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Consideration of Value Analysis and Value Engineering

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Abstract

Value engineering, in all of its stages, is a fundamental idea utilized in industry to boost corporate productivity and reduce extraneous procedures in order to maximize profit while lowering product costs. In the recent decade, the industrial sector has become increasingly competitive, requiring manufacturing enterprises to enhance their product lines and product design on a regular basis. Because the demand for goods has increased, the idea of lowering the entire manufacturing cost of items while also lowering the amount of wastage such as part scrap, quality issues, and other product rejection is a must. The international market creates competition, and the market-driven organization gives the highest value to the consumer. Standardization of products is critical for international trade in goods and services around the world.

Keywords: *Different phases, Cost reduction, Value engineering, Value analysis, VE job plan, Value engineering, Value analysis, VE job plan, Value engineering, Value engineering, Value engineering, Value engineering*

INTRODUCTION

Value Engineering is the systematic application of statistically significant by a multi-disciplinary team(s) that identifies the function of a product or service, creates a value for that function, generates alternatives through creative thinking, and reliably provides the necessary functions at the lowest overall cost.

[1] Value engineering is a systematic strategy to achieve desired product,

process, system, or service functionalities at a low overall cost and maximum consistent performance without compromising the product, process, system, or service's quality, dependability, performance, or safety. Value engineering is an active, interdisciplinary problem-solving activity that focuses on enhancing the functions required to fulfill a product's, processes, service's, or organization's aim or goal.

One of the most important cost-cutting and cost-prevention techniques is value engineering. It's a methodical technique that ensures the needed functionalities at the lowest possible cost without losing quality, reliability, performance, or appearance. It's a methodical approach to defining a product's or service's role.

It assigns a monetary value to the function and reliably does it at the lowest possible cost. Value engineering is an active, interdisciplinary problem-solving activity that focuses on enhancing the functions required to fulfill a product's, processes, service's, or organization's aim or goal. Value engineering is often referred to as "value management," "value methodology," or "value analysis" (VA).

Value engineering in manufacturing industries

Value Engineering now plays a significant part in controlling numerous elements such as cost, performance, and quality of various products in various industries. Value engineering is concerned with cost reduction, quality improvement, and the installation of an integrated system of persons, materials, and machines for the advantage of industries.

It provides specific knowledge and abilities in engineering analysis methods, as well as the ability to forecast and analyze the results of such a system. For each industry, the additional expenses associated with production time must be decreased, and product quality must be maintained to a specific level in accordance with client demand, among other things.

VE METHODOLOGY

Any product or problem can benefit from the VE technique (task plan). The VE's employment plan splits understudy responsibilities into functions. The job plan is usually organized by a value team leader. The eight successive phases are depicted below.

