

# **Application of Value Analysis for Increasing the Value of Industrial Products: A Case Study**

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## **Abstract**

The current state of global business competition is resulting in an ongoing struggle for a sufficient market share, which is typically not only attained by lowering prices but is instead more successfully accomplished by continuously introducing new innovations, functions, and features at all levels in a company. But the consumers are not getting the proper value and desired functionalities from a market product. This paper is about analyzing the value of an industrial product which is a rechargeable fan. Product value is determined by comparing between systematic features and product costs. The main focus of VA is to identify and get rid of product or service features that don't really add value for the customer but add costs to the production process. In contrast to replacing the old product with a less desirable substitute, the VA method guarantees a better product or service for the consumer at a low cost. This study seeks to present a comprehensive analysis of using the TRIZ method in raising the value of a rechargeable fan. The recommendation stage explains the best alternative design for a rechargeable fan and the changes that should be made to increase the value of the product.

## **Keywords:**

Innovation, Value analysis, TRIZ.

## **1. Introduction**

In today's competitive world, customers are attracted to the best products and services as a result companies are trying to ensure the highest quality products and services at a low cost to meet the requirements of the customers. We are becoming technologically prosperous thanks to science which makes our life much easier and more comfortable. Lots of works are being done to solve the problems we face in our daily life. Among them, the rechargeable fan is undoubtedly a timely invention. However, sometimes we don't get the service we expect from these inventions. In our case, we were concerned about those drawbacks, and based on that we tried to solve them methodologically. Much effective work was done in the past and is still being done on various electronic devices, but very little work is being done on rechargeable fans. So, we selected rechargeable fan as our field of research and tried to increase their value. In this case, all the components of a rechargeable fan, their individual prices, their functions, and other important information related to it have been prioritized. Based on this, a suitable approach has been implemented to increase the value of rechargeable fans from the customer perspective.

Due to global warming in the current situation, the temperature and air humidity are constantly increasing. On the other hand, inadequate power supply has made our daily lives even more intolerable. For this reason, we are focusing on rechargeable fans in our case. Note that, several issues like high cost, low battery backup, short lifetime, and high servicing cost are found in the existing rechargeable fans. Among these problems, high cost is currently the main one.

### **1.1 Objectives**

As the high cost becomes the main issue, so we tried to reduce the cost by fixing the functionality of the rechargeable fan based on the needs of the customers. To do so, we planned to conduct a "Value Analysis" of a particular model of rechargeable fan by collecting all the necessary information including specifications and their corresponding cost.

## **2. Literature Review**

'Value Analysis' can be conducted as a process for systematically improving the "value" of goods, services, or products, particularly in terms of their "functions" (Leber M. et al.,2014). Value analysis is established as a creative process that strives to precisely and profitably identify and eliminate unnecessary



### 3.2: 40 Inventive Principles of TRIZ:

There are well known 40 inventive principles such as 1. Segmentation, 2. Extraction, Separation, Removal, Segregation, 3. Local Quality, 4. Asymmetry, 5. Combining, Integration, Merging, 6. Universality, Multi-functionality, 7. Nesting, 8. Counterweight, Levitation, 9. Preliminary anti-action, Prior counteraction, and 10. Phase transformation and so on. Here only few are mentioned. Details will be found in literature.

## 4. Data Collection

We collected information from ‘Walton Hi-Tech Industries Limited. Gazipur, Dhaka, Bangladesh’ about W170A-AS (Type- Rechargeable fan), model's Specifications (Materials, dimensions, power, speed, battery backup, warranty etc.), cost of each component etc. As per their information and market value we estimated labor cost and transportation cost per fan. Through all these data analysis, we aimed to increase the value of rechargeable fan.

### 4.1 Specifications:

Model no: W170A-AS (Type- Rechargeable fan)

#### Relevant Costs:

Total estimated manufacturing cost per fan:  $(4990/2.5) = 1996$  TK

Estimated labor cost per fan: 100 TK

Estimated transportation cost: 13.5 TK (Approximate)

Table 4.1: Data for the Pareto Chart

Factors	Price (Tk)	Cumulative Price	Cumulative %
Battery	900	900	28
Motherboard	600	1500	46
Keypad	400	1900	58
Motor	370	2270	70
Motor Accessories	250	2520	77
Grill (Fan net)	150	2670	82
Blades	100	2770	85
Stand	100	2870	88
Base	100	2970	91
Gear Box	100	3070	94
AC Charger Cable	40	3110	96
Oscillation Switch	30	3140	97
Transportation Cost	13.5	3153.5	97
Labor Cost	100	3253.5	100

### 4.2 Bill of Materials (BOM):

Table 4.2: Bill of Materials (BOM) of W170A-AS (Type- Rechargeable fan)

