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Enhancing Efficiency in Traditional Construction Practices through the Application of Value Engineering Techniques

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Abstract: ***Traditional construction practices often face problems like extra use of materials, labour delays, and rework. This study focuses on how Value Engineering (VE) can improve efficiency and reduce cost in new construction projects that follow traditional methods. The research is based on observations from a project of 770 sqm area, where common issues such as steel lapping at multiple levels, extra concrete pouring and later demolition, and manual shifting of materials like scaffolding were identified. Other issues included delay due to lack of shuttering or scaffolding parts, excess material ordering leading to wastage, and labour dependency for bending heavy reinforcement bars. The absence of clear brand specifications in the BOQ also caused material rejection and rework. By applying value engineering, these non-productive activities can be minimized. The study suggests measures like optimizing lapping lengths, using accurate concrete pouring techniques, mechanizing reinforcement bending, proper planning of material movement, and ensuring timely procurement. Involving technical staff in daily coordination can also save time and improve decision-making. Overall, this research shows that adopting Value Engineering in traditional construction can lead to significant savings in cost, time, and material, while maintaining quality and function of the structure.***

Keywords: Value Engineering, Traditional Construction, Cost Saving, Labour Efficiency, Material Management, Project Optimization

1. Introduction

My name is **Rahul Giradkar**, and I am currently pursuing a **Postgraduate degree in Project and Construction Management** from **MIT ADT University, Pune**. As part of my academic journey, I joined an organization as an **intern** and was later deployed at a **construction site in Pune**. Initially, my work involved verifying structural components according to approved drawings. During this process, I began observing several on-site challenges and realized that many of the issues I had studied in my PG program existed in real construction practice.

I noticed frequent **steel lapping at multiple heights**, **extra concrete pouring and later demolition of excess portions**, and **manual transfer of materials like scaffolding**, which required multiple labourers and caused time loss. There were also delays due to **shortage of shuttering and scaffolding materials**, **excess material orders leading to wastage**, and **manual bending of heavy reinforcement bars**, which demanded unnecessary manpower. In some cases, **unclear material specifications in the BOQ** caused client rejections and rework.

These site experiences helped me understand how **traditional construction practices** often lead to material waste, time delays, and cost overruns. This motivated me to apply the concept of **Value Engineering (VE)** to find more efficient and cost-effective solutions without compromising on quality. Through this research, I aim to study how the application of VE techniques can improve **labour efficiency**, **material management**, and **overall project performance** in traditional construction methods.

2. Problem Statement

In many construction projects, traditional construction practices continue to dominate due to familiarity and ease of use. However, these methods often lead to **material wastage, labour inefficiency, rework, and time delays**. Activities such as **excess steel lapping**, **extra concrete pouring**, **manual material handling**, and **poor coordination between technical and non-technical staff** increase project costs and reduce productivity. Additionally, issues like **shortage or over-ordering of materials** and **unclear BOQ specifications** create further inefficiencies and disputes during execution.

Despite the availability of modern management techniques, **Value Engineering (VE)** is rarely applied at the site level to identify and eliminate these non-value-adding activities. There is a clear gap between the theoretical understanding of VE and its actual implementation in traditional construction projects.

Therefore, the problem addressed in this research is to **identify major inefficiencies in traditional construction practices** and **propose practical Value Engineering solutions** that can help optimize **cost, time, material usage, and labour productivity** without compromising the quality or function of the structure.

3. Research Objectives and Scope

Objectives
The main objective of this research is to study how **Value Engineering (VE)** can be effectively applied to improve efficiency in **traditional construction practices**.
The specific objectives are as follows:

1) **To identify** the key problem areas in traditional construction that cause wastage, delay, or cost overrun.
2) **To analyze** these issues using Value Engineering principles to find their root causes and impacts.
3) **To propose** practical VE-based solutions that can optimize material usage, reduce rework, and improve labour productivity.
4) **To evaluate** how the implementation of VE can enhance cost efficiency, time management, and project quality.
5) **To recommend** a framework for applying VE techniques in future construction projects to ensure sustainable and value-based execution.

Scope of the Study

This research focuses on **new construction projects using traditional methods** such as conventional concrete works, manual reinforcement bending, and on-site formwork operations. The study is based on **real-time observations** collected from an ongoing construction project in Pune with an area of approximately **770 sqm**.

