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Value Analysis for Cost Saving in Mechanical Pencil Manufacturing: A Case Study

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Abstract - *The objective of this study was to analyze the prospect of cost reduction through value analysis technique. A manufacturing process of a conventional lead pencil is studied to apply the value analysis technique in order to decrease the cost. Value analysis is the study of the current processes to reduce the cost incurred on the manufacturing of a product through process reengineering or design modification without reducing the performance of the product regarding its elementary functions. This study focuses on the design amendment of the mechanical pencil by varying materials used for manufacturing of the pencil. This study presents the purposeful cost analysis of lead pencil and ideas are projected to reduce the cost of manufacturing per product. Through newly projected ideas, cost saving per pencil is foreseeable to be 25% of the former manufacturing cost.*

Key Words: Value Analysis, Cost reduction, Pencils, Cost Minimize, Function Analysis.

1.INTRODUCTION

Value Engineering establishes an association between value and price of a product by evaluating its functions to determine the best value. When a product accomplishes its essential functions reliably at the lowest life-cycle cost while preserving the quality labelled as the best value of that product. Value engineering is the set of activities performed while the product is in the design & progress phase. On the contrary, value analysis is a technique implemented for the cost reduction and procedure development for the current product. Value of a product is well-defined by the proportion of the functions performed by the product to the cost of that product. It has been proved that Value analysis can reduce costs by 25% to 45% or even more without disturbing its quality.

The manufacturing process of mechanical pencil roughly comprises cutting and shaping of wood, inserting lead into the wood, coating of wood, and lastly, assembly of the metal lid along with the eraser. A study was directed to gather the information about present estimate of the pencil to discover the extents where enhancement is likely, along with the functional examination of the numerous parts and procedures to study their importance in the procedure. In the technical terminology of the value engineering, this phase is known as the orientation phase.

In order to cut the cost incurred on the production of the mechanical pencil, the comprehensive study of present figure is undertaken to recognize the possible areas of enhancement. The overall study presented that the minor design aspects can produce a substantial impact on the cost of manufacturing and need to be prudently studied. The concepts presented in this manuscript suggest a minor variation in the design of the product by changing the shape and coating used during manufacturing of the pencil. The potential of the concept is also explored in this text through the probable reduction in the cost of manufacturing. Further, the current and newly projected costs are compared to estimate the cost saving per piece. The process of cost reduction through value analysis is described through this manuscript.

2. VALUE ANALYSIS & VALUE ENGINEERING

According to the Society of American Value Engineering, "Value engineering is the systematic application of familiar techniques which recognize the function of a product or services, establish a financial value for the function and deliver the necessary function reliably at the lowest overall cost."

The objective of value analysis is not only to degrade or low-price the products but to advance its value by reducing cost. Value analysis is applied to the current product in order to enhance its value. Whereas, Value Engineering is applied to the product at the design phase and therefore ensures prevention rather than elimination. The value analysis must be applied at the appropriate period and exact stage of product life cycle to get expected results.

3. VALUE ANALYSIS: PHASES

i. Orientation Phase

In this phase, functional analysis of numerous parts and processes is carried out to separate them into basic and subordinate functions. The separation is done based on the discrete function and their functional input to assembly. The elementary function is what a product or process must do to work or sell, and the buyer is ready to pay for, trailed by subordinate functions that support that basic function. Subordinate functions can be revised or removed to condense product cost. The pencil is mainly divided into the following components: -

1. Lead
2. Wood
3. Metal cap
4. Eraser
5. Coating

The functional analysis is also presented in Table. 1, based on their influence on the assembly.

Sr No.	PART NAME	FUNCTIONAL DEFINITION	
		VERB	NOUN
1	LEAD	MAKE	INDENT
2	WOOD	PROVIDE	STRENGTH
3	METAL LID	PROVIDE	PROTECTION
4	WOOD SHAPE	PROVIDE	GRIP
5	PRINTING	DISPLAY	INFORMATION
6	COATING	IMPROVE	AESTHETIC
7	ERASER	CLEAR	MARKS

Table. 1: Functional Analysis of Parts and Processes

ii. Knowledge Phase

In the knowledge phase, the detailed information regarding the costing of the pencil is gathered from the survey of the production line. The pencil manufacturing consists of overall 5 stages. As a unit, the current manufacturing cost of the pencil per piece is ₹ 5/-. Wood and coat are the two expensive elements in the manufacturing of a pencil which share 37.5% of the total cost of a pencil. The primary focus is kept on these two elements for the cost reduction. The detailed costing of the parts and processes is presented in the following table.

SR. NO.	PART NAME	QUANTITY	COST IN Rs.
1	LEAD	1	1
2	WOOD	1	1.5
3	METAL LID	1	0.25
4	SHAPING OF WOOD	1	0.50
5	PRINTING	1	0.8
6	COATING	1	0.15
7	ERASER	1	0.8
		TOTAL	5.00

