

# Optimization of Mechanical Pencil by using Value Engineering

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**Abstract:-** In today's era of increasing competition maintaining a product and having a better edge over competitors is quite difficult so cost reduction is basic solution provided but it's not the only solution, improving product quality while maintaining its price or adding features without changing price are also better options. For achieving this value engineering is used as the tool to get better outputs. Value can be defined as the combination of quality, efficiency, price and service which ensures the satisfaction of Customer. This paper focuses on application of creative phase of value engineering to Mechanical Pencil, the possible advancements in this product along with suggestions of improvement.

**Key Words:** Value Engineering, Optimization, creative phase, Improvement.

## 1. INTRODUCTION

The competition is increasing continuously and with the application of globalization a lot of new ideas, concepts and technologies are open to everyone so to remain in competition it is necessary to improve continuously otherwise the manufacturer will be thrown out of competition. So, there is need of application of value engineering of existing and upcoming products. There is continuous demand to reduce the product price.

Value simply means that what is worth to you divided by price we pay. The value is cost proportionate to the function. It is therefore clear that the value of product can be increased by

1. Increasing the utility that is function with the same cost
2. decreasing the cost for the same function
3. a large increase in utility with a small increase in cost function specifies the purpose of product for what product does.

Thus, value analysis should not be taken as only cost reduction technique; but instead it increases the value of product either by increasing its utility with the same cost or by decreasing the cost for the same utility.

Mechanical pencil also called as lead pencil used to provide constant line without need of sharpening also with the various lead size options.

## 2. History

Conrad Gesner described a lead holder pencil in 1565, but the lead had to be manually held to sharpen and filled properly. The earliest extant example of a mechanical pencil was found aboard the part of HMS Pandora, which sank in 1791.

The first patent for a refillable pencil with lead-propelling mechanism was issued to Sampson Mordan and John patriarch Hawkins in Britain in 1822. After shopping for out Hawkins' patent rights, Mordan entered into a business partnership with Gabriel Riddle from 1823 to 1837. The earliest Mordan pencils are thus hallmarked SMGR. His company continued to manufacture pencils and a large vary of silver objects till warfare II, once the plant was bombed.

Between 1822 and 1874, more than 160 patents were registered pertaining to a variety of improvements to mechanical pencils. The first elastic device mechanical pencil was proprietary in 1877 and a twist-feed mechanism was developed in 1895. The 0.9-millimeter lead was introduced in 1938, and later it was followed by 0.3, 0.5 and 0.7 sizes. Eventually, 1.3- and 1.4-millimeter mechanisms were offered, and 0.4 and 0.2 versions are currently made.

Value Engineering technique was introduced during world war 2 at General Electric Co. During war there was shortage of raw materials, components and skilled labours.

## 3. Value Engineering

Value Engineering in systematic effort to improve the value of product project or system and optimize life cycle cost

It is a process that identifies opportunities to remove unnecessary cost while sharing that quality; reliability; performance and other critical factors meet the customers expectation. Typically, it is undertaken after the

conceptual design stage prior to detailed design and manufacture with the goal increasing the net value.

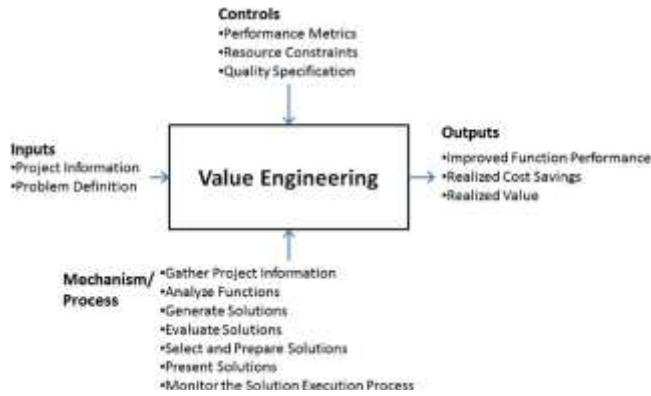


Figure 1 Value Engineering

however, Value Engineering can be carried out at other stages of product/project life cycle.

Value Engineering has two primary elements

- To deliver functions at minimum cost
- To use group brainstorming and to broaden the solutions space and avoid narrow thinking

Value can be improved by reduction in life cycle cost and by increase in customer worth or customer acceptance. The action of Value Engineering requires studies in calculation of product's life cycle cost where the focus is on the product's total cost. teamwork is the key to successful Value Engineering.

A multidisciplinary team composed of representatives of all stakeholders plus specialist from different fields work together to identify improvements. Value Engineering aims to avoid suboptimal decisions caused by having one of the stakeholders in project & drive the design according to single criterion. Value engineering techniques also provide the opportunity to make improvements in various aspects of design such as cost and time reduction and improvement in quality reliability performance and maintainability. the use of resources can be maximized by eliminating unnecessary costs while maintaining the required levels of quality.

