

Value Engineering in Construction

K. Ilayaraja and MD. Zafar Eqyaabal*

Department of Civil Engineering, Bharath University, Chennai - 600073, Tamil Nadu, India;
ilayaraja.civil@bharathuniv.ac.in, zafareqyaabal.civil@bharathuniv.ac.in

Abstract

Value engineering is a methodology used to analyze the function of the goods and services and to obtain the required functions of the user at the lowest total cost without reducing the necessary quality of performance. 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. In the initial stages VE was used by production engineers for reducing the cost of manufacture. 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.

Keywords: Job Plan, Life Cycle Cost, Value Analysis, Value Engineering

1. Introduction

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 labor after agriculture and plays an important role in nation's economy. Due to increase in business opportunity and migration of labor, the demand for commercial and housing spaces has also increased. According to the tenth five-year plan, the estimate of shortage in urban housing is accessed to be 8.89 million units. As of now, the housing and construction industry employs 30 million people and about 250 industries are associated with construction industry directly or indirectly. It includes hospitals, schools, townships, offices, houses and other buildings as well as urban infrastructure, highways, roads, ports, railways, airports, dams, power plants etc.

Market globalization has in effect led to increased competition, not just between companies, but also on macro level, between individual countries. The need for improvement of organizational activities is thus felt not only in private industry but also increasingly in institutional,

governmental or other non-profit organizations whose efficiency and effectiveness determines a countries competitive position in the world.

2. Definition of Value Engineering

2.1 Definition

Value Engineering (VE) is a management technique that seeks the best functional balance between cost, reliability and performance of a product, project, process or service¹.

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 level². 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 expectation³.

An organized study of functions to satisfy the user's needs with a quality product at the lowest life cycle cost

*Author for correspondence

through applied creativity. There are many tools and techniques being applied in a VE in its quest to improve value, these tools include the FAST diagram, creative thinking technique, life cycle costing and weighted scoring techniques and others⁴.

2.2 What Value Engineering is Not?

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3. Objective and Need for the Study

3.1 Objective of the Study

There is always a scope to improve value, in terms of material value or the worth. The main objective is to provide all necessary functions at a lowest cost. The aim of the thesis to conduct a study on value engineering also to understand and identify the areas of poor value in structure and to understand the cost saving attained after conducting VE study with that of conventional one⁶. To remove the ambiguity and a lot of misconceptions about the concept and targets of value engineering. To find the possibility of the application of value engineering by the institutions of the building construction industry and to find out the benefits of application of value engineering in construction projects in terms of;

1. Time;
2. Quality;
3. Efficiency; and
4. Better management.

3.2 Need for the Study

In this work, an attempt has been made to highlight the importance of value engineering in construction industry and how value engineering technique was applied in supervision of construction works for the successful implementation of construction projects⁷.

4. Methodology

In general every thesis involves methodology or framework for the proceedings. This gives a clear idea how the project is going to be dealt and in which manner the

results are to be obtained⁸. The thesis involves selecting a title. Then the literatures based on the project are collected. Then the work done on the similar projects are understood. Then the study area is defined. Then the methodology is framed how to proceed the project. The methodology involves identifying the value engineering in practice and the performance measures with respect to those methods are framed out. Then a questionnaire survey is prepared. The same will be used to collect data from the project managers and site engineers of various companies in the city. The survey is done to check the awareness of the aspects among the engineers⁹. The questionnaire prepared will be a weighted scale type. Then the data obtained from the survey are analyzed and results are obtained. Based on the obtained result suitable suggestions are made that what should be done to enhance the performance of the engineers.

4.1 Task Involved in Phase I

Task 1: Literature review collection literatures based on the topic are collected¹⁰. These are used as a base for the project. From the literatures collected various measurement methods are studied.

Task 2: Study of value engineering. The study provides analytical descriptive method which is based on the study of reality or phenomenon described and collected information about them and then studied and analyzed¹¹. The study is done in order to get the various performance measures used in those methods. Then a set of indicators are derived based on the measures identified in the methods and a questionnaire is to be prepared on the basis of the same

5. Value Engineering and Application Phase

Enhancing qualitative projects and services by lifting its value with the improvement and development of total cost reduction without sacrificing the necessary requirements is possible if we apply value engineering curriculum¹². The optimization of resources is demand increasingly needed day after day because most if not all depletive and demand steadily, and for this value becomes application engineering approach to projects and services and other urgent requirement for survival and development under severe global competition, especially if knew that the application of value

engineering in results to reduce costs and development and improvement of ranged between 5% to 15% and amounted to much more than this in certain cases¹³.

