Selection of Maintenance Practice through Value Engineering

Prof. Malay Niraj

Abstract --In this study the techniques of value engineering have been studied for finding the suitable maintenance practice. Value engineering is a one of the most powerful decision making techniques which depends upon factor. The VE process identifies; opportunities to remove unnecessary costs while assuring that quality, reliability, performance, and other critical factors will meet or exceed the customer's expectations. The improvements are the result of recommendations made by multidisciplinary teams representing all parties involved. VE is a rigorous, systematic effort to improve the value and optimize the life cycle cost of a facility. Using factor comparison study has been made between different maintenance practice .and finally select best maintenance practice based of value engineering.

Key-words- Maintenance Practice, Functional Analysis, Value engineering

1. INTRODUCTION

VE is the most popular technique amongst all Industrial Engineering (IE) techniques for cost reduction.VE cells are available in all the Leading industries like TML, SAIL, and BHEL etc. The leading national body, INVEST is selling the concept of VE through seminars etc. and well appreciated by all Managements,VE is a decision making technique for selection of best of one. Decision is what we do when we solve a problem. Decision maker and engineering are linked together in most of projects. When decision maker solve a problem or satisfy a need, they often use appropriate engineering technology. Appropriate technology can be low or high technology. It is any type of technology that suits the way it is being used. Therefore VE plays an important role in determining the situation and in choosing better Engineering solution. Value engineering approach [1] is selected as a communication platform between industrial designers and engineering designers. Expanding on the meaning of value, the product needs to be not only mechanically efficient but also to satisfy human needs, which are often irrational. Value engineering is based on function analysis and customer information to optimize design related factors in particular situations, and has been utilized in the construction industry for many years.

Mr. Lou [2] studied value engineering and risk management. In a complicated system development, the decision is made through an organization structure, which consists of people with different backgrounds. The undetermined factors in the project often confuse the team member in decision-making. Value engineering can be utilized as a systematic development framework and can be helpful in risk management.

Mr. Kou [3] studied the vertical cooperate framework in Taiwan's electronic industry. The research investigated the switching mode power supply industry to find out how to use value engineering to enhance the product function, reduce the product size and keep the thermal management ability within a reasonable range. Function modeling analyzed the product based upon the functions of its components and outside elements [4]. These outside elements, which intersect in a relevant way with the components of the system, are called super system elements. By defining functions, we are able to describe the problematic interaction and the performance of the system at a higher level of abstraction. Functions are relationships between components and are performed to affect the parameters and the characteristics of the components. Functions can be described as useful and harmful functions. The qualitative definition of function is then provided the actual value of function's parameters, the acceptable value of parameter as well as the ideal value .Sharma, D.V.S [5] again has beautifully applied the techniques of VE in elimination of child lab our in his article presented in the seminar in Indian Institution of Industrial Engineering and published in the proceeding of IIIE.According to O'Brien, J.J [6] VE Recognizes the increased benefit from early implementation.

A decision that improves quality but increases cost to a point where the product is no longer marketable is as unacceptable as one to avoid confusing the cost with value. If added cost does not improve quality or the ability to perform the necessary functions, then value is decreased. Three basic elements provide a measure of value to the user: function, quality, and cost. These elements can be interpreted by the following relationship:

Value=Function Quality/Cost

Where: Function = the specific work that a design/item must perform.
Quality = the owner's or user's needs, desires, and expectations.
Cost = the life cycle cost of the product.

Therefore, we can say that:
Value = the most cost-effective way to reliably accomplish a function that will meet the user's needs, desires, and expectations. The main objective of VE is to improve value, and VE techniques can overcome many of the roadblocks to achieving good value.

2. PHASE OF VALUE ENGINEERING

Selection phase: The following parameters have been selected for value analysis.

- **Cost**
- **Safety**
- **Quality**
- **Severity factor**
- **MTTR**

Cost: According to cost the following points are given to the different maintenance practice for cost through comparison, here less cost of maintenance has more value than high cost of maintenance, so low cost car getting more value.

Table 1: Value point for cost

Maintenance type	Point out of 10
Break down maintenance	9
Maintenance prevention	8
Corrective maintenance	7
Condition base maintenance	6
Time base maintenance	5

Safety: The following points are given to safety; here maximum point got more safe maintenance practice.

