

Value Engineering- An Approach to Enhance Real Estate Industry

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Abstract - Value Engineering is a proven management technique that can make valuable contributions to value enhancement and cost reduction in construction industry. Value Engineering is one of the most effective techniques known to identify and eliminate unnecessary costs in product design, testing, construction, operations, maintenance, procedures and practices. Value Engineering is the systematic application of recognized techniques that identify the functions of the product or service, creatively establish the worth of those functions, and provide only the necessary functions to meet the required performance at the lowest overall cost. Value Engineering focuses on accomplishing the required functions at the lowest overall cost. It helps in eliminating or minimizing wastage of material, time, and unnecessary cost, which improves value to the customer. Value engineering is the tool of construction management in the real estate sector to improve the construction work in all aspects.

Key Words: Value engineering, Job Plan, FAST Diagram, Value analysis, Project Management

1. INTRODUCTION

The current scenario can be seen that the construction industry has reduced the traditional methods of construction and approaching towards research and application of new techniques by utilizing advancements in technology. Value Engineering is the systematic application of recognized techniques that identify the functions of the product or service, creatively establish the worth of those functions, and provide only the necessary functions to meet the required performance at the lowest overall cost. Value Engineering focuses on accomplishing the required functions at the lowest overall cost. It helps in eliminating or minimizing wastage of material, time, and unnecessary cost, which improves value to the customer. Value engineering is the process of relating the functions, the quality and the costs of the project in the determination of optimum solutions for the project. A cost-effective solution is achieved by an application of VE principle for different components of the structures relating its quality and quantity. This study mainly focuses on new techniques, methods and materials that can be adopted in construction industry, in which, its cost, quality, process time and feasibility are considered. Value engineering play a very important role regarding quality, reliability, durability and enhancing the performance throughout the life of project without disturbing future needs. Value engineering is creative, systematic effort directed at analyzing functional requirements of a project for the purpose of achieving essential functions at lowest total cost over life span of project.

1.1 History

Value engineering began at General Electric Co. during World War II. Because of the war, there were shortages of skilled labour, raw materials, and component parts. Lawrence Miles, Jerry Leftow, and Harry Erlicher at G.E. looked for acceptable substitutes. They noticed that these substitutions often reduced costs, improved the product, or both. What started out as an accident of necessity was turned into a systematic process. They called their technique "value analysis".^[1] During the World War II, General Electric Company (GE) faced the problem of scarcity of critical materials to fulfil the demand of the war equipment. To overcome that problem, GE had to use substitute materials for those in shortage. Many of the substitutes were less expensive and better in performance. In 1947, Lawrence D. Miles, a staff engineer for GE developed a number of ideas and techniques to select alternative materials that could be used internationally. His main attitude was to search for value in a product and he developed a function-based methodology that was successfully proven. The new methodology was so successful that it was possible to produce goods at greater production and operational efficiency and at lower costs. As a result of its success, GE formed a special group headed by Larry Miles to refine the methodology. In 1954, the U.S Navy Bureau of Ships used the Value Analysis process to cost improvement during design. They called it "Value Engineering". The Value Engineering was used formally in the U.S Department of Defense in 1961.^[2]

2. THEORY OF VALUE ENGINEERING

Value engineering is a practice whose goal is, always, to achieve value for money. Value engineering aims to value improvements through cost reduction and or improve quality and enhance design features for the customer.

Value Engineering technique directed toward analyzing the functions of an item or process to determine best value or the best relationship between worth and cost. Best value is represented by an item or process that performs the required basic function and has the lowest life cycle cost. Value engineering is thus not simply a cost cutting method but improving value for service by modifying and enhancing functions. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost.

Reasons for poor value can be that, lack of information, decisions based on wrong beliefs, habitual thinking, negative attitudes, and reluctance to seek advice, shortage of time,

changing technology, and lack of yard stick to measure value, old specifications and poor human relations.

