Educational Administration: Theory and Practice
2024, 30(5), 3981-3993
ISSN: 2148-2403
https://kuey.net/

Research Article

Investigate Strategies for Maximizing the Return on Investment in Construction Projects and Predicting their Viability

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Citation: Pradip Fulpagare, et al (2024), Investigate Strategies for Maximizing the Return on Investment in Construction Projects and Predicting their Viability, Educational Administration: Theory and Practice, 30(5), 3981-3993
Doi: 10.53555/kuey.v30i5.3561

ARTICLE INFO

ABSTRACT

Uncertainty regarding technology, money, and development methods makes the building industry fundamentally unpredictable. Nowadays, building projects are significantly more difficult and complex. Surprisingly, the whole project team is coping with these new and diverse issues. Examining a project's performance and identifying areas for improvement is one strategy to raise its profitability. On the other hand, construction industry specialists still lack a precise definition of project performance or improvement strategies. Every firm must be profitable in order to succeed and remain competitive in the market. Profitability also implies cost-cutting. The majority of contractors fail to manage this strategic problem systematically and effectively or to examine its impact on project profitability, despite the fact that doing so might provide them with a competitive advantage in the market. So, the goal of this research is to determine which variables influence project profitability, how to improve performance using lean construction tools and concepts, and how to make the most use of the project's resources. We anticipate the study's results will reveal patterns in the primary performance criteria used to forecast project profitability. We might use these findings to launch profitable and productive companies.

Keyword: Key project Performance Indicators, Critical Success Factors, profitabili improvement Techniques, Lean Construction, Earn Value Management.

1. Introduction

India has the world's largest and most complex building industry. Human resources are essential for increasing productivity in the construction industry. The effective and optimum utilization of human resources can boost productivity. Labor accounts for around 30% to 50% of total project costs since most construction projects depend on basic hand tools and equipment [1]. No sector is growing at a greater pace than the Indian construction industry. The construction business employs the second-most people after farming. In addition to directly or indirectly employing nearly 71 million people, India accounts for around 8% of global GDP [2]. Unskilled labor is a big concern in the construction industry since it affects productivity, resulting in cost overruns and delays. The workforce's efficiency is an important factor in determining how far the building project has progressed physically. We developed and used a variety of control systems and procedures to ensure the effective completion of projects. These enabled project managers to assess how much time and money had been diverted from the established objectives. Given the complexity and inherent unpredictability of construction projects, these variables have a significant influence on project performance in the industry. Furthermore, only around 2.5% of firms complete all of their objectives to the letter.

Furthermore, just 28% of firms adopt project performance techniques, despite the fact that projects have a terrible track record for budget and schedule overruns. As a result, it is vital for construction project success that businesses have access to trustworthy technology that can predict when and how much their projects will cost and take longer than projected early in the project life cycle [1]. When it comes to schedules and cost overruns, the construction industry has finally reached parity. The KPMG study found that only 31% of construction projects completed within 10% of their assigned budget, and even fewer (25% of projects) within 10% of their original timetables. Furthermore, multiple studies have linked the inefficiency of current project performance assessment and forecasting systems to the poor performance of the construction industry.

Everyone understands how important the construction industry is to a country's economy, since it serves as the driving force behind so many other industries. To continue in business, diverse construction enterprises must be adaptable enough to react to market fluctuations and technological advancements. Nowadays, a considerable number of human resources, such as experts and professionals, are required for construction projects. Consequently, dealing with these people and their arguments is surely a much more difficult undertaking.

Claims may arise from differences among people participating in various efforts. According to many definitions, a claim based on a rejected change or alteration causes controversy between the parties, according to many definitions of the claim [1, 2, 3, 4, 5]. Claims in projects have a detrimental influence on project performance and success because they increase project costs and timelines. Handling the claims appropriately will prevent future conflicts. Claims have a significant impact on a construction project's performance, overall success or failure. Claims have a negative influence on project performance, so it is critical to investigate why they occur, resolve the issues as soon as possible, and devise preventive measures to ensure the project's success.

