

A Critical Literature Review on Application of Value Engineering in Building Construction Project

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Abstract : The current construction practices require a great effort to balance the factors such as money, time and quality. Value Engineering is a proven management technique that can make valuable contributions to value enhancement and cost reduction in construction industry. Many a time, Value Engineering (VE) is confused with cost cutting exercises in construction industry. The essential difference between conventional cost cutting and VE is that it involves reducing the cost by improving the functionality through lesser consumption of energy in terms of manpower, materials, and machines. However, it was found that the benefit of VE is much greater if multidisciplinary teams of engineers were involved which would also influence the design team that is normally the case in construction. Value Engineering is one of the most effective techniques to identify and eliminate unnecessary costs in building design, construction, operations, maintenance. The methodology is composed of three main stages, Pre-Study of the Value Engineering, value engineering job plan, and post study of the value engineering. In this critical literature review, how the principles of Value Engineering are applied in building construction projects is explained, in order to reach out better quality with lower cost.

IndexTerms - Value Engineering, Value Analysis, Job Plan, Building Construction Project, Cost.

I. INTRODUCTION

The Construction industry is an index of growth of a nation. The real estate sector in India has assumed growing importance with the liberalization of the economy. Today, the construction industry is the second largest employing skilled and semiskilled labour after agriculture and plays an important role in nation's economy.

Value analysis and value engineering and value management is the concept of a single administrative approach aimed at finding practical solutions and reduce the unnecessary cost. Value Analysis is a study applied on projects completed or products currently used other look for improvement of their performance and get rid of the extra costs. Value Engineering is designed to improve the quality and reduce the cost of construction projects and applied during project idea or after completion of public perception. while Value Management is a comprehensive concept of how to manage programmes and how-to setup value studies and follow-up, so that value engineering workshop or value analysis is part of this process.

Value Engineering (VE) is a management technique that seeks the best functional balance between cost, reliability and performance of a product, project, process or service. Value engineering is a powerful problem-solving tool that can reduce costs while maintaining or improving performance and quality requirements. Value engineering can improve decision-making that leads to optimal expenditure of owner funds while meeting required function and quality. The success of the VE process is due to its ability to identify opportunities to remove unnecessary costs while assuring quality, reliability, performance, and other critical factors that meet or exceed customers expectation. An organized study of functions to satisfy the user's needs with a quality product at the lowest life cycle cost through applied creativity. There are many tools and techniques being applied in a Value Engineering to improve value, these tools include the Functional Analysis Systems Technique (FAST) diagram, creative thinking technique, life cycle costing and weighted scoring techniques and others.

II. CRITICAL LITERATURE REVIEW

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

Akintola et al. (2001) studied that the factors that determine a building project and its costs can be separated into two groups: one consisting of factors related to specific engineering systems and the other of factors that are general in character and relate to the whole building. Value engineering is effective because its procedures give opportunities for raising design issues associated with the latter group of factors, as well as providing for peer-review of the designs. [1]

Hee Sung Cha and O'Connor et al. (2005) found that selection of value management process (VMP) is based on the identification and quantification of the selection principles e.g. PVO, timing of initiation, relative impact, and project characteristics. From the industry perspective this computerized selection tool facilitates the implementation of the VMPs on the construction industry and maximize the potential benefits to a particular project. [6]

Philip and Stephen and Udo-Inyang et al. (2006) found that the performance of value engineering studies with an independent facilitator in the private construction industry is rare and the industry is confusing cost saving measures with value engineering. [16]

Simaan and Xiaoming and Xueqing et al (2009) proposes a value engineering knowledge management system (VE-KMS) to support the knowledge creation process, code and retain ideas from historical value engineering(VE) studies, and share this valuable information in the construction industry. [17]

El-Alfy and Ryosuke et al. (2010) stated that the Value Engineering approach and a database of available systems with classification of how each system complies with the different sustainability factors are proposed to be used during the system's selection process, and also need to update the database on a regular basis with new and improved systems and materials. [2] [18]

Ferry and Fadil and Khairulzan et al. (2012) stated that the adoption of prefabrication construction methods, intelligent excavation works, 'Reduce-Reuse-Recycle' principles, and simple 'environmentally-aware' on-site practices can minimize waste produced and local environmental impacts emitted during project execution. Green building design shall encompass Value Engineering and Lean Construction concepts in order to modernize the Indonesian construction sector to achieve a sustainable construction industry. [5]