Value engineering gets closer to cost control because it looks at ways to reduce cost on specific items or activities. However, it does not look at the total project picture or check the daily performance it focuses only on specific items in the designs, procurement or construction area.^[3]

2.1. Value Management

Value management is defined as process of delivering some benefit to the client. It is the process of delivering value throughout the project lifecycle.

1. VM is a cost effective technique (to reduce the costs by using cost effective materials)
2. VM reduces delay in the project.
3. VM reduce cost without sacrificing quality
4. Value = (Function + Quality + Performance) / (Cost + Time)

2.2. Analysis of Value Management

It is a systematic tool to reduce the unnecessary costs and to give good quality and performance. Through value analysis, wastages in site, duplication of work, unnecessary expenditure can be minimized.

1. By giving alternative ideas.
2. By finding out unnecessary cost.
3. By applying innovation and creativity.
4. By saving cost and time.
5. By applying easy methods and procedures.
6. By removing or eliminating unnecessary items.

2.3. Application of Value Analysis

Low cost valuable materials are being introduced

1. If investment is reduced.
2. If Sales of product is reduced.
3. Competitor's products are cheaper.
4. Raw material costs are increased.
5. If delay in project.
6. Problem in performance or quality.

2.4. Value Engineering Concept in Building Construction

By applying value engineering concepts or value management process in the project, it can be used to

1. Reduce money.
2. Solve the problems.
3. Make profit in the project.
4. Routine review on site.
5. Attain project objectives.
6. Select best alternatives.
7. Reduce life cycle costs.

8. Planning at tender stage.
9. Align resource efficient and effective.

3. METHODOLOGY

For any certain project, the VE study is applied by a multidisciplinary team to improve its value. SAVE International sets 6 sequential phases for performing a successful VE study. The phases are distributed in 3 stages; pre-workshop stage, workshop stage, and post-workshop stage. The methodology of the SAVE International VE studies, including stages and phases, is shown in Figure 1.^[4]

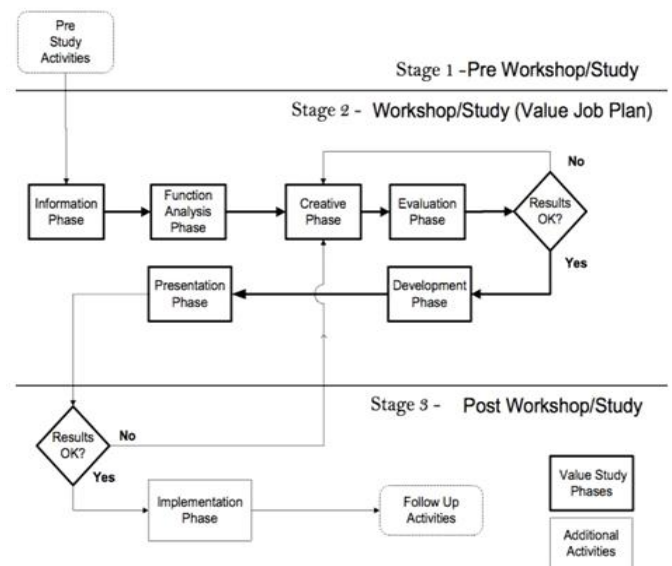


Figure 1: Value Study Process Flow Diagram by SAVE International

Here, in this paper we will discuss about the stage 2-JOB PLAN.

Value engineering can be applied during any stage of a project cycle. VE may be applied more than once during life cycle of construction project. Early application of VE helps in more organized implementation of project activities, thus reducing overall cost by avoiding any major changes right in the beginning. If the application of VE is done in later stages it may result in higher project cost.

VE is applied in an organized process known as VE job plan. The purpose of job plan is to assist a study team to identify and focus on key project functions in a systematic manner, in order to create new ideas that will result in value enhancements. The VE job plan consists of five phases as below:

3.1 Information Phase

In this phase maximum information is collected from various aspects of project regarding identification of problems to be solved and gathering of information on background, function

and requirements of the project. At the beginning of VE study it is important to:

- Understand the background and decisions that have influenced the development of design.
- Define owner’s objective and criteria governing the project.
- To analyze issues of project.
- To discuss project cost and schedule data.
- To prepare cost and energy models.