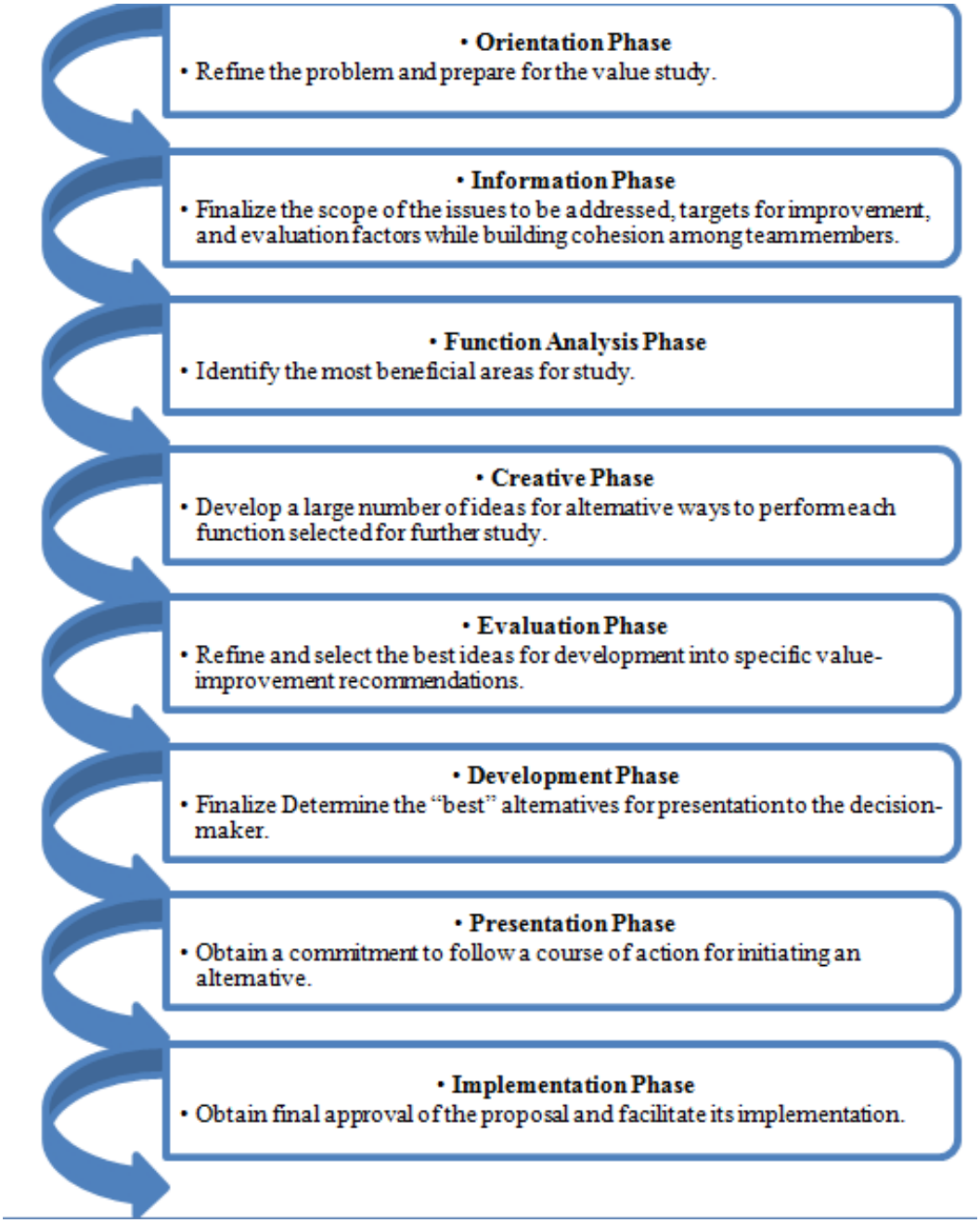

Figure 1: Phases of Value Engineering

LITERATURE REVIEW

Pratik Mahajan et al. conducted a case study on the fundamentals of value engineering and the many phases that may be used to optimize the value of a fitting bath product (CONC). The authors proposed changing the material and utilizing ZAMAK instead of brass using value engineering and Decision Matrix. The cost of the product was reduced as a result of the above change, saving 35RS per product. A total of 2,80,000RS was saved per year.

In a case study on the principle of value analysis in sheet metal, **Amit Narwal et al.** provided a case study. The author was having problems with hole tapering and cutting into parts, so he gathered a team from various departments to investigate the problem. To solve the problem, a why analysis was performed The punch is designed in such a way that punching and embossing can both be done at the same time. As a result, product rejection is minimized, and rework time is reduced, resulting in savings of 234600RS total.

Amit Narwal et al. presented a case study on the concept of value engineering, its job plan, and its effective implementation for a Focus Adjustment Knob for Slit Lamp in a microscope. From the feasibility rating table, the best choices, nylon knobs, were chosen. The cost evaluation table resulted in a total savings of 11.59 per product. Costs were lowered, total production rose, scrap was reduced, and the product's value was increased as a result of the foregoing adjustments.

R. Vijayan et al. performed value engineering and value analysis on a part in the air suspension system without compromising the product's performance or quality. The existing rear air spring bracket model has a high cost and weight; thus, a new design was developed in which the unneeded material, such as the pivot bracket, was deleted and redesigned. The revised design was able to endure additional stress and displacement because of the usage of solid works software. Weight loss of 4 kg was achieved. The cost per piece was reduced by 78RS, and the annual cost savings were 10,10,880RS.