Value Engineering is term applied to value analysis done for the design and prototype stage of product. The potentials of saving is more in case of value analysis done at design stage other advantage is that any changes at this stage is less costly rather than at later stage when the production is at full swing.

At the design stage the time is rather short since company wants to put a new product in market Before any of its competitors can set in and Value Engineering will have very short time to apply that Different techniques. evaluation of value at this stage becomes difficult in absence of any customer reaction and opinion.

Value engineering methodology is based on three specified phases:

### 3.1. Pre study Preparation Phase:

The pre study preparation phase often commences with meeting between owner, designer and Value Engineering team leader to promote a common level of understanding on the objectives of study to confirm the schedule of events of study and to review the required information

Project data provided by owner and the designer are distributed to the team for review prior to the formal workshop in order to develop Relevant questions models of appropriate costs energy costs and life cycle costs are provided by the team leader.

### 3.2. The project study workshop phase:

This phase is conducted at a location convenient to the owner and designer frequently at owners' premises near the project site it lasts for a minimum of 3 to maximum of 5 days with an agenda for the first meeting including from introduction to questions by the value engineering team members for the designer. After the designer's oral presentation with the question and answer period it is desirable for the owner and designer to escort the value engineering team on a brief site visit the team then process with the following basic job plan common to all Value Engineering includes following phases.



Figure 2 Value Engineering Phases

### 3.2.1 Information phase:

All team members participate in a function analysis of the project as a whole, and then of its component parts, to determine the true needs of the project. Areas of high cost or low worth are identified.

### 3.2.2 Creative phase:

The team lists creative ideas generated from its review of the project with the aim of obtaining a large number of ideas through brainstorming and association of creative proposals.

### 3.2.3 judgment phase:

Creative ideas are analyzed, and the team selects the best ideas for further development.

### 3.2.4 Development phase:

The team prepares alternative designs with capital and life cycle cost comparisons of original designs and proposed alternatives. All recommendations are supplemented with written descriptions, sketches, basic design concepts, technical information and cost summaries.

### 3.2.5 Presentation phase:

The team presents an oral summary of its findings to the owner and the designer, explaining the basic ideas recommended, the cost saving implications and their attendant rationales.

### 3.3 Post workshop phase:

The team prepares a report on final analysis and submitted timely manner, such that the design process may continue.

### 3.4 Advantages of Value Engineering:

- i. Reduces the cost of the product, it is because of special attention which is paid for simplification, standardizations and improved method of production.
- ii. Most suitable products are manufactured.
- iii. It helps employees in better understanding of their jobs.
- iv. Improvement leads to greater all-round efficiency.
- v. It helps to generate new concepts and ideas for the R and D work.
- vi. Increased in product design, functions which ensure consumer satisfaction.

## 4. Application of Creative phase to Mechanical Pencil:



Figure 3 Mechanical Pencil

Mechanical pencil most commonly known as Lead Pencil or Pen pencil is popular product among students, artists, Designers or Engineers. It uses graphite lead of 0.3 mm, 0.5 mm and 0.7 mm which varies the line thickness. It first invented in 1565 along with time there are lot of advancements but there are some problems with its functioning which are not fixed which means there is chance of improvement.

So, following are the ideas which can be applied to decrease the cost and improve the value of the product:

- The major problem of conventional mechanical pencil is lead breaking with nominal pressure so, we can fix this problem by introducing a spring to the chuck mechanism
- To absorb inclined force applied to the pencil a sleeve of conical shaped fitted with second spring should be introduced so that flexibility will be increased by absorbing pressure from the diagonal writing angle.
- Both the springs will guard the lead all the time and the conventional problem of lead breaking will be solved.
- The internal mechanism of Mechanical Pencil should be made from High strength steel so that it will increase structural integrity.
- The body material should be made from high strength plastic which will decrease its weight and also decrease the cost.

## 5. CONCLUSION:

In this Research paper we have applied principles of value engineering to improve the functioning and reduce the cost of Mechanical Pencil a popular product among

students. The suggestions given are to reduce the cost of the product without compromising on the quality of product.

#### 6. REFERENCES:

[1] Racha Rachwan, Ibrahim Abotaleb," The Influence of value Engineering and Sustainability consideration on Project Value", 'Science Direct', 2016

[2] Mr. Chougule Mahadeo Annappa & Dr.Kallurkar Shrikant Panditrao, "Application of Value Engineering for Cost Reduction", 'International Journal of Application or Innovation in Engineering & Management (IJAEM)' July 2012.

[3] A Case Study Analysis through the Implementation of Value Engineering by: Amit Sharma and Harshit Srivastava.

[4] Historical Overview of Value Management - Dr Roy Barton (2001)

[5] Value Analysis, Functional Analysis, Value Engineering and Target Costing (P2) by Norwood Whittle