COMPREHENSIVE STUDY OF COST CUTTING STRATEGY & IMPLIMENTATION IN INDUSTRY

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Abstract- In my thesis I worked on the cost reduction practice applied in an Industry. The applied tool in the thesis is "Value Engineering". According to value engineering the value of a product can be increased by reducing the cost of the product or by increasing the functionality of the product. I have selected an automotive company which manufactures headlamps for several reputed companies. I applied value engineering tool for the cost reduction in this industry by changing the material of a part (Adopter) of the headlamp. Adopter is used to hold the main bulb in the correct position. It was initially made up of Aluminum which costs Rs 20; I have changed this material with the Sheet Metal which costs Rs. 15. Not only this has the sheet metal adopter fulfilled all the necessary conditions which are expected from an adopter for the satisfactory fulfillment of the job.

Index Terms— VE-Value Engineering, FA-Functional Analysis, FE-Functional Evaluation, VA-Value Analysis, CW- Creativety Worksheet, FAW-Functional Analysis Worksheet & FD-Functional Development.

1 INTRODUCTION

The focus of my project is towards the Value Engineering. The value engineering acts as a tool to reduce the cost of a product. The application of value engineering is very much wide in the industries as in the competitive market cost reduction is the prime factor. Hence every industry in present scenario is applying their expertise to reduce the cost of the product.
Before understanding about value engineering it is important to understand that what is value and how value engineering plays its role in an industry.

Value= Function of the product/ cost

Value is dependent upon two parameters i.e. functionality of the product & cost of manufacturing. If we want to increase the value of a product; then it is necessary to increase the function of the part or by decrease the cost of the product. [4]

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Management recognizes Value Engineering but also recognizes its organizational limitations as a product line reaps the upfront Value Engineering savings and then struggles Engineering and purchasing department have current activities underway using Value Engineering workshops as a means of creating less costly products while proving the same or better function. One company reported that Value Engineering was dead due to company management's short term outlook of making profit. The company has always treated VE as a self-sufficient cost center harder every year to justify the future cost savings through Value Engineering for the same programs & parts in future. [1]

1.1 Thesis Outline

In my thesis I have worked in an industry dealing with the automobile head lamps & tail lamps. Here my focus is on the reduction of the cost of head lamps and by the virtue of Value Engineering. I have been able to reduce the cost of the head lamp by some amount.
Model has been prepared for deciding the parameters on which the cost reducing practice can be performed. This model helps in successfully accomplishing the test to get the desired output. The industry is a medium scale industry and deals with different automobile companies for the head & tail lamps

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2. IMPLEMENTATION

In this thesis I have chosen an automotive company which deals with the manufacturing of Head Lamps of most of the prestigious two-wheeler & four-wheeler companies.
The purpose of my thesis is to reduce the manufacturing cost of the Head lamp of any four-wheeler chosen. To start this cost reduction method I have chosen "Value Engineering" as a tool. [5]
Value Engineering is applied to the Head lamp. The steps used for this purpose are as follows:-

A. Functional Analysis Worksheet is prepared for the different parts of the product.
B. Functional Evaluation is done for each part.

C. Creativity Worksheet.
D. Selection of alternative is done.
E. Finding and Recommendation.
F. Conclusion.[2]

Above steps are selected for the cost optimization of the headlamp, these steps will help me in creating the structure of the experiment. Following structure starts with the Functional Analysis which deals with the description of the each component used in the headlamp. The next step is Functional Evaluation in which the cost of each component is estimated. [7]
Numerical evaluation is prepared on the basis of graph plotted between the components and the cost of them. This helps in identifying the cost difference among each other. This gives the idea to select the part to be replaced by other material.
Creativity worksheet deals with the methods can be applied in the present condition for the cost reduction. It helps in the proper selection of the direction in which the thesis work can be progress. This step is followed by finding and recommendation. Finally, the conclusion will be provided regarding the experiment done. [6]

