

Implementing Value Engineering for Designing a Student Friendly Wardrobe

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Abstract— Value Engineering is a proven management technique that can make valuable contributions to value enhancement in design of a Student Friendly wardrobe. This paper presents the tools used in Value Analysis Value Engineering (VAVE) methodology; Functional Analysis, Functional Evaluation and Decision Matrix, which gives the most appropriate results when implemented during New Product Development (NPD) phase. The Student Friendly wardrobe (1) has a Bed (2) Computer table (3) Study table (4) chairs (5) Dining table (6) Ironing board (7) Sofa. Everything is integrated to the wardrobe to increase the value of the product and decrease the space consumption. Wardrobe is redesigned through its functions in order to meet customer requirements of having higher value furniture, by increasing functions while there is slight increase in the cost without scarifying the quality, salability and maintainability.

Keywords: Value Analysis, Functional Areas, Design of Wardrobe

I. INTRODUCTION

Value engineering is a systematic and organized approach to providing the necessary functions in a product at the lowest cost. Value Engineering analysis techniques can be applied to any product and can be for a process procedure system or service in different kind of business or market activity including health care, construction, industries and in the service sector areas. It is a primary aspect of value engineering such that basic functions can be preserved for the value improvements. Its main significant for improvements of quality and reliability of the product by focusing on the functions that are identify most to the problems, and the most likely reason behind these problems.

II. THE CONCEPT OF VALUE

Value is the lowest possible cost of a product or service performing a useful and essential function with required quality and reliability.

A. Types of Values

1) Use Value

Which is based on those properties of the product, which enable it to perform work or service

2) Cost value

Which is based on the minimum cost of achieving a useful function.

Category of 'value'	Examples
Use value	Nail
Cost value	Bus fare
Esteem value	Gold watch
Exchange value	Antique furniture

3) Esteem Value

Which is based on those properties of the product, which contribute to pride of ownership.

4) Exchange Value

Which is based on those properties which make a product valuable for exchange purposes. Examples of the different categories of value are:

III. ADVENT OF VALUE ANALYSIS

Value engineering began at General Electric Co. during World War II. Because of the war, there were shortages of skilled labor, raw materials, and component parts. Lawrence Miles and Harry Erlicher at G.E. looked for acceptable substitutes. They noticed that these substitutions often reduced costs, improved the product, or both. What started out as an accident of necessity was turned into a systematic process. They called their technique "value analysis".

A. Definition of Value Analysis

According to Lawrence D Miles, "A problem solving system which has an organized and a creative approach which has its purpose of effective identification of unnecessary cost which neither provides quality nor use, not appearance nor customer feature is called Value Analysis."

B. Objectives & Scope of Value Engineering

- Reduce Cost
- Reduce Time
- Reduce Risks
- Improve Quality
- Improve Profitability
- Improve Serviceability

IV. VAVE METHODOLOGY

The four different segments of VAVE methodology used for this study was enhanced base on the Value Analysis Study Activity Chart (VASAC) which has covered the three out of seven phases from engineering design process; conceptual design, embodiment design and detail design. The first two segments were overing the first phase of engineering design-process.

V. INFORMATION PHASE

A wardrobe or armoire is a standing closet used for storing clothes. The earliest wardrobe was a chest, and it was not until some degree of luxury was attained in regal palaces and the castles of powerful nobles that separate accommodation was provided for the apparel of the great. The name of wardrobe was then given to a room in which the wall-space was filled with closets and lockers, the drawer being a comparatively modern invention. From these cupboards and lockers, the modern wardrobe, with its

hanging spaces, sliding shelves and drawers, evolved slowly.

A. Origin of Wardrobe

In the United States, the wardrobe in its moveable form as an oak "hanging cupboard" dates back to the early 17th century. Consequently, the item was sometimes referred to as an oakley. For probably a hundred years, such pieces, massive and cumbersome in form, but often with well-carved fronts, were produced in moderate numbers; then the gradual diminution in the use of oak for cabinet -making produced a change of fashion in favour of the more plentiful American walnut. In the nineteenth century the wardrobe began to develop into its modern form, with a hanging cupboard at each side, a press in the upper part of the central portion and drawers below. As a rule, it was often of mahogany, but as satinwood and other previously scarce, fine-grained, foreign woods began to be obtainable in considerable quantities, many elaborately and even magnificently inlaid wardrobes were made.

B. Function of Wardrobe

The main function of a wardrobe organizer is to help you get rid of the mess. This is perfect little accessory for storing a variety of items – from clothes to jewellery. All in all, this is a compact and fully functional substitution for a set or shelves or drawers. At the same time, a typical wardrobe organizer is designed for storing lots of smaller items.



Fig. 1: Existing Wardrobe

C. Case Study

It is done on a wardrobe. Value Analysis is performed in the following steps on the design of a wardrobe.