Measuring project performance helps you to analyze and manage the project's success. Recently, researchers have developed a variety of strategies and procedures to anticipate and analyze the performance of construction projects. A variety of performance evaluation approaches and frameworks are available. Performance forecasting models have largely failed so far, particularly when considering interdependence across MPIs. One option to circumvent these constraints is to develop a system dynamics model capable of forecasting the interdependence of dependent variables and representing their change across time. The construction industry accounts for a portion of any economy's GDP [6]. Failure to meet ever-changing performance targets for half a century has brought the issue of diminishing productivity in the construction industry [7] to the forefront [8, 9]. Because the construction industry impacts both wealthy and developing countries' economies, resolving the productivity deadlock is critical. Poor performance in the Iron Triangle—time, money, and quality—not only leads to dissatisfied consumers, but it also has a negative impact on the economy as a whole. This challenge has spurred authorities in the United Kingdom, a pioneering building industry, to consider construction reengineering. To achieve the predicted productivity gain based on the Iron Triangle pillars as fundamental performance constraints, the construction sector needs an enhanced operating system. We then expanded these limits to encompass time, money, quality, breadth, and risk [11]. Sabet and Chong [12] identify five major components of construction performance: time, money, quality, shareholder satisfaction, and safety. Companies and authorities in the construction industry struggle to manage these constraints. Eliminating the obstacles to achieving targeted construction performance necessitates new business structures and improved construction management [13]. Cutting-edge technologies power a stable project operating system, which is the first step towards improving workflow. Despite management's best efforts and the use of cutting-edge techniques, performance targets remain unmet. A range of productivity principles must supplement measurements to accomplish productivity targets at different stages of a project's lifespan. Now we need to discover which fundamentals may boost the effectiveness of these complex strategies.

2. DATA COLLECTION & METHODOLOGY

2.1 Performance Evaluation Model

Step 1: Data Collection
Step 2: Fitting of Parametric Distribution Functions
Step 3: Fitting of Nonparametric Distribution Functions
Step 4: Calculation of Cost and Schedule Overruns
Step 5: Model Verification
Step 6: Guidelines for Using the Developed Model in Industry Practice
Step 7: Model Application

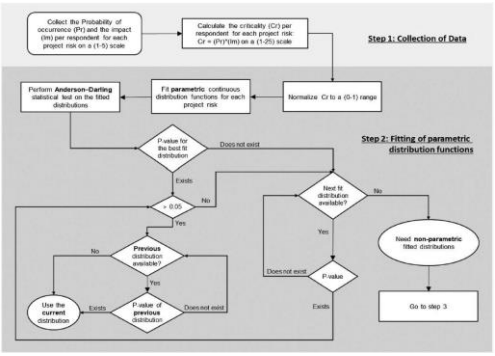

Fig. 1. Methodology to fit parametric distributions

2.2 Profitability Improving Model

This initiative employs a proposed project management technique to reduce costs and increase profitability for small and medium-sized construction businesses in India. The quantity and quality of work, along with the availability of resources, determine the success of a construction project. Resources are required for all project tasks. Each activity necessitates a resource and demands completion within a specific time frame, failing which the project might face delays. Resource availability has an impact on both time and cost. To calculate the time required, divide the productivity of the resources used in the activity by the quantity of work assigned. The contractor's ability to detect resource interdependence has an impact on the optimal construction resource mix. We investigate the same site using traditional and resource-constrained methodologies, then analyze aspects to demonstrate how our strategy is preferable for Indian small and medium-sized construction companies. The resource-constrained approach is philosophical [5].