Table. 2: Detailed Estimate of Parts and Processes

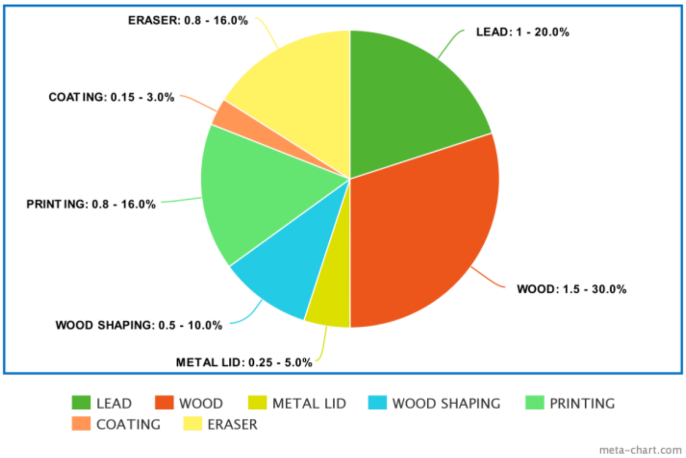

Chart-1: Components & Cost Distribution

Key Letter	Part	Function	Weight	% Cost
A	LEAD	MAKE MARK	8	20
B	WOOD	PROVIDE STRENGTH	8	10
C	METAL LID	BASE PROTECTION	7	5
D	SHAPING OF WOOD	PROVIDE GRIP	3	10
E	PRINTING	DISPLAY INFORMAT ION	2	16
F	COATING	IMPROVE APPEARANCE	1	12.5
G	ERASER	REMOVE MARKS	4	16

Table. 3 Comparison of Functional Weight and Cost

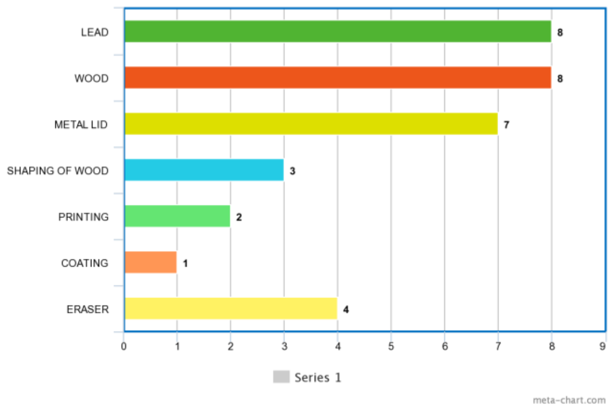

Chart 2: Functional weightage & cost

iii. Creative Phase

This phase is concerned with, "What are the alternate possibilities which could satisfy the same functions" of the assembly. Many concepts are generated and discussed in the brainstorming conference. Following thoughts were made during this phase.

1. Change in the design (round shape)

Instead of using the hexagonally shaped wood for the body of pencil, the triangular shaped design can be incorporated to reduce the manufacturing time and thereby, manufacturing cost.

2. Eliminate polished coating (use matte coating)

Polished paints are expensive and great care is to be taken while applying is on the wood. Instead of that, the matte paints can be used to save the cost & improve aesthetics.

3. Use plastic lid instead of metal lid.

Manufacturing of metal lid is expensive as compared to plastic lid. Plastic Lids are light in weight.Hence it would require less effort to write.

After discussing the concepts put forth, the function cost worth analysis is performed on the product to estimate the effectiveness of the newly proposed ideas.

Table. 4: Function Cost Worth Analysis

PART	CURRENT COST in Rs.	NEW COST in Rs.	IMPROVEMENTS
LEAD	1	1	No Change
WOOD	1.5	1.5	No Change
LID	0.25	0.1	Plastic Lid
WOOD SHAPE	0.5	0.1	Triangular Shape
PRINTING	0.8	0.8	No Change
COATING	0.15	0.15	Matte Coating
ERASER	0.8	0.8	No Change
TOTAL	5	4.45	No Change

iv. Assessment Phase

This phase is concerned with the alternate possibilities which could satisfy the same functions of the assembly. Many concepts are generated and discussed in the brainstorming conference. Following thoughts were made during this phase.

In the evaluation phase, the costing of the new ideas is done considering the monthly demand of 5000 pieces. The percentage saving and total per order are also calculated.

- Saving per product = ₹ 0.55/-
- % saving per product = 11 %
- Monthly demand = 8000
- The actual monthly overall cost = ₹ 40000 /-
- The new monthly overall cost = ₹ 35,600/-
- Total monthly saving = ₹ 4,400/-

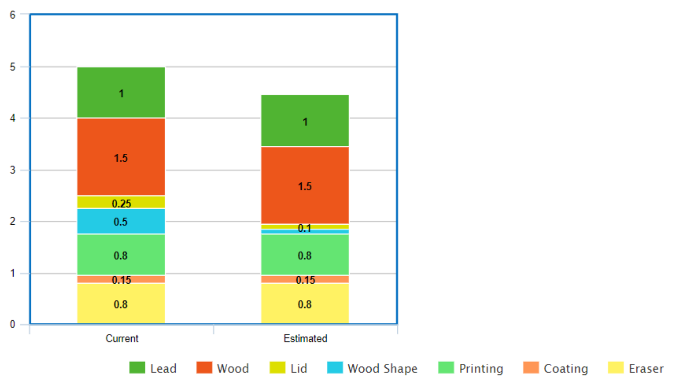

Chart 3: Current & Estimated costs

4. CONCLUSION

With the projected design changes, it is likely to cut the cost for the manufacturing of one unit of the pencil by 11%. It is a massive reduction in cost. The savings expected per order is ₹ 4400 /- which can be used for the further manufacturing of nearly 880 extra pencils. Along with the straight financial advantage, the manufacturing process would be made simpler which will result in the lesser production time. It will be possible to manufacture more products with the same given time for a lot. The new design will also give the product a more aesthetic look which will be more appealing to the customers. New concepts are also likely to attain more buyer fulfilment along with performance enhancement and cost saving.

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