The scope includes the identification of site-level inefficiencies related to:
- Steel lapping and reinforcement work,
- Concrete pouring and rework,
- Material handling and scaffolding management,
- Labour productivity and technical coordination, and
- Procurement and specification clarity.

The study is **limited to project execution activities** and does not cover advanced construction technologies or financial modelling. The findings are intended to provide **practical guidelines** for engineers, contractors, and project managers to integrate Value Engineering into daily construction practices for better performance and reduced costs.

4. Literature Review

1) **Value Engineering (VE) — overview:** VE is a structured method to improve project value by keeping required function while lowering life-cycle cost. Recent reviews show VE remains an effective tool in construction to reduce cost and improve schedule when applied systematically. Wiley Online Library
2) **Rework, waste and impact:** Rework is a major source of time and cost overruns in construction; it produces material waste and reduces productivity. Studies identify poor planning, incorrect execution and material/supply problems as dominant causes. ScienceDirect+1
3) **Steel lapping and splice optimization:** Research shows that unoptimized lap splice practices increase steel consumption and cutting waste. Optimizing lap locations, lengths or using mechanical splices can significantly reduce steel wastage and improve constructability. Taylor & Francis Online+1
4) **Excess concrete pouring and rework:** Extra concrete pours (then chipping/demolition) are tied to poor formwork alignment, surveying errors and sequence issues. VE methods (better checks, sequencing and formwork control) reduce such rework. ScienceDirect
5) **Material supply, scaffolding & schedule delays:** Delays from missing scaffolding/shuttering parts and poor procurement planning cause idle labour and schedule slip; waste-aware procurement and better material planning reduce these impacts. ScienceDirect+1
6) **Manual vs mechanized reinforcement work:** Manual bending/treatment of large-diameter bars is labour-intensive and slow; studies report mechanized bending, tying and automated rebar tools increase productivity, accuracy and safety. ResearchGate+1
7) **BOQ/specification and procurement risk:** Errors or unclear items in BOQs (including brand/make ambiguity) lead to disputes, rejections and reorders. Literature recommends function-based specs and early client approval of makes to avoid procurement rework. ResearchGate+1
8) **Synthesis for your study:** Across international studies, VE consistently targets the same site problems you observed: reduce rework, optimize reinforcement detailing, improve procurement and logistics, and adopt mechanization where it gives better value. These findings justify applying VE on your Pune site.

5. Data Collection and Analysis

This research is based on both **primary** and **secondary data** to study the application of Value Engineering in traditional construction practices.

1) Primary Data

Primary data was collected directly from a **construction site in Pune**, where I am currently working as an **intern**. The project area is approximately **770 sqm**, during daily site work, I observed and recorded different issues related to material usage, labour efficiency, and construction methods.

Some key observations included:
- Multiple **steel lapping** points increasing steel consumption.
- **Excess concrete pouring** in vertical members and later demolition of the extra part.
- **Manual shifting of scaffolding materials** requiring more labour.
- **Delay in work** due to shortage of scaffolding or shuttering components.
- **Over-ordering or shortage of materials** causing wastage and idle time.
- **Manual bending of heavy reinforcement bars** needing 5–7 workers.
- Lack of **technical coordination** and unclear **BOQ specifications** leading to rework.

All these on-site issues were documented through photos, supervision logs, and discussions with site engineers and supervisors.

2) Secondary Data

Secondary data was gathered from journals, textbooks, research papers, and construction management reports that discuss the use of Value Engineering in improving cost and time performance. The literature helped in identifying standard VE methods and comparing them with actual site observations.

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3) Analysis Method

The collected data was analyzed using **Value Engineering principles** and the **Function Analysis System Technique (FAST)**.

Each problem observed on-site was studied to identify:
- The **main function** of the activity,
- The **cost impact** or wastage involved, and
- The **possible alternative solution** that provides the same function at lower cost and time.

Comparative analysis was carried out to evaluate how the suggested VE alternatives could improve project performance in terms of **cost savings, reduced wastage, and better labour utilization**.

