT INFORMATION

Product specifications	
Production process	Aluminum Alloy
Material used	C.N.C. drilling and Milling.
Weight	540 gm
C.N.C turning	1.5 min
C.N.C. milling	9.5 min.
Cycle time	20.5 min.(machining)
Finishing operations	15 min.(drilling, taping, filing)
Black anodizing	6 min.
Total cost	**Rs 450**

c) FUNCTIONAL ANALYSIS OF PRESENT FUNCTIONS

TABLE 1: FUNCTIONAL ANALYSIS

Component	Basic Function –Verb	Basic Function – Noun	Secondary Function – Verb	Secondary Function – Noun
Slit Housing	Provide Provide	Housing Support	Support Fix	Cam Shaft Slit knobs

d) DEVELOP ALTERNATE DESIGN OR METHODS

During brainstorming these ideas were listed:-

Creative Worksheet

Ideas:
- i. Change material
- ii. Change design
- iii. Use ABS plastic
- iv. Make it lighter
- v. Change the dimensions
- vi. Change the process
- vii. Make product through casting

e) EVALUATION PHASE

For judging the ideas, the following designs were considered:

- A. Ease of Operation
- B. Durability
- C. Maintainability
- D. Safety
- E. Reliability

The following criteria was used for evaualting the ideas

Weight age analysis	Points
Major difference	3
Medium difference	2
Minor differences	1

TABLE 2: PAIRED COMPARISON

	B	C	D	E	Weight	Adj. Weight	% Weight
A	B2	C2	D3	E3	0	1	03.44
	B	B2	B3	E3	7	8	27.58
		C	C2	E2	4	5	17.24
			D	E2	3	4	13.79
				E	10	11	37.93
Total						29	

Alternatives:

Serial No	Idea	Symbol
1	Use ABS plastic	a
2	Make through casting	b
3	Existing	c

TABLE 4: COST EVALUATION

Item	Material cost (Rs.)	Machining cost (Rs)	Anodizing cost (Rs.)	Total cost (Rs.)
Slit Housing	86.8	54	15	155.8
Casted Slit Housing	64.48	24	10	98.48
Part Eliminated	-	-	-	-
Difference/part	22.32	30	5	57.32

f) RESULT

The total savings after the implementation of value engineering are given below:-

- ➤ Total Existing Cost – Rs 155.8/-
- ➤ Total Proposed Cost – Rs 98.48/-
- ➤ Saving per product – Rs 57.32/-
- ➤ Percentage saving per product –36.79%
- ➤ Annual Demand of the product – 10,000
- ➤ Total Annual Saving – Rs 5,73,200/-
- ➤ Value Improvement - 58.20%

6 CONCLUSION

Value analysis is a technique with immense possibilities, and systematically employed, it can achieve great Economies and increased efficiency. Although good results have been obtained in several individual cases in some industries, only a large scale and systematic application of this technique in all industries can result in substantial economies on a national scale.

In the Case Study discussed above we see that how Value Engineering is used for the cost reduction and hence improving the value of the product. A thorough analysis has been done for choosing the most viable option from the various feasible choices available.

This is not the end of the value improvement of the product. In Future we can make the changes in the design so that the Value of the product can even be enhanced. Various other Industrial Engineering tools like the QFD, TRIZ can be integrated with Value Engineering which can further enhance the value of the product.

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Table 3: Ranking for Alternatives Proposed

ATTRIBUTE	A	B	C	D	E	PERFORMANCE SCORE	COST	VALUE SCORE
% WEIGHT	03.44	27.58	17.24	13.79	37.93			
ALTERNATIVES								
A	2*03.44	1*27.58	1*17.24	1*13.79	1*37.93	97.22	30.6	3.17
B	3*03.44	3*27.58	2*17.24	2*13.79	3*37.93	259.62	98.48	2.63
C	1*03.44	2*27.58	1*17.24	2*13.79	2*37.93	176.18	155.8	1.13

Note: From the above table it is seen that the alternative 'a' has the maximum value score.

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