- 1) Functional Analysis Worksheet is prepared for the different parts of the product.
- 2) Functional Evaluation is done of each part
- 3) Numerical Evaluation Sheet is prepared
- 4) Creativity Worksheet formulated
- 5) Selection of alternative is done through Decision Matrix
- 6) Conclusion

VI. FUNCTIONAL PHASE

The functional phase being one of the most powerful techniques in Value Engineering makes it possible to detect the precise areas where unnecessary costs originate. With this objective in mind, the assembly and their study are broken down into its parts to determine which part perform the basic function and which part/parts perform the secondary function.

A. Function Analysis Table

Detailed Function Analysis of different parts of wardrobe as shown in the table below

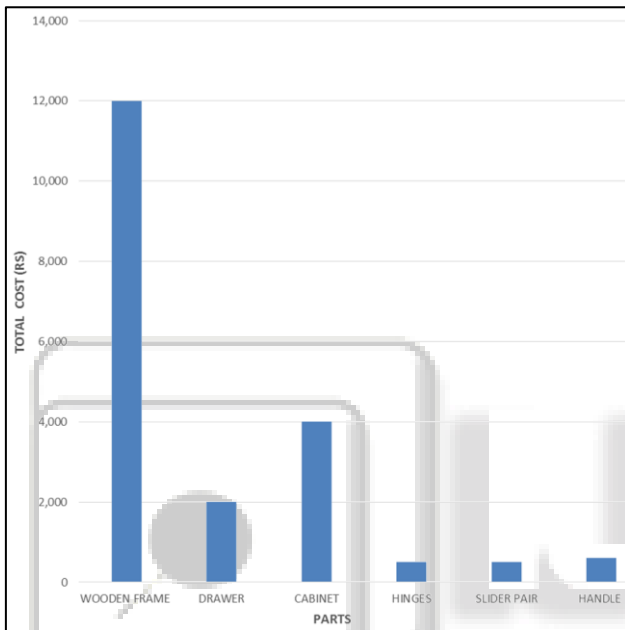
PART NAME	QTY	FUNCTION		PART	
		VERB	NOUN	BASIC	SECONDARY
WOODEN FRAME	1	HOLD	ASSEMBLY	X	
		HOLD	PARTS		X
		PROVIDE	STORAGE		X
		PROVIDE	STRENGTH		X
DRAWER	2	PROVIDE	STORAGE	X	
		IMPROVE	APPEARANCE		X
		IMPROVE	APPEARANCE		X
CABINET	13	SUPPORT	FRAME		X
		PROVIDE	STORAGE	X	
HINGES	4	HOLD	ASSEMBLY		X
		PROVIDE	STRENGTH		X
		PROVIDE	GRIP	X	
SLIDERS	4	HOLD	MATERIAL		X
		MOVE	MATERIAL	X	
HANDLE	4	PROVIDE	GRIP	X	
		IMPROVE	APPEARANCE		X

Table 1: Function Analysis Worksheet

Costing of different parts of wardrobe as shown in the table below:

SL.NO	PART	QUANTITY	TOTAL COST(Rs)
1	WOODEN FRAME	1	12,000
2	DRAWER	2	2000
3	CABINET	13	4000
4	HINGES	4	500
5	SLIDER PAIR	2	500
6	HANDLE	4	600
			19,600

Table 2: Total Costing of Wardrobe Parts
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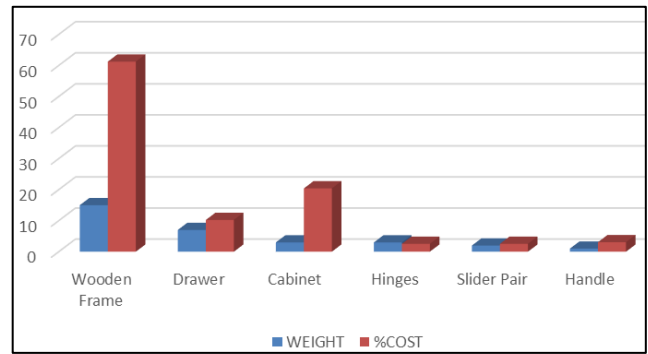
Graph 1: Cost of Each Part of Wardrobe (in Rs) Functional

1) Functional Evaluation

Detailed Functional Evaluation Of different parts of divan bed with weight and percentage cost in the product as shown in the table

KEY LETTER	PART	FUNCTION	WEIGHT	%COST
A	Wooden Frame (Complete)	Hold Assembly	15	61.24
B	Drawer	Hold Material	7	10.24
C	Cabinet	Provide Storage	3	20.4
D	Hinges	Support Frame	3	2.55
E	Slider Pair	Provide Movement	2	2.55
F	Handle	Provide Grip	1	3.06