6. Findings and Recommendations

Based on the analysis of the site observations and the application of Value Engineering (VE) principles, several important findings and practical recommendations have been identified. These address the common inefficiencies found in traditional construction practices and suggest cost-effective and time-saving solutions.

1) Steel Lapping

Finding: At the site, most columns had multiple lapping points at different heights, increasing steel consumption and labour time.

Recommendation: Plan reinforcement bar lengths properly before cutting and optimize lap lengths as per IS codes. Use couplers or mechanical splicing where possible to reduce overlapping and material waste.

2) Excess Concrete Pouring and Demolition

Finding: Extra concrete was poured in columns and other vertical members to "match later," leading to demolition and rework.

Recommendation: Ensure formwork alignment and element positioning before pouring. Use proper levels, line marking, and shuttering checks to avoid extra concreting. This reduces rework and saves both time and material.

3) Manual Material Handling

Finding: Materials like scaffolding pipes and boards were manually transferred across the site by 8–10 labourers, consuming time and energy.

Recommendation: Use trolleys, wheelbarrows, or temporary site lifts for material transfer. Properly plan storage and movement routes to reduce labour fatigue and improve productivity.

4) Delay due to Material Shortage (Scaffolding/ Shuttering)

Finding: Work was delayed when scaffolding components such as ledgers and clamps were not available on time.

Recommendation: Maintain a small buffer stock and use a tracking system for scaffolding and shuttering materials. Regularly review material schedules to prevent work stoppages and idle labour time.

5) Over-Ordering and Wastage

Finding: To avoid shortages, excess materials were ordered, leading to unused stock and wastage.

Recommendation: Use accurate quantity estimation and material tracking systems. Order materials in planned batches based on work progress and approved BOQ quantities.

6) Manual Bending of Heavy Reinforcement

Finding: Reinforcement bars above 16mm diameter were bent manually, requiring 5–7 people and causing delays.

Recommendation: Use mechanized bar bending and cutting machines to save labour, improve accuracy, and maintain the quality of reinforcement bends.

7) Lack of Technical Coordination

Finding: Excess time was spent in meetings and mail follow-ups due to poor communication between technical and non-technical staff.

Recommendation: Assign technically qualified engineers for site coordination, decision-making, and approvals. This reduces confusion, improves response time, and ensures smoother execution.

8) 8. Unclear Material Specification in BOQ

Finding: BOQ did not mention the approved make of materials (e.g., steel brand). This led to client rejection and reordering of materials.

Recommendation: While preparing the BOQ, clearly specify approved brands or include a "make list" approved by the client in advance to avoid rejection and delays during procurement.

Summary of Findings

The study found that most inefficiencies in traditional construction practices occur due to **poor planning, unoptimized resource use, and lack of technical decision-making**. Applying **Value Engineering** techniques helps in identifying these non-value-adding activities and replacing them with **practical, cost-effective solutions**.

Overall Recommendation

Integrating Value Engineering as a regular practice during the **planning and execution stage** of construction projects can lead to:
- Better material management,
- Reduced rework and wastage,
- Improved labour productivity, and
- Enhanced coordination between teams.

7. Conclusion

This research highlights how **Value Engineering (VE)** can significantly improve the efficiency of traditional construction practices. Based on real site observations and analysis, it was found that most inefficiencies arise from **unplanned material use, manual handling, excessive rework, and lack of technical coordination**. Problems such as **steel lapping at multiple heights**, **extra concrete pouring**, **labour delays due to scaffolding shortages**, and

unclear BOQ specifications lead to both time and cost overruns.

By applying VE principles, these issues can be minimized through **systematic planning, accurate quantity estimation, mechanization of heavy work, and improved technical supervision**. The study shows that adopting VE not only reduces wastage and labour dependency but also ensures better decision-making and overall project performance.

In conclusion, integrating **Value Engineering** from the initial planning to the execution stage helps deliver **higher quality and function at lower cost and time**. Therefore, it is strongly recommended that construction organizations include VE as a regular part of their project management process to achieve sustainable, efficient, and value-based outcomes.

Self- Observations


Manual Material Lifting


Manual Bar Bending


Demolition of Extended Part


Removing ledger for another work


Waste of Material

References

Primary data: On Site, Project Documents, Self Observations
Secondary data: Books, journals, and previous research papers

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