Components	Quantity	Material	Unit cost (TK)	% of cost
Blades	3	PP	100	3.18
Grill (Fan net)	2	Mild Steel	150	4.78
Motor	1	-	370	11.78
Battery	1	Lead (Pb)	900	28.66
Stand	1	ABS	100	3.18
Base	1	ABS	100	3.18
Motherboard	1	-	600	19.12
Oscillation Switch	1	Plastic	30	0.96
Keypad	1	-	400	12.75
Motor Accessories	1	-	250	7.96
Gear Box	1	-	100	3.18
AC Charger Cable	1	Cu	40	1.27
		<b>Total</b>	<b>3140</b>	<b>100</b>

### 4.3 Function Analysis:

Table 4.3: Function Analysis

Unit	Component name	Functions		Function Classification	
		Verb	Noun	Basic	Secondary
3	Blades	Circulate	Air	✓	
2	Grill (Fan net)	Protect	Human body	✓	
		Cover	Blades		✓
1	Motor	Rotate	Blades	✓	
1	Battery	Store	Power	✓	
1	Stand	Support	Upper parts	✓	
1	Base	Hold	Body	✓	
		Support	Body		✓
1	Motherboard	Control	System	✓	
1	Oscillation Switch	Oscillate	Upper parts	✓	
1	Keypad	Receive	Commands	✓	
1	Motor Accessories	Hold	Motor	✓	
1	Gear Box	Transmit	Power	✓	
1	AC Charger Cable	Charge	Battery	✓	
		Provide	AC Supply		✓

Through this "Function Analysis", the functions of each component of the rechargeable fan of this model were arranged in the form of their basic and secondary functions.

## 5. Results and Discussion

In this Rechargeable fan [W170A-AS (Type)], we faced some conflicts among some parameters which were mainly caused by the battery. Battery contributes the highest percentage of the cost. We tried to apply the "TRIZ (Theory of Inventive Problem Solving)" method to solve these conflicts.

**5.1 Selected Parameters of the Contradiction Matrix:** [The Contradiction matrix consists of 39 improving and worsening features]

The factors Speed (9), Power (21), Loss of Energy (22) and Productivity (39) are contributing more. Contradiction prevailing, between 21 vs 9, 9 vs 22, 21 vs 27 and 21 vs 39, are more prominent. These are shown in table 5.1.

Table 5.1: Contradiction between the parameters

Parameter to improve	Parameter to deteriorate
21	9
9	22
21	39

## 5.2 Alternatives

**TRIZ innovative solutions (According to 40 TRIZ Principles)**

Table 5.2: Alternative solutions

21 vs 9	15,35,2
9 vs 22	14,20,19,35
21 vs 39	35,20,10

### 5.3 Proposed Solution

Since principle no. 35 was enlisted as a common innovative solution to the above 3 contradictions, we selected principle no. 35 as our proposed solution.

#### Principle 35: Transformation of Properties (Parameter Changes)

##### Change the physical state of the system:

We can change the physical appearance of the rechargeable fan (such as: using a thinner blade, lightweight grill & changing the blade material etc.)

##### Change the concentration or density:

We can use the low-density material (such as: HDPE, LDPE) which are better than PP that makes the product lightweight.

##### Change the degree of flexibility:

We can eliminate the unnecessary functions of the rechargeable fan (such as: USB charging port, LED lights etc.) which just adds more cost into it.

In our case, we applied the “TRIZ” method to do value analysis where parts and components of the rechargeable fan, as well as transportation cost and labor cost were considered. It made our work more specific. Since rechargeable fan is an existing product, we tried to increase its effectiveness by applying “TRIZ”. Here, we tried to eliminate the contradiction of various parameters related to the battery to reduce the cost which is comparatively less time-consuming and also requires less effort.

In our case, we only considered the contradictions of the battery and these related parameters but the contradictions of the other parts of a rechargeable fan that contribute to increase costs was not considered. Since we didn’t work on all the functionalities, there could be much better scope to increase the overall value.

### 5.1 Numerical Results

#### Pairwise evaluation of the function important weight:

Here, the component with the highest weighting factor is determined through a pairwise comparison. Thus, we determined that ‘Battery’ contains the highest weighting factor in this model of rechargeable fan. So, the battery has a major role in improving the value of a rechargeable fan.

Figure 5.1: Pairwise evaluation of the function important weight

Components	Blades	Grill (Fan net)	Motor	Battery	Stand	Base	Motherboard	Oscillation Switch	Keypad	Motor Accessories	Gear Box	AC Charger Cable	Score	Weighting Factor
Blades	-	1	0	0	1	0	0	1	0	1	0	1	5	7.35
Grill (Fan net)	0	-	0	0	1	0	0	1	0	1	0	0	3	4.41
Motor	1	1	-	0	1	1	0	1	1	1	0	1	8	11.76
Battery	1	1	1	-	1	1	1	1	1	1	1	1	12	17.65
Stand	0	1	0	0	-	0	0	1	0	1	0	0	3	4.42
Base	0	1	0	0	1	-	0	1	1	0	0	1	5	7.35
Motherboard	1	1	1	0	1	1	-	1	1	1	1	1	11	16.18
Oscillation Switch	0	0	0	0	0	0	0	-	0	1	0	0	1	1.47
Keypad	1	1	0	0	1	0	0	1	-	1	0	0	5	7.35
Motor Accessories	0	0	0	0	0	1	0	0	0	-	0	1	2	2.94
Gear Box	1	1	1	0	1	1	0	1	1	1	-	1	9	13.24
AC Charger Cable	0	1	0	0	1	0	0	1	1	0	0	-	4	5.88
												Total	68	100