5.1 Value Engineering

Value analysis and value engineering and value management is the concept of a single administrative approach aimed at finding practical solutions and reduce the useful flying quality in cost. The conventions were agreed to by specialists in the field value.

1. Analysis of value (Value Analysis, VA):

A study applied on projects completed or products currently used other look for improvement of their performance and get rid of the extra costs.

2. Engineering value (Value Engineering, VE):

Or the so-called often 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 perception¹⁷.

3. Management of value:

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. Regardless of these professional titles, we will use in this book all these words and terminology in rotation according to the context, but we will refer more to “*value engineering*” that this is a vernacular name.

5.2 Function (Performance/Functionality)

Functionality or performance value engineering means the specific purpose of existence of the thing or use it whether that element or experiencing good or service or otherwise¹⁸. This work describes the performance played the thing makes it a valuable possession. Expresses the function of value engineering studies by two words: name, and verb, needs to be so facilitated compare alternatives and costing variant, for example, post column construction in building is carrying the weight it already shows the activity of a pregnancy either name measurable units of weight¹⁴.

5.3 Value

Most people consider that value and the price were synonymous, express one other and this contrary to the right price is one of the criteria value such as performance and timing value are the view does not mean the same thing to

everyone every person understood the special value this affected by several factors such as space, time, resources and status of supply and demand factors, is a high value upon someone else for example, the value of a piece of land adjacent to your home and you need it to expand considerably higher than the value of someone else¹⁵.

5.4 Price Receivable

Is less expensive, price can be paid for performance or service of a commodity or item, and is desired price from the viewpoint of the customer for this service or that performance you can specify the price receivable by the alternative price leads the same function and achieve the same goal for example, use an electrical lamp for lighting into a specific illumination level (LUX) for a specific period this functionality can be achieved using many types of lights with the lowest price for these alternatives that meet the same level of lighting, the same term is the price receivable for this post¹⁶.

6. Time to Apply Value Engineering

We can conduct the studies of value theory in any stage of the emergence and development of the project and even after the operation, but experience and logic indicate that everything started school early whenever economic yield and artwork much higher and proposals and ideas are accepted high proportions to reverse everything late study less those ratios and increasing difficulty of acceptance and the high cost of application¹⁹. The best way is to apply foundation on value studies romp in addition to study technical review. Value engineering application phases:

6.1 First Phase: Preparation of the Study

The value must be setup to study well prepared and used in such a study:

1. Team selection and a multi-disciplinary expertise in order to obtain the largest number of ideas and is different for different size
2. Of the project team often consists of five to nine members. Does not require that all members of the team engineers, but it must be the team led by Certified Value Specialist (CVS Certified Value Specialist).

3. Review the project and field of study (Study Scope of Work) in detail and collectively.
4. Initially detailed cost and light determines the project team savings ratio to be achieved.
5. A timetable showing the beginning and end of each stage of the study.
6. Determine the date of completion of the study and the date the results of the study to the beneficiary.
7. Preferably study within the area of work in building the team to easily obtain the required administrative support.

6.2 Phase II: Workshop on Value Engineering

Action plan consists of seven sequential steps, where a logical sequence should be finished completely before starting any step in the next step: -

1. Collect information.
2. Job analysis.
3. Innovation and brainstorm
4. Evaluation and testing
5. Research and development
6. Briefing and presentation of recommendations

7. Advantages of Value Engineering

Value engineering is characterized by a branch of knowledge and practical methods to solve problems for other quality improvement in the following:

1. Job analysis distinctive way (function analysis).
2. Get appointed a large amount of good ideas that are applicable.
3. The action plan in place which consists of several sequential stages of a logical sequence.
4. Multi-disciplinary team working in the studies of collective values.
5. Ensure coordination between the relevant authorities in the project.

8. Type of Projects That Benefit Most for Value Engineering

There are costs associated with value engineering; therefore, it is probably impractical to use it on every project.

