



# A STUDY ON VALUE ENGINEERING & GREEN BUILDING IN RESIDENTIAL CONSTRUCTION

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## ABSTRACT

*Value is a function of cost relative to quality or function. Saving time, money and providing superior value is a concept that everyone can support. The benefits of scattering our invested rupee, building more for less money, increasing efficiency and cutting down our dependency on energy-intensive buildings and plant facilities need to be recognized today and pursued in the future.*

*Value Engineering can increase the product cost by reducing unnecessary costs, associated with the product. In VE hidden costs may be eliminated without affecting quality. Hence Value Engineering saves money and improves productivity.*

*The literature deals about the value engineering in construction industry that is helpful to gain knowledge about the work study, value management, improvement techniques. This thesis based on qualitative and quantitative analysis, questionnaire, interview by the engineers, review of previous journals regarding value engineering. Hence these are the finding.*

- *Value engineering methods and techniques*
- *Implementation of value engineering in a green building*
- *Important roles of value engineer and how to do effective value on cost*
- *Recommendations and development in green building*

**Key words:** Value Engineering, Value Management or Value Methodology, Value Analysis, Unnecessary costs, Hidden costs, Productivity, Quality.

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## 1. INTRODUCTION

Keeping costs low with traditional methods has been a common practice to improve competitiveness. Reducing money and, at the same time, provided that better value is a concept that everyone emphasizes. Value Engineering is a practice whose goal is, always, to achieve value for money.

Value Engineering aims to deliver quantifiable value improvements through cost decrease and or get better quality and improve design features for the customer.

These regulations cannot be unobserved if a company is to continue meeting the growing opportunity of its customer, who resolve always take their business to where they can get the maximum quality at the lowly possible price.

Value engineering is accomplished within the project management or industrial engineering body of facts as a method in which the value of a system's outputs is optimized by crafting a mix of performance and costs. In most cases this practice recognizes and removes needless expenditures, thereby increasing the value for the producer and/or their customers.

Value engineering concepts are used in the projects because the expenses for design and construction materials are a huge part of the construction project budget. Conducting value engineering will make the most of the building's value of the budget.

## 2. VALUE ENGINEERING

System Oriented – an official job plan to recognize and eliminate unnecessary costs.

### *A Proven administration method*

Function oriented – relates function required to the value received.

Value engineering is to choose the best alternative before starting the work, to check whether the alternative material suits the project, to use innovative methods to improve the project, and also best alternate form the past projects can be taken.

### 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.

- VM is a cost effective technique (to reduce the costs by using cost effective materials)
- VM reduces delay in the project
- VM reduce cost without sacrificing quality
- 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.

- By giving alternative ideas
- By finding out unnecessary cost
- By applying innovation and creativity

- By saving cost and time
- By applying easy methods and procedures
- By removing or eliminating unnecessary items

### **2.3. Application of Value Analysis**

- Low cost valuable materials are being introduced
- If investment is reduced
- If Sales of product is reduced
- Competitors products are cheaper
- Raw material costs are increased
- If delay in project
- 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

- Reduce money
- Solve the problems
- Make profit in the project
- Routine review on site
- Attain project objectives
- Select best alternatives
- Reduce life cycle costs
- Planning at tender stage
- Align resource efficient and effective

### **2.5. Phases in Value Engineering**

These are the phases in value engineering

- Preparation
- Information
- Analysis
- Creation
- Evaluation
- Development
- Presentation
- Follow-up

## 2.6. What is a Green Building?

A green building is said as ecologically accountable, gainful and a well place to live and work. It makes sure that waste is decreased at each stage during the construction and development of the building, resulting in little costs.

Green building technology relates to both accessible and fresh construction, from an easy commercial space to large development projects.

Green building has the potential to save 30-40% energy. The general alertness on green buildings in India is scarce and sprinkled. Though architects have been adopting concepts like inactive architecture and natural air – conditioning, an integrated and holistic approach towards construction of green buildings is yet to emerge.

Green building cost effective materials are used as substitutes in construction industry. Substitutes are less expensive but have better performance. By substituting green materials to the construction project, we can save up to 30% on estimated cost.

The benefits of green building materials are,

- Lowers costs
- Less expensive material with same quality
- It reduces maintenance/replacement rate all over the life of the building.
- Power protection.
- Enhanced occupant health and productivity.

Application of green building cost effective materials as a substitute to conventional materials can reduce the cost and gives green environment.

## 3. METHODOLOGY



Figure 1 Methodology

## 4. EXPERIMENTAL PROGRAMME

The literature deals about the value engineering in construction industry that is helpful to gain knowledge about the work study, value management, improvement techniques. This thesis based on qualitative and quantitative analysis, questionnaire, interview by the engineers, review of previous journals regarding value engineering.

All necessary and possible information regarding the project were collected by visiting the site office and company directly.

From the data available, useful data related to the projects were taken. The analysis has been done through the feedback given by the engineers and based on the interview the final results are obtained. The recommendations and the suggestions from them are taken into account, hence I have concluded with my suggestions to reduce the costs without affecting the quality (effective value on cost) and to maintain the green building. This provides scope for value analysis and at the same time value engineering for the next repetitive project.