Table 3: Function Evaluation



Graph 2: Parts and % Cost

Numerical Evaluation Sheet

	B	C	D	E	F	
A	A3	A3	A3	A3	A3	15
	B	B1	B1	B3	B2	7
		C	C1	C1	C1	3
			D	D1	D2	3
				E	E2	2
					F	1

- Major Performance -3
- Medium Performance - 2
- Minor Performance - 1

VII. CREATIVE PHASE

The central theme of the creative phase is “what else could do the same needed function?” the ranking of the function based on the value gap in descending order, is the indicator to which one must pinpoint in order to get the maximum advantages. In order to more ideas, the group restored to the brainstorming technique. The following ideas were generated during this phase,

- 1) Wardrobe.
- 2) Common Shelf.
- 3) Bags or Suitcases.
- 4) Usage of Big boxes.
- 5) Student Friendly wardrobe.

Ideas → No. of Parameters ↓	1	2	3	4	5
Durability	1	0	1	0	1
Maintenance	0	1	0	0	0
Ease of use	1	1	1	1	1
Compactness	1	0	0	0	1
Appearance	0	0	0	0	1
Total	3	2	2	1	4
%	30	20	20	10	40

1: Yes and 0: No

Table 4: Forced Decision Matrix

VIII. EVALUATION PHASE

The evaluation phase enables us to select the most feasible ideas which also meet the required criteria. Rank each idea from 1 to 10 for the below shown factors. We use our judicial ability for ranking and discard non- feasible ideas.

Sl. No	Ideas	State of art	Probability of Implementation	Cost of Development	Time to implement	Rating
		10:Offthe shelf	10: High Chance	10: High Cost	10: No time	
		1 :New Technology	1: Low Chance	1 : Low Cost	1: Maximum time	
1	Wardrobe	5	6	7	7	25
2	Common Shelf	8	5	5	8	26
3	Bags or Suitcases	6	4	4	9	23
4	Usage of Big boxes	7	3	1	8	19
5	Student friendly Wardrobe	3	9	8	7	27

Table 5: Feasibility Ranking Matrix

IX. DEVELOPMENT PHASE

This phase allows the manufacturers to determine the most preferred alternatives amongst the various proposed alternatives. Advantages and Disadvantages are listed and ranked to determine which alternative should be implemented

Sl. No	Ideas	Ranking	Advantages	Disadvantages
1	Wardrobe	2	Sufficient storage	Uni-function
2	Common Shelf	3	Easy access & light weight	Less Durable
3	Student friendly Wardrobe	1	More efficient & Multi-purpose	Increased Weight

Table 6: Ranking of Preferred Ideas

Parameters Weightage	Performance Rating	Cost Benefit Rating	Customer Satisfaction rating	Total
Alternatives	9	8	7	
Common shelf	2	1	2	40
Student friendly Wardrobe	18	8	14	79
Existing Product-Wardrobe	3	3	4	27
	27	24	28	
	2	2	3	55
	18	16	21	

Table 7: Evaluation Matrix

X. RECOMMENDATION PHASE

The Evaluation Matrix indicated that alternative of Multi-functional Wardrobe is preferred to the existing product and to the Common shelf. The function benefit analysis is done

for the preferred alternative and the existing one as shown below

Situation Before- Existing Product	Situation After- Student friendly wardrobe
Less efficient	More efficient
Used only for storage	It contains Bed, computer table dining table, sofa, closet, chair, study table
Less Economical	More Economical

Table 8: Comparison Table

XI. PRESENTATION PHASE



Fig. 2:



Fig. 3: Front View



Fig. 4: Chair



Fig. 5: Computer Table/ Study Table



Fig. 6: Bed



Fig. 7: Sofa



Fig. 7: Dining Table/Ironing Board



Fig. 8: Front View of Student Friendly Wardrobe

A. Key Points on Implementation

- Improved Space Usage
- Higher Return-on-Investment
- Increased functionality
- Better Ergonomics
- Higher Consumer Satisfaction
- Lesser Lead time

XII. CONCLUSION & FUTURE SCOPE

The Value Engineering process and procedures are generally well defined and well-understood at all levels in the industry. Value Engineering has well formulated techniques of evaluation of cost and functions of the product considering key criteria like consumer satisfaction, durability, time lead and so on. It is more effective and influential on the performance, quality, and cost of a product

when done relatively early in the production schedule. In the Case Study discussed above we have seen how the VE is used for increasing the function with change in the product design & its value. We have tried to implement these potential ways to improve the function of the product. The results of our study show that the traditional wardrobe serving the purpose of storage is evidently improved by adding functions of computer table or study table, dining table with chairs or ironing board, bed, sofa. A proper decision matrix is prepared for choosing the appropriate alternative from the feasible choices available. 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 techniques can be even made use in further improvement of product.

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