VE team recognizes low quality area and high cost area and sets target quality improvement and cost savings.

3.2 Function Analysis Phase

The purpose of this phase is to understand the project from a functional perspective, thus identifying the project intended functions [4]. In this phase, the functions are identified and classified. Functions are to be in a certain format where only two words are used in the function; a verb and a noun. For example, one of the functions of Car is to “comfort user”. Another example of a function of the interior design is “aesthetical view”. The mostly used function model is the Function Analysis System Technique (FAST), developed by Mr. Charles W. Bytheway in 1964. The FAST diagram links the simply expressed verb-noun functions to describe complex systems. It has many symbols and notations. But the probably the most important information to know is that it answers three primary questions; how, why and when. For further demonstration, the FAST diagram for a sample project is presented in Figure 2.

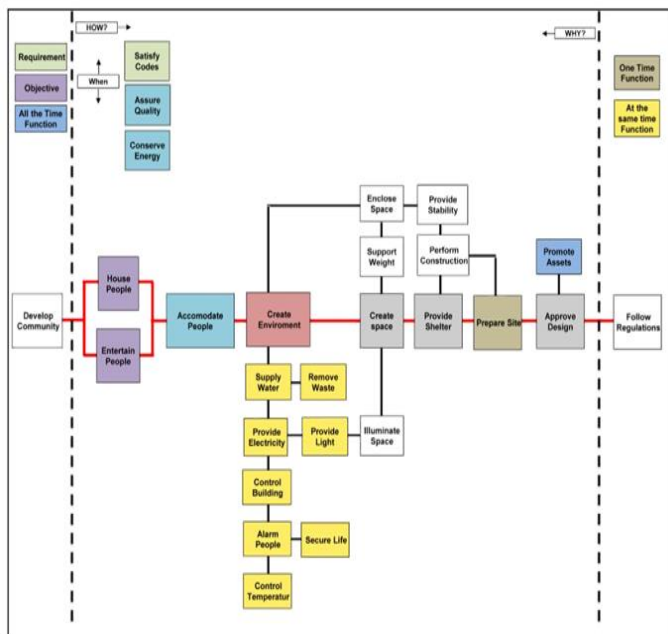


Figure 2: FAST diagram for a sample project

3.3 Creative Phase

This phase involves generation of creative ideas and listing of them in accordance with project viewpoint. The value engineering team lists creative ideas generated from its review of the project with the aim of obtaining a large number of ideas through brainstorming and association of creative proposals VE team provides necessary functions within the project. In team everyone is encouraged to participate. Evaluation of ideas is prohibited in this phase. The VE team is looking for quantity and grouping of ideas, which will be screened in the next phase.

3.4 Evaluation Phase

In this phase of project, VE team together with client defines the criteria for evaluation. It involves:

- Analysis of ideas resulting from creative phase.
- Ranking of ideas by VE team.
- Irrelevant or non-worthy ideas are discarded.
- Selection of ideas which represents greatest potential for cost saving and improvements.

A weighted evaluation is applied in some of the cases to account for impacts other than cost such as quality, safety, reliability, time, constructability, aesthetics, serviceability, durability, maintainability, etc.

3.5 Development Phase

The team prepares alternative designs with capital and/or life cycle cost comparisons of original designs and proposed alternatives. All recommendations are supplemented with written descriptions, sketches, basic design concepts, technical information and cost summaries. The selected ideas are developed into proposals that are clearly written so that the owner and other project stakeholders understand the intent of the proposal and how it benefits the project, and also to identify any potential negative factors associated with the proposal.