Rushil Kadu et al. looked at the prospect of lowering costs using the value analysis technique. A production process for a conservative wooden bed was researched in order to apply a value analysis technique in order to cut costs. The function Cost Worth Analysis (FCEA) was used to come up with ideas, such as making slots in the top slat and using strength analysis to optimize the thickness of the wood. The cost per product saved by implementing proposed solutions was 415RS or 18.14 per cent of the overall cost.

Pranish M. Naoghare et al. did a case study on process optimization for rubber house moulding and assembly lines using value analysis. The author devised a new line balancing chart by integrating the rubber house's moulding on a single injection moulding machine and altering the post-curing oven's interior architecture.

The throughput time ratio reduced from 22 to 2.76, a reduction of 87.4 percent, as a result of the aforesaid recommendation. The space usage ratio dropped by 50.89 percent, the material handling ratio dropped by 51.8 percent, and the productivity of each operator grew from 100 to 350 units.

P. Pimpanont et al. used a value engineering-based methodology to reduce product costs in the hard disc component manufacturing process. This research uses the VE principle to construct a head stack assembly, with an emphasis on the tail fixing procedure. To conduct cost and functional analysis of certain technical processes, a seven-phase VE technique has been created. Statistical analysis and hypothesis testing were used to determine which approach produced the greatest results. The study demonstrates that the indirect cost of the product's material can reduce the price of the adhesive used in the tail-fixing procedure by 30%.

Sri Indra wati et al. used a case study to develop a ceramic display table that meets the needs of users. The optimum alternative product design for the ceramic display table was developed using value engineering approaches. A hefty table, a less flexible display table, and a huge display table were all common issues. It was discovered that the user needs three characteristics in ceramic display tables. The user's preferences for a ceramic display table were used to generate the alternative design score. The finest alternative design for the ceramic display table was built of Dutch teak wood, which may also be used as luggage.

Chougule Mahadeo Annappa et al. presented a case study on the furniture business in which the product's material size was altered using the value engineering technique. This case study shows how value engineering ideas and methods can be applied to a specific sector. Value engineering, with its several phases, can be employed in any product to lower costs. The material has been chosen in such a way that the cost of the product is reduced without compromising the product's value or design. The author employed methods like function analysis, function evaluation, and decision matrix to choose the best option from the available options, resulting in the most appropriate outcomes. The divan was subjected to value engineering, which included functional and financial research. During the evaluation process, the writers decided on the major four criteria, and two choices were chosen: 1 to adjust the gauge of the

material and 2 to lower the thickness of the board (where required). By implementing alternatives, the total cost savings for alternative 1 was 19.60 percent and 14.61 percent for alternative 2.

Chougule Mahadeo Annappa et al. discussed a case study on a small-scale furniture manufacturing business in which the product's material size was altered using the value engineering technique. The application of value engineering ideas and practices in the industry is discussed in this study. Value engineering is a powerful management method that can contribute significantly to the furniture manufacturing industry's value enhancement and cost reduction. The material was chosen so that the cost could be reduced without compromising the product's value or design. The author employed tools like Function Analysis, Functional Evaluation, and Decision Matrix to choose the best option from the available options, resulting in the most appropriate outcomes. The computer workstation was used to do functional and cost analyses, as well as value engineering. During the evaluation process, the writers settled on the major four criteria and two choices, one to change the material and the other to fold it. Option 2 had a total saving cost of 3,00,000RS per year, while alternative 1 had a total saving cost of 1,20,000RS per year after implementation.

Chougule Mahadeo Annappa et al. conducted a case study in which they found that the unnecessary cost increase was caused by the usage of expensive materials, an increase in the number of hardware items available, and an increase in inventory. The authors chose UTM components such as the hand wheel, range selector knob, top bearing bracket assembly, dial bracket, and recorder gear. The cost of these UTM components was reduced using a value engineering technique. It was suggested that the top bearing bracket assembly and dial bracket be modified to minimize cost, weight, and material needs. By switching from CI to nylon, the cost and weight of the handwheel, range selector knob, and recorder gear are reduced. The total amount saved was 3875RS or 20.84 percent.