Liang et al. (2012) found that the related departments, enterprises and experts should make great efforts together to analyse the situations, find out the causes, take effective measures to promote the application and development of value engineering in construction industry, so that ideal effect can achieve. [10]

Husseinb and Ibraheemb and Mohammedb and Youssef et al (2012) studied that the most valuable alternative does not mean that of the lowest price, but it means that alternative achieving a great percent of the required functions with lowest cost, and also for each school building its own criteria and its alternatives have their own weights against each criterion even if this building has a similar environment or similar users. [7]

Eqyaabal and Ilayaraja et al. (2015) stated that Value engineering can improve decision-making that leads to optimal expenditure of owner funds while meeting required function and quality level. The success of the VE process is due to its ability to identify opportunities to remove unnecessary costs while assuring quality, reliability, performance, and other critical factors that meet or exceed customer's expectation. [8]

Gowrisankar and Nayana et al. (2015) stated that information phase has much importance to know the problem well, the idea generation will be easier if the information is wide and plenty, Decisions on idea selection may vary upon the relevancy of the information collected. [13]

Li Ning et al. (2015) stated that construction design requires to meet the functional requirements of the users and to achieve the most reasonable cost function, while according the traditional method basing on the experience to is not in conformity with the current economic situation and the real estate environment. Currently, research direction of value engineering mainly focuses on the selection of the models of product design and construction projects, while the models of design scheme in the construction projects are fewer. [11]

Ahmed and Amr and Ibrahim and Mohamed and Racha et al. (2015) illustrated the value engineering (VE) methodology provided by SAVE International, which is consider as the official society for value engineering practitioners, and provided two case studies where such methodology was successfully applied resulting in cost savings and quality improvements. The result of the full VE studies that were made reached 19% cost reduction in the total project cost and also provided a semi-generic recommendation matrix for design alternatives in various disciplines and their advantages on residential projects. [3]

Attarde and Rane et al. (2016) studied that the application of Pareto Law 20/80 states that around 20 % of the functions constitute around 80% of the cost. These functions are the subject of value engineering. And also stated that best time for conducting value engineering study is during the planning stage of project prior to release to the contractor. [14]

Khaled and Pandey et al. (2016) suggests that a lack of management support is not a primary cause of the lack of use of value engineering(VE) as a construction management tool, senior management needs to appreciate the benefits of using VE as a construction management tool before its implementation can be increased. professionals involved in managing the design need to understand the conflicting agenda that exist between design and management and understand the tools which can aid the management of the construction process. The decisions made in the early stages of a project affect all its aspects, yet the industry spends the least on this stage, in contrast with other industries. [9]

Arivazhagan and Guru and Partheeban and Rachel et al. (2017) studied that there will be a significant amount of savings due to applying the Value Engineering in the range of 20% to 25% of the project total cost. 53% of the respondents of the one who apply Value Engineering were aware that the designer and the project manager should select the bridge.

Construction method, while only 33% mentioned the cost estimator which is alarming. Most of the respondents admitted that they don't perform an organized Value Engineering job plan as supposed. [15]

Darshan and Jitendra et al. (2017) found that value engineering concepts having a main focus to reduce the cost of the project by simply recommending the other advanced replaceable materials which are locally available to improve the value of the project. Just by changing the proper materials the project cost can be reduced around 8 % in which if the project having extreme construction cost, it can be consider as a large saving comparing the overall cost of the project. [4]

Mohammad and Omid and Vahid et al (2017) surveyed a case study and found that after investigation of all options for the transmission pipeline, it is possible to reduce up to 41% of construction costs by adopting a different alternative track to cross the Reno Mountain. Future studies can focus on the proposal of novel strategies in order to achieve the best results in the VE practice. [12]

III. CONCLUSION

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

1. Value Engineering is a proven management technique that can make valuable contributions to value enhancement and cost reduction in construction industry.
2. Value engineering can improve decision-making that leads to optimal expenditure of owner funds
3. Best time for conducting value engineering study is during the design and planning stage of project
4. Information phase very important, decisions on idea selection may vary upon the relevancy of the information collected.
5. Functional Analysis Systems Technique (FAST) diagramming tool provide systematic roadmap to identify main functions of project.
6. Value engineering is not just about reducing the costs, but increasing the design standards, making it easier to build the project and saving time and money.
7. Value Engineering application deliver better quality, faster completion, environmentally friendly practices, and less waste generation.
8. About 5% to 10% reduction in construction cost can be achieved using value engineering in building construction.

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