3.6 Presentation Phase

In this phase, the results of the development phase are presented to the decision makers to assist them and get the best understanding of the different VE alternatives and their short-term and long-term benefits. Presentation of recommendation is prepared in the form of a report. The team for presentation consists of client, consultants and other stakeholder representatives. The VE team members describe the recommendations and basis that went during development phase. VE report is shared with client and designers. This begins the evaluation by the client and designer of the VE report. After incorporating client’s comments a preliminary proposal implementation action

plan is prepared. In this phase as well, an anticipated implementation plan is outlined.

4. STAGES OF VALUE ENGINEERING

VE can be applied at any stage in a project, even in construction. However, the earlier it is applied the higher the return on the time and efforts invested. Thus, the greatest benefit and resource saving is achieved in planning and conceptual stage. At this point major information is established.

When to apply VE

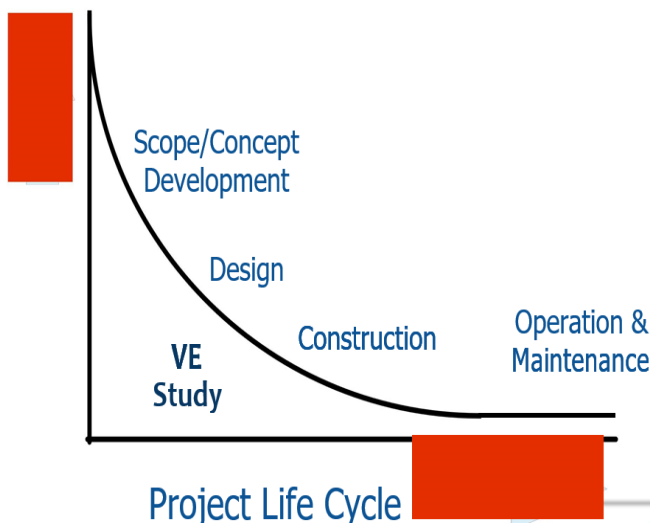


Figure 3: The stages of VE application

4.1 Concept and Design Phase

The first step of Value Engineering study is applied during the planning and designing stage to define the project goals, functions, objectives, requirements, design criteria and scope of work. Benefit of starting Value Engineering at this stage is that project will be developed with fewer changes, redesigns and greater understanding by all parties of what final function will be. When there will be clear scope of the project with less changes, it makes the worth value of the project which should be applied vigorously in each Real Estate Project. And less changes in design means quality work at the time of execution reducing the burden on site engineers so that they can focus on quality rather than focusing on changes in designs. Multiple design alternatives are considered and the most cost effective and overall efficient alternative is selected. Suggestions by other personal like constructor, designers are also taken for improvement.

4.2 Construction Phase

During this phase value engineering is still possible though the use of VE change proposal. But application of VE at this phase is generally costly and difficult to implement due to resistance to change.

4.3 Operation and Maintenance Phase

The most important and should be taken care of phase in value engineering stages is operational and maintenance stage. During this stage various maintenance works in building takes places which reduces its worth and also customer satisfaction is lost reducing the worth of the project and also reducing the reputation and brand value of the company. To avoid these loss, more focus should be on delivering high quality construction work to the customers with additional value engineering techniques. Focusing on this stage reduces a huge amount of cost of maintenance work after the delivery. Infusing the high cost in good quality work in early stage can be a good decision, rather than taking a huge loss in maintenance and operational cost.

5. APPLICATION OF VALUE ENGINEERING TO CONSTRUCTION PROJECTS

There has been much competition in the construction sector from last decade and it requires them to have a better reliability towards the customer which intends them to give better services at reasonable cost. There are many factors which need to be considered for keeping a low cost. It is necessary to know that having low cost is not only the binding factor but also it is necessary for them to have a better value to their project. The value in this case can be different for all concerned parties. Each party tries to have a better value and the main motive behind a business is to have a good profit. When it comes to the contractor side he would always try to complete his work in the lowest possible cost similarly for the client he should be getting maximum gains as possible. The customer has to only consider his comfort level and the design team would consider its functions and aspects to be taken into consideration.