2.3 Methodology Adopted

This study presents a complete paradigm for resource management, focusing on labor as a resource element in the construction area. In this project, we employ both the resource-constrained methodology and the Primavera methodolWe conduct this research in stages, utilizing lean construction tools and principles to enhance project management, reduce costs, and boost company profitability for small and medium-sized enterprises in the Indian construction industry. ses. Here, we examine several building sites using conventional and resource-constrained approaches, then analyze key factors to determine how our suggested technique is superior for small and medium-sized construction enterprises in India. This study uses Primavera for execution, Autodesk Takeoff for planning, and Build Trend for control.

2.4 Planning-Execution-Control Approach (PEC)

1. Autodesk Takeoff

Material pricing is faster, easier, and more exact. Cost estimators may combine geometry, images, and data from other tools with building information modeling (BIM) technologies such as Revit® Architecture, Structure, and MEP software to provide synchronized, comprehensive project views. Count building components manually or automatically, then convert to Excel® and publish in DWFTM format.

2. Planning in Construction Management:

It is the process of picking a certain technique and work order for a project from among all conceivable methods and sequences. It primarily addresses the topics of 'What to do' and 'How to accomplish it'.

Fig. 2. Planning in Construction Management

Importance of construction project planning:

- Planning helps to minimize the cost by optimum utilization of availableresources.
- Planning reduces irrational approaches, duplication of works and interdepartmental conflicts.
- Planning encourages innovation and creativity among the constructionmanagers.
- Planning imparts competitive strength to the enterprise.

3. Scheduling in Construction Management:

Scheduling is the fitting of the final work plan to a timescale. It shows the duration and order of various construction activities. It deals with the aspect of 'when to do it'.

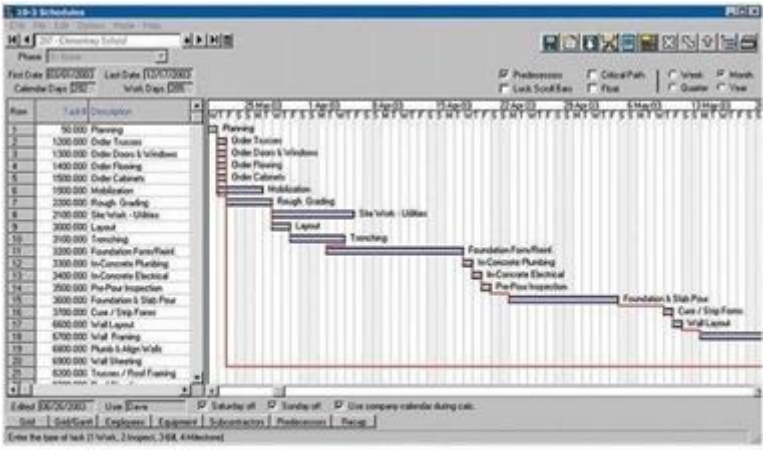

Fig. 3. Scheduling in Construction Management

4. Organizing:

Organizing is concerned with decision of the total construction work into manageable departments/sections and systematically managing various operations by delegating specific tasks to individuals.

5. Staffing:

Staffing is the provision of right people to each section / department created for successful completion of a construction project.

6. Directing:

It is concerned with training sub ordinates to carryout assigned tasks, supervising their work and guiding their efforts. It also involves motivating staff to achieve desired results.

7. Controlling:

It involves a constant review of the work plan to check on actual achievements and to discover and rectify deviation through appropriate corrective measures.

8. Coordinating:

It involves bringing together and coordinating the work of various departments and sections so as to have good communication. It is necessary for each section to aware ofits role and the assistance to be expected from others.

2.5 Importance of Construction Management:

- "Maximum production at the lowest cost" is the unavoidable outcome of effective construction management systems. A well-managed construction project stays within the allocated budget.
- Efficient resource utilization is a critical component of good construction management. In essence, it guarantees the efficient use of resources throughout a construction project.
- Leadership is vital in the construction sector, and strong management motivates employees to complete difficult tasks on time and to their full potential.
- Construction management is beneficial to society because it prevents cost overruns, excessive resource usage, unlawful labor abuse, and environmental damage.