Satish M. Silaskar et al. focused a case study on applying value engineering and value analysis to a hydraulic ball valve. Value engineering ideas have primarily been applied to the weight optimization of valves in order to increase cost-effectiveness and performance. Valve wall thickness was lowered from 36mm to

26mm, a slot was created at the site where the ball rest was, and the hole at the seat retainer was reduced from 24 to 16 no, all of which reduced drilling time and had an influence on torque. The effort put in resulted in a weight loss of roughly 60kg, or 12-13 percent of total weight. The cost of change and cycle time was both lowered as a result of the above changes.

A case study was undertaken by **Sri Lakshmana Kumar et al.** on the development of design and cost reduction in a mono block pump. There were a few things that had to be observed during value engineering in order to save money. The impeller material was changed from gunmetal grade LTB-4 to stainless steel grade 410, resulting in a net savings of 42.6 percent. The adaptor and end cover designs were also changed, resulting in a net savings of 21.69 percent for the adaptor and 28.84 percent for the end cover, as well as a weight reduction. The reduction in main and auxiliary winding turns from 130 to 95 resulted in a net savings of 11.79 percent. The change in net savings as a result of the foregoing changes was 24.84 %.

Himaanshu Kumaraswamy et al. focused a case study on value engineering and analysis of roof exhausters, which are employed in most companies for air circulation. Value engineering methodology was used to modify the design and eliminate the superfluous pieces. The new proposed product is made of mind steel rather than stainless steel. The above improvements resulted in a net savings of 3180RS.

For the gasoline tank neck locking mechanism, **Vinay Kumar Sing et al.** offered a case study on cost analysis and optimization for the automotive product life cycle using value engineering and value analysis approaches. The locking mechanism for the fuel tank neck has been redesigned. The number of parts has been reduced from 23 to 17. The length of the present filler neck was shortened and projected within the gasoline tank. A single key was also advised by the author for locking the gasoline tank cap, starting the engine, and locking the doors. A total cost savings of 6% was realized.

Aprinder Singh Sandhu et al. presented a case study on using the Value Engineering Job Plan (VEJP) to lower the cost and increase the value of an auto-rickshaw steering bar. During the creative process, the author came up with four different concepts. The significant alterations in the upper cone were made by

changing the shape so that it fits correctly in the dust cover and by using two plain check nuts to prevent steering play. Grooving and radius chamfering were done in the upper cup, and the bottom cup can improve fitting techniques to lessen the risk of breaking. Because of the preceding recommendation, the grinding wheel's efficiency was improved, and it was changed after 4500 assembly instead of 3000 assemblies. The life of the auto-rickshaw steering bar is extended by using a dust cover. The total cost reduction was 1.54%, with savings of 240000 RS on an annual basis.

Amit Sharma et al. did a value engineering case study on flush valve cost minimization. By employing value engineering, the author advised replacing the material with ZAMAK instead of brass, which was less expensive and had the same value while requiring no design changes. A total of 16RS per part was saved, with a projected annual savings of 192000RS.

Amit Sharma et al. presented a case study of value engineering on slit housing, which resulted in a rise in product value and cost optimization. Value engineering was used to change the manufacturing process, and casting was used instead of CNC turning and CNC milling. The modified procedure saved 57.32RS per product, for a total savings of 5, 73,200RS per year. This resulted in a 58.20% gain in value.

Bhaskar B. Gardas et al. used the case study value engineering and its approach to lower the cost and weight of the Mumbai local train's handle assembly. The author proposes one solution based on the assessment matrix, which is to "remove handle assembly and lower the road on which handles are installed." Weight was lowered, material and cost were saved, pollution was reduced, and the passenger dropping ratio was reduced as a result of the aforesaid recommendation.

Celestine Aguwa et al. used case study value analysis and multiple phases to improve product development and increase customer satisfaction for a tree climbing gear. The author built a new design based on value analysis and evaluation; it was a safer, superior product that met customer expectations. Users' safety has been ensured by the usage of safety hooks. Footrest and height-adjustable elements were utilized for the clients. Because of the aforementioned adjustments, tree climbing gadgets now serve the role demanded by clients and have gained in value.