Table 2: Value point for safety

Maintenance type	Point out of 10
Break down maintenance	4
Maintenance prevention	7
Corrective maintenance	7
Condition base maintenance	8
Time base maintenance	9

MTTR (Mean time to repair): It is a ratio of repair time to frequency of failure & it should be less for best maintenance practice so have a less MTTR got maximum weight.

Table 3: Value point for MTTR

Maintenance type	Point out of 10
Break down maintenance	4
Maintenance prevention	5
Corrective maintenance	6
Condition base maintenance	8
Time base maintenance	9

Quality = It can be define as an owner's or user's needs, desires, and expectations. Here we give better point to good maintenance practices.

Table 4: Value point for quality

Maintenance type	Point out of 10
Break down maintenance	4
Maintenance prevention	6
Corrective maintenance	6
Condition base maintenance	8
Time base maintenance	8

Severity factor: It represents the effect level of failure on the equipment on the basis of downtime, scrap rate and safety .It should be less for best maintenance practice, so best maintenance practice got maximum point.

Table 5: Value point for severity factor

Maintenance type	Point out of 10
Break down maintenance	3
Maintenance prevention	5
Corrective maintenance	6
Condition base maintenance	8
Time base maintenance	8

Evaluation phase: in this phase we have chosen factor comparison method to evaluate the maintenance practice which has most value.

(a) FACTORS OF SELECTION

1) Cost (A)
2) Safety (B)
3) MTTR (C)
4) Quality (D)
5) Severity factor (E)

(b) DEGREE OF IMPORTANCE

- Major Difference (3)
- Medium Difference (2)
- Minor Difference (1)
- No Difference (0)

(c) FACTOR COMPARISON TABLE

Assuming one company has the following requirements while selecting maintenance practice

- **Cost -** Aveg.
- **Safety**- High
- **MTTR** -Very high
- **Quality** -High
- **Severity factor**- Very high

Table 6: table for paired comparison

Cost (A)	Safety (B)	MTTR (C)	Quality (D)	Severity (E)	Total weight	Adjusted. Weight
A	B_2	C_1	A_1	E_1	1	2
	B	C_1	B_2	E_2	2	3
		C	C_1	C_2	3	4
			D	E_2	2	3

Maintenance type	Cost	Safety	MTTR	Quality	Severity	Total score
	A 2	B` 3	C 4	D 3	E 4	
BM	9 (8)	4 (12)	4 (16)	4 (12)	3 (12)	70
MP	8 (16)	7 (21)	5 (20)	6 (18)	5 (20)	95
CM	7 (14)	7 (21)	6 (24)	6 (18)	6 (24)	101
CBM	6 (12)	8 (24)	8 (32)	8 (24)	8 (32)	124
TBM	5 (10)	9 (27)	9 (36)	8 (24)	8 (32)	129
				E	3	4

Table 7: table for criteria evaluation matrix

The proposed processes for maintenance practice are based on weighted points scored as shown in evaluation matrix table. And finally TBM Maintenance practice get highest point, and alternately it should be selected as a best maintenance.

3. RESULT

With the help of VE we evaluate one of the best Maintenance practice, in this study we had taken five parameters for selection of Maintenance practice which are Cost, Safety, MTTR, Quality and Severity, and with the help of different phase of VE we found the best maintenance practice as a TBM since it got highest score point in evaluation phase.

4. CONCLUSIONS

The study is very helpful for new industry or small scale industry for selecting the best maintenance practice for economic point of view it is new concept for selection of maintenance practice and enhance the moral of employee for taking a strong decision. The time consumption for taking a decision is less in this concept comparison to other technique with the help of VE
Some of the salient features of the proposed model include-

- VE has emerged as the most effective and appropriate management tool for achieving quick result in cost reduction through best maintenance selection.

- It is a technique with immense possibilities, and systematically employed, it can achieve great economies and increased efficiency.

ACRONYMS

VE-Value Engineering
TML-Tata motors LTD.
SAIL-Steel authority of India
BHEL-Bharat heavy electrical LTD**.**
INVEST-Indian value engineering society
MTTR-Mean time to repair
BM-Breakdown maintenance
MP-Maintenance prevention
CM-Corrective maintenance
CBM-Condition base maintenance
TBM-Time base maintenance

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Malay Niraj
Assistant Professor
Mechanical Engineering Department, National Institute of Technology, Jamshedpur, INDIA
E-mail: malay9mednit@yahoo.in