However, it is good idea to apply value engineering if any one of the following items is the case on the particular project:

8.1 Costly Project

Since value engineering will usually results in costs saving in the order of 5 to 10%, or in many cases higher percentage, applying value engineering to high cost projects is almost always cost effective.

8.2 Complex Project

A value engineering study affords an opportunity to get expert second opinions. When using value engineering, team members who are independent from the original design team for very technically complex project, getting a second opinion is almost always an excellent idea.

8.3 Repetitive Costs

When an organization is involved with repetitive type construction project those which they tend to build many times in various locations, the utilization of value engineering is usually very cost effective because the cost reduction ideas can be incorporated in each of the latter project of the same type.

8.4 Unique Projects with Few Precedents or with New Technology Elements

This is very simple situation to complex projects. Again the benefit of value engineering is in achieving an expert second opinion when independent team members are included.

8.5 Projects with Very Restricted Construction Budgets

With projects of this type, it is imperative to achieve maximum value for money. Since by definition value engineering seeks to achieve the elimination of unnecessary costs, its application on projects with tight budgets is usually a very good idea.

8.6 Projects with Compressed Design Programs

The old saying 'haste makes waste' is especially true with regard to construction projects. Whilst value engineering is an added requirement which can have a tendency

to add to projects programs, this time can be minimized if the value engineering activity is properly coordinated with the design programs.

8.7 High Visibility Projects

This situation applied to the government sponsored or environmentally sensitive construction projects. If errors or problems developed on a project they tend to be seized upon by the media and publish headline news. Again as value engineering provides an opportunity to obtain expert second opinion it is very effective tool for avoiding problems of this nature.

9. Job Plan

It is an organized approach which allows the VE team to analyze a project by quickly identifying high cost to worth areas and selecting alternatives which minimizes cost while maximizing quality. VE team which does not follow a formal VE job plan tends to perform a design or cost cutting review rather than true value engineering studies. It encourages VE team to think in a more thoughtful and creative manner i.e. to look beyond the use of common or standard approaches. It emphasizes total ownership costs (Life cycle costs) for a facility rather than just initial capital cost. It leads the VE team to develop a concise understanding of the purpose and functions of the facility.

A typical job plan consists of the following phases:

1. Information Phase
2. Speculation Phase
3. Evaluation Phase
4. Development Phase
5. Implementation Phase

9.1 The Information Phase

The first step in information gathering is to know the owners/users and understand their needs.

- Who are the owners/users?
- Who or what influences the owner in making critical decisions?
- What do these individuals or organizations want?

9.2 The Speculation Phase

Being creative is difficult for most engineers, because they have a built-in urge to find a quick solution.

The job plan controls this tendency and requires the engineer go through all phases of this systematic procedure. Larry Miles discusses the strategy of creativity in value engineering. One important point to remember is to let your mind wander freely with no limitations. Utilize functions as a vehicle to create the widest possible range of ideas. Unit 10 will discuss this approach in detail.

9.3 The Evaluation Phase

After all ideas are listed, a series of screening processes is needed to sort them. Idea comparison, feasibility ranking, and analysis matrix are some of the techniques that will be utilized. These techniques will be discussed in Unit 11. Basically, the system will help you focus on ideas that are closer to the user's concerns, needs and requirements. At the end of this phase, outstanding ideas will emerge for development.

9.4 The Development Phase

Good results are obtained by combining the strengths of various ideas. Development should include the following steps:

1. Research and add information to substantiate your approach.
 - (a) Separate ideas that are industry standards.
 - (b) Recognize ideas that are not tested.
 - (c) Become aware of ideas those are controversial.
2. Recognize ideas that may be unique.
3. Involve specialists to support and perfect your ideas.
4. Prepare cost estimate.
 - (a) Consider impact on customer(s).
 - (b) Use cost to perform rate of return analysis.
 - (c) Consider life cycle cost.
5. Analyze risks and back up your ideas accordingly.

9.5 The Implementation Phase

Be aware of road blocks. Look out for signals that may doom your edrts. The VE job does not end at presentation. It should continue until the ideas or the dreams materialize into reality. Keep in mind that your ideas are only as good as their implementation. It is important that the VE leader should listen, monitor and react to all concerns.