Finu John et al. conducted case studies on value engineering techniques in residential building construction projects in order to save time and money. Authors generated fresh plan designs for cost savings and also created quick diagrams at the start of construction. Cement plastering was replaced with gypsum plastering, hardwood windows and doors were replaced with UPVC, and the windowsills were tilled for easier cleaning. For the project's success, the information phases were more critical for identifying and solving problems.

UgoIbusuki et al.utilized value engineering methodology and target costing in cost management in a case study on a vehicle's engine starter system. Improve the current design by conducting extensive research with local suppliers, changing the material and manufacturing method, and simplifying the design to meet the needs of customers. Pneumatic starters, rather than electrical engine starters, provide longer usable life, lower maintenance costs, more force and less weight, and safe operation, according to the author's value analysis. As a result of the foregoing modification, each starter saved 9.97RS, for a total of 59,820RS saved every year.

Ali Mostafaeipour used value engineering to make required design adjustments to humidifiers in order to decrease superfluous expenditures, improve product quality, and optimize the life cycle cost. The author suggested that the fan cover material be changed from galvanized iron too hard plastic or fiber plastic, which was chosen as the best idea from the decision matrix. This adjustment resulted in a weight reduction, maximum cost savings, and improved item quality.

Finding from Literature Review:

1. Value engineering is a powerful problem-solving strategy that can help you save money while maintaining or enhancing quality and performance.

2. Value engineering is the process of reducing costs by modifying design and changing component materials.

3. Using value engineering methodologies at the idea and design stages of new product phases resulted in a shorter overall lifetime time, lower product costs, less waste, higher product reliability, and higher customer satisfaction.

4. Value engineering reduced space utilization, material handling, and

throughput time by removing unneeded parts, lowering weight, increasing stress capacity, and increasing productivity.

5. Value engineering extended the product's lifespan.

CONCLUSIONS

Value engineering is a powerful tool that produces superior results in any product, process, or system after it is implemented. This results in improved replacement/change, as well as increased product or service quality and productivity. It eliminates the extra components and processes that raise the manufacturing cost of items in the industry while also improving the company's performance and profit. The cost of various items can be effectively decreased by implementing Value Engineering techniques. As a result of implementing value analysis in a manufacturing line, this study found that there was a decrease in labour, resulting in lower investments, which improved space utilization, material handling throughput time, and ultimately boosted productivity.

REFERENCES

1. Pratik Mahajan Manohar, Chamarthi, VaibhavBangar, Prof. Shitalpatel, "A Case Study Analysis Through The Implementation Of Value Engineering", International Research Journal of Engineering and Technology (IRJET), Vol 6, Issue 4, pp 2472-2477, 2019.

2. Amit Narwal, Mr. Kuljeet Lamba, "Case Study on the Concept of Value Analysis in Sheet Metal", International Journal of Enhanced Research in Science, Technology & Engineering, Vol 4, Issue 12, pp 64-71, 2015.

3. Amit Sharma, R. M. Belokar, "Achieving Success Through Value Engineering: A Case Study", Proceedings of the World Congress on Engineering and Computer Science, Vol 2, 2012.

4. R. Vijayan, T. ThankaGeetha, B. Nishanth, M. Tamilarasan, V. Vijaya Kumar, "Value Engineering and Value Analysis of Rear Air Spring Bracket", ELSEVIER, pp 1075-1082, 2019.

5. RushilKadu, MayureshKamatkar, AmolKarne, Shital Patel, "Value Analysis Aimed at Cost Reduction

in Wooden Bed Manufacturing", International Research Journal of Engineering and Technology (IRJET), Vol 6, Issue 4, pp 160-162, 2019.

6. Pranish M. Naoghare, Atul R. More, Sandip S. Patil, "Value Analysis of a Rubber Hose Moulding and Assembly Line: A Case Study", ", International Research Journal of Engineering and Technology (IRJET), Vol 4, Issue 3, pp 1817-1820, 2017.

7. P. Pimpanont, P. Chutima, "Application of Value Engineering in Head Stack Assembly Process: A Case Study", International Journal of Material, Mechanics and Manufacturing, Vol 4, No1,pp 46-51,2016.