2.1 FUNCTIONAL ANALYSIS WORKSHEET.

Table 2.1 Functional Analysis worksheet

SN	Qt	Part name	Function	
		Description	Verb	Noun
1	1	Reflector	Reflects	Beam
2	1	Glass Lens	Converge	Beam
3	1	Adopter	Holds	Bulb
4	1	Parking Bulb	Blinks	Parking light
5	1	Shadow Cap	Reflection control	Beam
6	1	Rubber Cap	Grips	Lens & Reflector
7	1	Main Bulb	Glows	Beam
8	1	Clamping Wire	Clamps	Main Bulb
9	1	Parking Holder	Holds	Parking Bulb

2.2 FUNCTIONAL EVALUATION.

Table 2.2 Functional Evaluation

S. No	Key Letter	Part	Function	Weight	Cost (Rs.)	% Cost
1	C	Adopter	Bulb resting & Holding	90g	20.3	16.40
2	H	Clamping Wire	Main Bulb Holding	.5g	1.6	1.29
3	B	Glass Lens	Beam Deflection	558g	24.9	20.22
4	G	Main Bulb	Beam Generation	24g	33.0	26.80
5	D	Parking Bulb	Parking light Illumination	5g	0.5	0.40
6	I	Parking Holder	Parking Bulb Holding	14g	6.2	5.03
7	A	Reflector	Beam Reflection	428g	29.5	23.96
8	F	Rubber Cap	Water entry prevention	26g	5.0	4.06
9	E	Shadow Cap	Beam Reflection control	6g	2.1	1.70

		Sum of the Parameters	**1151.5g**	**123.1**	**100%**

The following parts have been found costly from the Function Cost Evaluation.

1. Reflector.
2. Glass Lens
3. Adopter.

2.3 CREATIVITY WORKSHEET.

a) Thickness reduction of the sheet metal used in reflector.
b) Changing the material of reflector from sheet metal to some other cheaper material.
c) Changing the material of Adopter from Aluminum to some other cheaper material.
d) Elimination of the least important component .i.e. Shadow Cap.
e) Compounding of the Rubber Gasket. Rubber gasket is made an integral part of the headlamp assembly.

Now, it is required to review all the above possibilities of cost reduction.

2.4 SELECTION OF ALTERNATIVE.

Changing the material of reflector from sheet metal (iron base) to some other cheaper material**.**

- Alternative materials:

a) Change it to Plastic material (Polystyrene).
b) Change it to Iron- copper base alloys.
c) Change it to Composite material (composed of Sheet metal & carbon fiber).

2.5 Functional Development

Table 2.3 Functional Development of Reflector.

S. No.	**Function**	**Creative ideas and Development.**	**Estimated cost(Rs.)**
1	**Reflector**	Use plastic material (Polystyrene).	20.50
Sheet Metal cost-29.5		Use Fe-Cu base alloys.	29.35
		Use Composite materials (Composed of Sheet metal & carbon fiber).	29.25

From above cost estimation we find that the original cost of the product was Rs. 29.5 and the two alternate has not significant cost reduction but if we select the plastic material then it will help us in the cost reduction by changing the material of Reflector. But, after selection of an alternative we have to check the feasibility of its application by performing various tests on it.

2.5.1 Tests conducted on the material to check the feasibility of the operation.

a) Vibration Test.
b) Photomatic Test.
c) Reflector Peel-off Test.

a) Vibration Test.

Table 2.4 Vibration Test Report of Plastic Material

Parameters	**Test Report**	**Remark**
1	Frequency 10-55-10 Hz	OK( )/ NOT OK(*)
2	Duration 3-6 Hrs.	
3	Amplitude 1.5mm.	
4	Axis of Vibration (X-Y-Z) 1 min at each axis.	
	. Material defects found. . Lens or reflector rotation. .Displacement or rupture of parts.	Y/N (Y) Y/N (Y) Y/N (N)

From the above test we find that the plastic material used for reflector fails to sustain in the Vibration test. Hence, we are stopping our experiment and we are not going for Photomatic test and Reflector Peel- off test.