10. Reasons for the Increased Unnecessary Costs and Poor Quality

The study of value, including what it characterized by collective action between the specialist team is an opportunity to bridge the gap that may occur in the usual process design based on the individual work for each specialty on its own. Work is the individual tends to put upper limit of the factors of safety and efficiency and functional reasons for this:

1. Lack of information
2. Temporary conditions
3. Erroneous beliefs
4. False Customs and traditions
5. Few ideas
6. Change in technology
7. Change in the requirements of the beneficiary
8. Follow an old specifications and standards
9. Time constraint
10. Absence of ties or good coordination.

11. The Difference between Value Engineering and Cost Cutting Method

Some confused between governance and value with cost reduction method that there is substantial difference between them. Reducing project costs based on segmentation and eliminating some of these parts while managing value based on analysis of project posts and then subtracting alternatives lead purpose required but less expensive alternatives may be quite different from what is found in the design.

For example if we have a multi-building story of 10 stories and our budget is not enough not to build eight roles only, cost-cutting method may require reducing the size of the building as a cancellation of some parts of the project or roles for example resulting in naturally eliminating some posts for the project while managing value looking for cheaper alternatives to the project systems, such as construction, air-conditioning system, System isolation, electricity system ... Etc. Without removing any parts or functions or minimize project.

12. The Measuring of Value

To improve the value of anything you must first find a way and a mechanism to measure this value. From the foregoing we can say that value is based on three key elements are cost and quality and functionality, and get a real measure of value, must take all these elements into account:

1. Functionality the primary purpose or purpose for which the product was found, or project or administrative process.
2. Quality and mean the requirements and the expectations and wishes of the beneficiary.
3. The total cost (Total Cost or Life Cycle Cost): initial cost often attracts the client but this cost is usually between 6 to 30% of the total cost in construction projects.

13. Selection of Team Work Study

Starts with selection of the team to conduct the study value to choose the commander of the study team, which must be a specialist in value engineering and holds a Specialist Engineering Certified Value (CVS) Certified Value Specialist, and that the qualification has the appropriate experience and enjoy the capabilities to manage a team to work efficiently. The rest of the team members by making the efficiency of scientific and practical experience both in the field of specialization, depends how many people component of the working group on the size of the project and the conditions and quality, time and information available to the study, and that the type of specialties determined by the type of project and needs in question, as that of the duties and responsibilities of team leader determine number and disciplines needed by the study and the use of any external expertise in matters of minutes may not be available locally.

14. Required Information for the Value Studies

Correct information and relevant is the core value studies and this information must be available for study and action group have several sources including:

1. Project documentation (studies, charts, specifications ... Etc
2. owner/designer

3. Field visits (for websites, the owner, information centers. Etc
4. Data costs and market quotations
5. There should also be a project coordinator for a link between study groups, the parties related to the project.

15. Team Management Values

To study the value depends on collective action for that team selection is a multi-disciplinary expertise, so as to get most amounts of ideas. Team size varies for different size of the project but mostly consists of 5-9 members and consists of the designer and the recipient, structural engineer and the end user the remaining individuals are selected according to selection of the project value engineering study group can be an internal team (design team) and can be external teams and each team has advantages and disadvantages.

15.1 Advantages of using an External Team to Study the Value

External team is specialized in the studies value is contracted to conduct the study in a specific time and specific wage and the use of such a team has advantages as following:

1. Can be selected by a team of various disciplines required the design team while the former component.
2. Objectivity.
3. The team outside of the client confirms that the design done by the design team is good.

15.2 Disadvantages of using an External Team to Study the Value Engineering

When using the external team may note some defects that can be summarized as follows:

1. The design team hard to accept the new team.
2. The design team for the absorber design and has experience in both advantages and disadvantages, which could take the time outside of the team for consideration.
3. In some cases, the team may try to cash outside the current design to show his proficiency and his ability to accomplish the design better.
4. Use an external team better.

16. Conclusion

A vast study has been conducted on value engineering and the application phases has been analyzed in the thesis from the study it is noticed that 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 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.

Further works of the thesis involves preparation of questionnaire based on the various aspects of a project as per mentioned in the methods and a survey will be done in various companies to check the related knowledge of the personnel towards those aspects. Further the data collected will be analysed and suitable suggestions will be framed according to the data.

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