8. Sri Indrawati, RizzaAbiArharra, "Product Design Innovation of Ceramics Display Table Using Value Engineering Method", Journal of Industrial Engineering Research, pp 7-11, 2015.

9. ChouguleMahadeoAnnappa, Dr.KallurkarShrikantPanditrao, "Application of Value Engineering for Cost Reduction of Household Furniture Product – A Case Study", International Journal of Innovative Research in Science, Engineering and Technology, Vol 3, Issue 10, pp 16577- 16583, 2014.

10. Mr. Chougule Mahadeo Annappa, Dr. Kallurkar Shrikant Panditrao, "Optimization of Furniture Product in Furniture Industry by Using Value Engineering With Function Analysis, Function Evaluation and Decision Matrix- A case Study", International Journal of Application or Innovation in Engineering & Management, Vol 2, Issue 3, pp 55-64, 2013.

11. Chougule Mahadeo Annappa, Kallurkaar Shrikant Panditrao, "Application of Value Engineering for Cost Reduction – A Case Study of Universal Testing Machine", International Journal of Advances in Engineering & Technology, Vol 4, Issue 1, pp 618- 629, 2012.

12. Satish M. Silaskar, Dr. Vilas B. Shinde, "Weight Optimization of Valve for Cost Effectiveness: Using Value Analysis", ELSEVIER, pp 329-337, 2018.

13. Sri Lakshmana Kumar, S. Nallusamy, RakeshModak, "Execution of Value Engineering Approach for Design Development and Cost Reduction of Monblock Pump", ARPN Journal of Engineering and Applied Sciences, Vol 13, No 3,pp 1734-1741. 2018.

14. HimanshuKumaraswamy, G.K. Vinay Kumar, "Implementation of Value Engineering in Rooftop Extractor", Journal of Management Engineering and Information Technology, Vol 4, issue 2, pp 18-22, 2017.

15. Vinay Kumar Singh, Rahul Kumar, Dr. M K. Arya, "Automotive Development Lifecycle Optimization Through Value Engineering and Value Analysis (VAVE)", International Conference on Advances in Mechanical, Industrial, Automation and Management System, pp 349-354, 2017.

16. Aprinder Sing Sandhu, Kusaldeep Sing Sekhon, "Cost Reduction Using Value Analysis for Auto Rickshaw Steering Bar", International Journal of Mechanical and Production Engineering, Vol 4, Issue 12, pp 43-49, 2016.

17. Amit Sharma, Dr. R.M. Belokar, "Implementation of Value Engineering – A Case Study", International Journal of Marketing, Financial Services & Management Research, Vol 1, No 3, pp 64-70, 2012

18. Amit Sharma, Dr. R.M. Belokar, "Enhancing Value of Slit Housing Using Value Engineering – A Case Study", International Journal of Scientific & Engineering Research, Vol 3, Issue 5, pp 1-4, 2012.

19. Bhasker B. Gardas, Naresh R. Shimpi, Sunil B. Mahajan, "Value Analysis for a Mumbai Local Train: A Case Study", International Journal of Scientific and Research Publication, Vol 3, Issue 6, pp 1-3, 2013.

20. Celestine Aguwa, VMA; Egbe-EtuEtu; Joshua Emakhu; OluwatobaOsoba; Darlington Egeonu; and Leslie Monplaisir, "Application of Value Analysis to Increase Customer Satisfaction in Product Development: A Case

Study on Tree Climbing Devices", SAVE International 2018 Value Summit PROCEEDINGS, 2018.

21. Finu John, Abraham Reji, Annmary Vincent , BibyBiju, SojaKuriakose, "Application of Value Engineering in Residential Building", International Journal of Engineering Research & Technology (IJERT), Vol 9, Issue 5, pp 1193- 1195, 2020.

22. UgoIbusuki, Paulo Carlos Kaminski, "Product development process with focus on value engineering and target-costing: A case study in an automotive company", Int. J. Production Economics, pp 459-474, 2007

23. Ali Mostafaeipour,"A Novel Innovative Design Improvement Using Value Engineering Technique: A Case Study", Journal of Optimization in Industrial Engineering, pp 25-36, 2016.