2.5.2 Functional Development

Table 2.5 Functional Development of Adopter

S. No.	**Function**	**Creative ideas and Development.**	**Estimated cost(Rs.)**
2	**Adopter**	Use of Composite materials (Composed of	20.10

		Al and iron-oxide.)	
Aluminum cost-Rs 20.3		Use of plastic material (Polystyrene).	12.20
		Use Sheet Metal material (iron base).	15.15

From the above table we have three alternatives and from the price point of view it is cheaper to select Plastic (Polystyrene) as a material for Adopter. Although, the composite materials can also be used for cost reduction but we would not find the expected cost reduction.

a) Vibration Test.

Table 2.6 Vibration Test Report of Composite Material

S.N	Test Report	Remark
1	Frequency 10-55-10 Hz	OK( )/ NOT OK(*)
2	Duration 3-6 Hrs.	
3	Amplitude 1.5mm.	
4	Axis of Vibration (X-Y-Z) 1 min at each axis.	
	. Material defects found. . Lens or reflector rotation. .Displacement or rupture of parts except filament.	Y/N (Y) Y/N (Y) Y/N (N)

Unfortunately Thermosetting Plastic don't pass the vibration test, hence we are compel to select the next alternative i.e. Sheet Metal, but to finalize the selected material i.e. Sheet Metal (iron base) as Adopter it will have to pass several test as discussed in the previous sections.

2.5.3 Tests conducted on the material to check the feasibility of the operation.

a) Vibration Test
b) Photomatic Test.
c) Reflector Peel-off Test.

a)Vibration Test.

Table 2.7 Vibration Test Report of Sheet-Metal

Parameters	Test Report	Remark
1	Frequency 10-55-10 Hz	OK(*)/ NOT OK( )
2	Duration 3-6 Hrs.	
3	Amplitude 1.5mm.	
4	Axis of Vibration (X-Y-Z) 1 min at each axis.	
	. Material defects found. . Lens or reflector rotation. .Displacement or rupture of parts except filament.	Y/N (N) Y/N (N) Y/N (N)

b) Photomatic Test.

Table 2.8 Photomatic Test of headlamp using Sheet-Metal Adopter

Parameters	Test report	Remarks
1	Distance -25 meters	OK(*)/ NOT OK( )
2	Cut- off angle-15^0	OK(*)/ NOT OK ( )
	. Object at 25m visualize easily. . Cut-off is perfect.	Y(*) / N ( ) Y(*) / N ( )

c) Reflector Peel-off Test/ Tape Test

Table 2.9 Reflector Peel-off Test

S. No	Test Report	Remarks
1	Tape Test-I	OK(*)/ NOT OK
2	Tape Test-II	OK(*)/ NOT OK
3	Tape Test-III	OK(*)/ NOT OK

Fortunately, this time this material has passed the entire test required for comfortable use as the Adopter. Hence, according to the test conducted we are replacing the Adopter material from Aluminum to Sheet Metal. This will save about Rs 5 for each Adopter.

3. Findings and Recommendation

I got the result that by applying all the available alternatives Sheet- metal is the most suitable material used as an adopter, which can successfully reduced the raw material cost.

4. Conclusion.

Sheet-metal as an alternative material for adopter in place of Aluminum we can save upto Rs. 5 for each adopter as an inventory cost.

According to the Functional Evaluation sheet we have estimated the cost of the headlamp is about Rs. 123.10, this cost is the inventory cost of the entire component used in the headlamp. When the Adopter material is replaced from Aluminum to Sheet-metal, then it is found that the total cost of the product will be reduced up to Rs. 5 i.e. we are successfully reduced the inventory cost of the headlamp from Rs 123.10 to Rs. 118.10.

The sheet-metal not only fulfills the cost related issues but also finds suitable in other parameters also. This follows the various test based on the various application in the working condition. This is provided by the Vibration test, Photomatic test and the reflector peel off test carried on the whole assembly.

5. FUTURE REFERENCES

Adopter is made up of Aluminum which has been successfully replaced by the sheet-metal, which saves Rs. 5 per adopter. The sheet-metal fulfills all the desired properties which an Adopter needs. The cost of the headlamp can further be reduced by searching other alternatives for the adopters. The cost can also be reduced by changing the material of the Reflector from the cheaper alternative.

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