The scope for application of value engineering is very high. The recommendations given for these projects could be considered for other project units to achieve maximum value.

Some of the methods are used with the procedures to arrive the results,

- Investigation (Information) phase
- Functional Analysis phase
- Speculation phase
- Evaluation phase
- Development and recommendation phase

### 4.1. Investigation Phase

Several areas of information are collected for the VE study during the information phase could are as follows.

- Design Criteria (System requirement)
- Site Condition (Topology, Soil condition, Soil boring, Surrounding areas, Photographs)
- Background of the project
- Available resources
- Requirements resulting from public participation
- Breakup of cost estimated.
- Architectural, structural, service and other drawings

### 4.2. Function Analysis Phase

Typical evaluation criteria for assessing value are:

- Initial cost
- Energy cost
- Return on profit
- Functional performance
- Reliability

- Ease of maintenance
- Quality
- Environmental owner requirement safety

### **4.3. Speculation of the Projects**

The main objective in this phase is to be creative and brainstorm alternate proposals and solutions. These techniques foster the concept of creativity in the human minds through psychological approach.

Techniques used in speculation space

- The Gordon Technique
- Lateral Thinking
- Checklists
- Brain Storming

The items under consideration are Footings, Columns, Slabs, Walls, Flooring, Plastering, Service ducts cover, Ventilators and Parking Flooring. In this Speculation Phase all the items with poor value are considered and the various alternatives are identified. From the alternatives identified, the best course of actions is finalized to get the best value.

### **4.4. Evaluation Phase in These Projects**

The objective of the evaluation phase is to weed out the ideas that were generated during creative phase and select the best among them for development. Applying NEFR method to rate the ideas, the scores are found out.

#### ***4.4.1. Green Building Council***

According to management in Energy & Environmental Design (LEED) rating scheme, the project checklist includes. Points are given to the projects based on the performance

- Sustainable development of sites
- Water efficiency
- Energy and atmosphere
- Materials and resources selection
- Indoor environmental quality

### **4.5. Development and Recommendation Phase**

The suggestions and recommendations are given below based on the feedback of the engineers for effective value on cost and to maintain the green building.

#### ***4.5.1. Tasks to be followed by the value engineers to reduce the costs***

- Proper planning before starting the work to reduce the costs.
- Cash flow forecasting
- The costs have to be limited
- To be careful on budget preparation
- Life cycle costing
- Cost analysis to be made

- Cost benefit analysis
- Estimating and costing
- Alternate low cost materials
- Cost reduction at planning stage

#### ***4.5.2. Tasks to be followed to maintain the green building***

- To maximize water efficiency within buildings to reduce the load on public water supply and wastewater systems.
- To avoid expansion of unsuitable sites and reduce the environmental impact from the place of a building on a site.
- To control erosion to decrease harmful impacts on water and air quality.
- To get rid of light intrude from the building site, get better night sky access, and lessen development impact on natural environments.
- To check the building fundamentals and systems are designed, installed and calibrated to operate as per the plan.
- To decrease toxic waste and land development impacts from automobile usage.
- To protect existing natural areas and renovate damaged areas to provide habitat and support biodiversity.
- To trim down the use of potable water for scenery irrigation purpose.
- To start the least amount level of energy efficiency for the building.
- To reduce ozone depletion.
- To Limit trouble of natural water flows by minimizing storm water runoff, increasing onsite infiltration and reducing contaminants.
- To encourage the environment for net zero pollution.
- To encourage for reduction of wastage in the building
- To maximize the life cycle of the building by efficient utilization of resources, by reducing wastages and to reduce environmental impacts.
- Demolition and debris to be cleared immediately, recyclable materials to be sent to manufacturing process.
- To reduce the environmental impacts in order to extend the life of the building.
- Clean air to maintain the health, safety and soothe of the building occupants is needed.
- To reduce the air contaminants that are odorous to occupant health and comfort
- To avoid exposure of dangerous chemical that badly impact air quality

## **5. RESULTS & DISCUSSION**

Hence in the conclusion, Value Engineering plans to bring quantifiable value developments through price lessening and to get better excellence for the customer. This can be applied in the architectural, structural and material components of the building. VE can achieve accurate and cost effective solutions to the problems.

## **Recommendations and suggestions are given to be aware while working out the cost**

- VE/VA creates price and excellence realization among employees.
- VE helps out workforce in healthier thoughtful of their employment.
- VE lessens the costs without affecting the quality.
- It helps in easy cash flow
- Quality is maintained throughout the project.
- Maintains throughout life cycle cost.
- Use of aesthetically pleasing and more durable materials without increase in cost.

During the analysis, the alternatives and currently existing facilities were evaluated by conducting a fairly detailed rate analysis, technical feasibility and aesthetic survey. These are some of the value-engineered elements that are believed to provide more comfort to the ultimate user without compromising on the quality, time or cost. This proves the scope and application of Value Engineering in building construction is tremendous, from both the developers and buyers point of view. Until recent times, VE was applied only in large turnkey projects.

It is sincerely hoped that this study opens new dimensions in the construction industry for the purpose of providing the best facility ultimately to the end user.

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