### 5.2 Graphical Results

#### Pareto Chart:

This Pareto Chart shows that 30% of the components (Battery, Motherboard, Keypad & Motor) account for 70% of the cost.

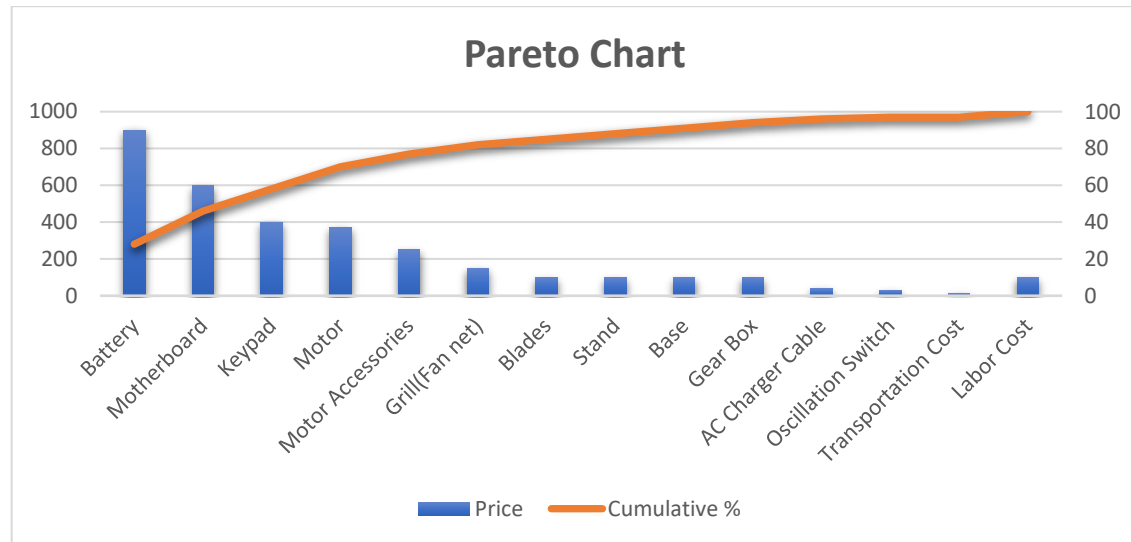


Figure 5.2: Pareto Chart of all costs

### 5.3 Proposed Improvements

Among the problems we faced in the use of rechargeable fans, we dealt with high costs in our case. Later, there is an opportunity to work on other drawbacks such as low battery backup, short lifetime, high service cost etc. so that appropriate solution could be identified for these problems as well. Also, we can achieve our targeted goal by utilizing the transportation cost and labor costs. By doing this, it is possible to increase the value of the rechargeable fan further.

### 6. Conclusion

Rechargeable fan is a timely invention to solve the irregularity in our life due to increase in temperature and air humidity as well as insufficient power supply. We selected a suitable method known as “TRIZ” to solve the main problems we faced while using a rechargeable fan in our case. As a while, we will be getting the required service as well as being able to reduce the cost of rechargeable fans. Basically, we worked on increasing the value by utilizing Value Analysis. Although we only worked on high costs, if we would work on the other factors related to this, it will be possible to increase the value of the rechargeable fan more and will become more useful.

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## **Biography**

**Adri Dash** is an undergraduate student from department of Industrial & Production Engineering at Rajshahi University of Engineering & Technology. He completed his SSC from Chittagong Engineering University School and College and HSC from Government Hazi Mohammad Mohsin College, Chottogram. He is preparing for his career what he chose. Recently he has designed a prototype of Automatic Hand Sanitizing Machine with his teammate in an academic “Product Design” course. He is quite ambitious and looking forward to work in Supply Chain Management.

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**Prof. Dr. Md. Mosharraf Hossain** is serving as a faculty member at RUET Rajshahi. He has long term experience in education in Bangladesh and some exposure in industry in Thailand and Singapore. He has supervised couple of PhD and Masters Students and published more than 50 journal papers. Other than research he involved in administration of RUET in various capacities from 2010 to now and established IQAC at RUET for enhancing educational quality. He organized ICMIME 2015 as organizing secretary and served IC<sup>4</sup>ME<sup>2</sup> as Co-Chair and attended several conferences. Currently He is serving as Chair, IEOM International Bangladesh chapter.