

Review Application of value engineering in construction project.

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Abstract

The role for value engineering in the building sector has expanded in recent years. Value engineering has a significant impact on project standard, dependability, and overall efficiency. Amongst the most successful strategies for identifying and eliminating excessive expenditures in building design, construction, operations, and management is Value Engineering. Value engineering is not primarily concerned with cost reduction; rather, it aims to improve value rather than minimize costs. In terms of quality, efficiency, endurance, and boosting implementation over the life of a project without disrupting future demands, both value engineering and sustainable development play a critical role. This methodology is divided into three stages: value engineering pre-study, value engineering work plan, and value engineering post-study. The ideas of VE are discussed in this critical literature study in order to achieve higher quality at a reduced cost in building construction sites.

Keywords: Value Engineering, Time Reduction, Quality, Construction, Value, Cost.

Introduction

Value engineering (VE) is a systematic strategy for enhancing the "value" of products and services by establishing the product or service's function, calculating a creation value for that function, and working to offer the required functionalities at the lowest cost. The ratio of performance to cost is known as value. As a result, value may be raised by either boosting performance or lowering costs. The preservation of core functionalities rather than their reduction as a result of seeking value enhancements is a central principle of value engineering [1]. Value engineering is a strategy for determining "best value," or the optimal relationship between worth and cost, by studying the functions of an object or process. In other terms, a "cost - effective" item or process is one that consistently fulfils the needed fundamental function while having the lowest life-cycle cost. Value engineering isn't about saving money. Value engineering is a methodical strategy for increasing the "value" of things, products, and services by looking at how they work. The ratio of function to cost is defined as value. As a result, value may be raised by either increasing the function or lowering the price[2]. Building quality has an impact on the value of a building, so employers and manufacturers are attempting to increase the value of a building through proper design methods and strict implementation of optimal, so employers with selected consultations and designers achieve new designs and accessed to this status owing to holding value engineering sessions.[3] Different phases in value engineering are as under:

- Information collecting entails determining what the object's requirements are. In this step, function analysis, a key approach in value engineering, is frequently performed. It seeks to figure out which functions or performance qualities matter the most. It asks questions like, "What does the thing do?" and "How does the object work?" What is it supposed to accomplish? What should it accomplish? What may it be capable of? Is there anything it can't do?
- Value engineers inquire, "What are the numerous alternative ways of achieving requirements?" during this stage of alternative generation (creation). What other option do you have for completing the task?
- Evaluation - At this step, all of the options are evaluated to see how well they fulfil the requirements and how much money they will save.
- Presentation - At the end of the process, the best option will be chosen and presented to the client for final decision[4]. Value engineering study's purpose is to achieve design perfection. The VE team is looking for the best combination of management, efficiency, project quality, and maintainability, concern for the environment, safety, and cost considerations. The Value engineering process is not intended to criticise current designs or to imply that the

traditional highway design process is failing to produce acceptable results. The designs that are currently being prepared are good designs that can be built and will function as designed. The following are the study's objectives:

- To determine the areas in which value engineering may be used to improve the quality of building.
- To determine the value of using value engineering approaches and the advantages of doing so.
- To use the value engineering process on construction job sites and in the construction industry to enhance economic viability, reduce construction time, and increase safety.[5]

II. LITERATURE REVIEW

The following are the previous research review based on application of value engineering in building construction project.

Brahmane and Bachav et al. (2020) studied that the fundamentals of value engineering and the many approach that may be used to improve time efficiency. As the construction sector seeks to decrease construction time and maintain quality. The main focus was on time reduction for these different alternatives were used in their case study. Some alternatives techniques which were used are Mivan technology, CLC bricks, Granite Tile. By implementing Mivan technology and CLC bricks time saved was 30% and 40% [6]

Ferry and Fadil and Khairulzan et al. (2012) Prefabrication building technologies, intelligent excavation operations, 'Reduce-Reuse-Recycle' concepts, and basic 'environmentally-aware' on-site activities, according to Ferry and Fadil can help reduce waste and local environmental consequences throughout project execution. In order to modernise the Indonesian construction sector and establish a sustainable construction industry, green building design must use Value Engineering and Lean Construction ideas. [7]

Li Ning et al. (2015), studied that building design must fulfil the operational requirements of users while also achieving the most cost-effective cost function, but the conventional technique based on experience is out of step with the present economic condition and real estate environment. Currently, value engineering research focuses mostly on the selection of product design and construction project models, with design scheme models in building projects being limited.[8]

Urmila A Mahadik et al.(2015) In terms of quality, dependability, durability, and boosting performance over the life of a project without disrupting future demands, both value engineering and sustainable development play a critical role. The function of value engineering as a cost-cutting approach, as well as the stages of value engineering in connection to sustainable building, are discussed in this research.[9]

Ahmad and abdefetah et al. (2020) studied that how one of the key functions of the Building Information Modelling approach (BIM) is to preview any collisions that may occur between distinct activities. In the end, it was estimated that the cost was reduced by 23% of the total price of average slabs and 1.7 percent of the whole contract amount without affecting the element's core functions.[10]