As construction involves a larger amount of task starting from the planning to the execution stage, there is a risk of completing the tasks in the given time and cost. Also it should be considered that the durability, reliability of the work should also increase. It is necessary to take precautionary measure in the planning or initial stage but we take fewer measures for considering value. Also after the work completed it is less seen the tendency of comparing the construction with the value but generally it is seen that the profit basis is been considered and compared. In value engineering we consider for designs which are integrating both value and cost and for that it finds the critical elements and eliminate the unnecessary cost associated with the project.

The production cost is always a major concern and it has to be reduced for achieving a better reduction in the overall cost of project. It can be either the material cost, equipment cost etc. It's always necessary to check whether the equipments and materials being used are according to the conformance of the current needs and if not then it is necessary to replace them with materials which is equivalent

to existing material and also it's necessary to consider the cost reduction aspect also.

The minimization of the defects and lack of clarification during the execution of projects leads to future unnecessary cost indulged and this can be reduced by proper details to be given to the execution team so that a better quality project could be done and the future unnecessary cost can be controlled. Value engineering can impart a good integration between the cost and value of the project. It is very necessary to always check the aspects of the project on a periodic basis. That basically helps to achieve more understanding of what functions need more clarity and changes to be done so that good quality can be achieved.

When we plan to do value engineering to particular project it is necessary to properly follow all steps related to VE in a proper manner so that we get better results. Firstly it is necessary to identify the critical elements which are imparting unnecessary cost in a project. There can be various such critical elements but it is not possible to carry VE on all the critical elements as it can affect the overall quality of the project. The combination of the elements should be taken which can have maximum cost reduction in a project. The possible combination of the elements can be selected by proper mathematical models which help us to analyse the best possible combination. Also it is necessary to compare the selected results with the quality of the project. The quality is to be maintained so that future sustainability is maintained.^[5]

6. CONCLUSIONS

Value engineering methodology is a powerful tool for resolving system failures and designing improvements in performance of any process, product, service or organization. Its application results in significant improvements to quality and reliability by focusing the team's attention on the functions that are contributing most to the problems, and the most likely causes of these problems. Getting down to the root causes and trying to resolve it through application of value engineering. Then, the team develops ways to improve these root causes of the problems, and ways to fix the problems that have occurred along with means to prevent their reoccurrence.

The necessity of application of value engineering is generally acknowledged by the construction industry and the findings indicate that VE is recognized as an effective construction industry Management tool. Many concede that a variety of problems exist within the construction industry process which need addressing such as the amount of complex information to be communicated. The success of the project depends on various factors which are involved in a project such as the methods applied for the projects, the internal and external factors associated with the projects. The initial estimates which are prepared should be maximum in accordance to the project and it is necessary as it can directly affect the fund requirements in the execution of project. It is

necessary to identify the necessity of VE in any project. The VE can only be applied on projects which can have considerable cost benefit. Hence it is useful if we apply value engineering to a big project where the VE can bring considerable benefit to the organization. Also there should be a proper balance between all the things which are being applied to a project and also the needs of the customer should also be taken into consideration.

The VE savings can be brought about in favor of all parties concerned to the project. It is necessary that all parties should understand the importance of value engineering and impart it as an important part of their function. Successful VE implementation is possible only through the coordination of all concerned participants. VE is mostly properly defined and understood by all levels in the organization. It can be an effective technique for having better performance with cost reduction. The quality of the concerned people undertaking VE is very important. It gives us better quality, cost and performance for the concerned product/service.

To summarize all this and conclude that Value Engineering can be an effective tool of Construction Management in Real Estate Sector. It just needs to have input from all the working and non working staff of the company and to follow and coordinate accordingly respective of their own profile and try to impose the Value Engineering techniques in each stage of the process of construction. To create better product and its value, firstly we should include the Value Engineering in the process of production.

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