Rachwan et al. (2016) Studied that the use of value engineering in the mentioned sustainability disciplines in a genuine large-scale residential project. The techniques and computations for value engineering and sustainability analyses are described in this case study. The overall predicted savings of the project as an outcome of the entire value engineering analysis varied between 20% and 30% of the element cost, resulting in a considerable decrease in the overall project cost as well as a 7% reduction in energy usage. [11]

Stephen M et al. (2006) investigated the majority of survey respondents do not participate in value engineering research and do not comprehend the fundamental meaning of value engineering. Only 15% of those polled confirmed that they had taken part in a value engineering research. Respondents also acknowledged that the conceptual phase of a value engineering research was crucial.[12]

Heralova R et al. (2017) studied the grounds for criticising highway constructions. They fail to meet specified project goals, execute projects in an acceptable length of time, and keep expenditures within their budgetary constraints, to name a few. By balancing cost, schedule, and scope through the production of new alternatives, value engineering approach can assist uncover methods to better solutions to these challenges. It was discovered that by employing the appropriate value engineering approach at the correct time, a project may dramatically reduce costs and increase project performance [13].

Parakhiya D et al. (2017) studied that the value engineering influential tool for decreasing cost and increasing cost. Because of various drawbacks, both current and conventional cost management strategies are not applied. The success of a project is determined by how it will be created, how much it will cost and whether or not it will be completed within the specified time frame. A wide range of materials are currently accessible in the building business. A project's total cost was cut by around 8% by switching to the correct material.[14]

Anand R et al. (2017) investigated the mixing of plastic with bitumen to improve road performance. Coated aggregate contains a polymeric polymer that minimises voids and water content. As a result, it can withstand higher traffic loads and has more strength than flexible pavements. For increased strength, a plastic mix with a bitumen concentration of roughly 10% will be added. This revolutionary technology is non-polluting.[15]

Chougule A et al. (2014) Value engineering may be used at any stage of a project, according to Chougule Pareto's Law was used to conduct a case study on home construction. They came to the conclusion that the top six items out of 14 accounted for 61.53 percent of the overall cost. This suggests that 37.5 percent of the functions account for 61.53 percent of the total cost, which is quite close to the Pareto principle.[16]

Cantwell J et al. (2016) Value engineering, according to Cantwell, focuses on completing the desired function at the lowest possible cost. It aids in the reduction of material waste, unneeded expenditures, and time, all of which provide value to the consumer. Using a hydraulic coupling instead of lapping reduces the cost of a 16mm dia. bar by 47.95 percent. [17]

Sultana A et al. (2012) Sultana drew the conclusion that using plastic as a covering aggregate boosted the road's strength. As a result, plastic is an excellent binder material. The addition of bitumen to plastic enhances strength, reduces absorption and ductility, and raises the softening point. Plastic coated aggregate is best at 8% and 6% weight of plastic, respectively, while Low Density polyethylene type plastic is best at 8%. Plastic coated aggregate has better stability and performance than plastic coated aggregate bitumen. According to the study, flexible pavement improves more than rigid pavement.[18]

Khaleel I. Al-Fadhli et al.(2020) A model is presented and applied to project stages, including the installation and maintenance phases, based on build ability and value engineering ideas. The results reveal that by utilizing the knowledge of all project partners involved in the project, the recommended model saves time, money, and improves the needed quality of materials and work.[19]

Mohamed A et al. (2015) concluded that value engineering is a potent toolset for lowering costs while maintaining or improving quality. VE is not used in Egypt, despite the fact that its advantages are well acknowledged save, the official association for value engineering practitioners, offered VE technique in this paper. By using VE approaches, the project's overall cost was reduced by 19 percent, which is a significant save. [20]

Gopal Dharmaraja et al. (2008) investigated a list of popular strategies and resources for lowering cost of construction, which differs based on the nature of the structure to be built. Effective planning and design processes are required and must be implemented, resulting in a 25 percent reduction in overall costs in implementation. [21]

Anuja Rajguru and Parag Mahatme et al. (2015) researched several efficiency approaches. At each step, it's critical to keep building costs and time to a minimum. Low-cost resources, such as premade roof slabs and precast wall slabs, are also recommended for lowering project costs while preserving construction quality and durability.[22]

Tam et al. (2011) demonstrated how to build houses that are cost-effective, creative, and eco friendly. The foundation, wall, roof, and lintel construction methods are all equivalent. The building's strength and longevity, as well as its steadiness, safety,

and cognitive acceptance, are all variables that must be considered while saving money. It was discovered that adopting low-cost housing techniques may save between 26.11 percent and 22.68 percent of the construction costs.[23]

III. CONCLUSION

From the above literature review we can conclude the following things:

1. Value Engineering is a demonstrated-and-true management method that may help the construction sector increase value and reduce costs.
2. Value engineering help in making better decisions that result in the best use of funds.
3. The perfect time to undertake a value engineering analysis is during the project's design and initial phases.
4. The importance of the information phase cannot be stressed; decision-making on concept selection may be influenced by the relevance of the data gathered.
5. The drawing tool Functional Analysis Systems Technique (FAST) offers a methodical pathway for identifying the project's major functions.
6. Value engineering isn't only about cutting costs; it's also about improving technical specifications, making the project easier to build, and resulting in cost savings and time.
7. Quality product, quick execution, ecologically responsible techniques, and minimal waste creation are all benefits of Value Engineering.
8. By implementing value engineering we can save up to 5% to 10% of total cost.

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