2.6 Primavera is used for Execution. It is main phase in construction development.

Primavera project management plans, organizes, secures, and executes resources to guarantee timely and budget-friendly project completion. The purpose of project management is to achieve all objectives within the constraints. Time, scope, and budget are common project constraints. Project management seeks to

streamline the process, properly allocate resources, and complete the project on time and within budget [4].

2.7 Use of Software for Project Planning And Scheduling:

Primavera P6 Professional Management, the industry standard for project management software, manages complicated, large-scale projects. It manages projects with up to 100,000 activities and provides endless resources and goal plans.

3. Project Management Process using P6

When contractors develop plans for a building, one of the first steps is laying a foundation. This is also a true for building projects using the Project Management module. The hierarchical structuring of data serves as the foundation before the addition of actual project data.

3.1 Setting up the Enterprise project structure

The enterprise project structure (EPS), which organizes and manages organizational projects, is the subject of this paper. It also addresses project development, creation, addition, and attribute definition in the EPS. Construction businesses typically have a large database that includes all of their projects and associated data. We must arrange this project data for quick and accurate retrieval. Users' roles and the questions they must answer determine the extent to which they can view project data [4].
An enterprise project framework structures the project data. You can divide the EPS into as many layers or nodes as necessary to align with organizational responsibilities. Nodes at the root level might represent corporate divisions, project phases, site locations, or other critical groupings that meet your organization's needs. Projects are always at the lowest level of the structure. The EPS nodes must include all projects. The scope of the project and the summarized data determine the number and structure of EPS levels. For example, you may create gradually lower EPS nodes, much like an outline, to depict broad work areas that grow into more complicated projects. For instance, the Caprini Corporation EPS node features a lower-level node named Apex Project, which further subdivides into Apex Construction. Apex Construction handles Automated System, Office Building Addition, and Conveyor System projects. Assign as many projects as you need to satisfy your operations leaders and program managers. Multiple layers allow you to manage projects separately while consolidating and summarizing data. For example, you may summarize EPS node information. You can use top-down budgeting to control costs, shifting from higher-level EPS nodes to lower-level projects. Here's an example of utilizing the aforementioned functions.

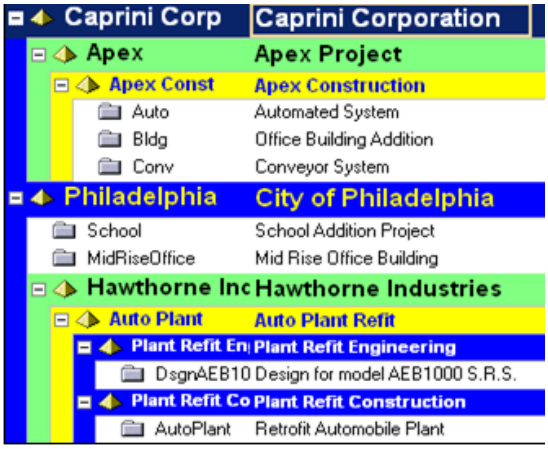

Fig. 4. EPS levels in Primavera

3.2 Setting up the organizational breakdown structure

An organizational breakdown structure (OBS) arranges project management in a hierarchical manner. An OBS hierarchy of responsible managers governs user access and permissions to enterprise project structure (EPS) nodes and projects.
OBS do not have resource pools. Activities receive resources, while EPS nodes and projects allocate OBS components. An EPS node's OBS element serves as the project manager for all work in that branch. As a result, an OBS provides support for larger projects with multiple project managers and responsibilities.

Fig. 5. OBS Menu

The organizational breakdown structure (OBS) is a worldwide hierarchy of managers in charge of your organization's tasks. The OBS generally mirrors your organization's management structure, from top-level staff down to all levels.
Specific sections of the EPS, such as nodes or specific projects, may assign the accountable managers. All new projects added to that branch of the EPS automatically receive the manager element when you connect a responsible manager with an EPS node. People also assign unique access rights to projects and WBS levels within them using the OBS hierarchy.

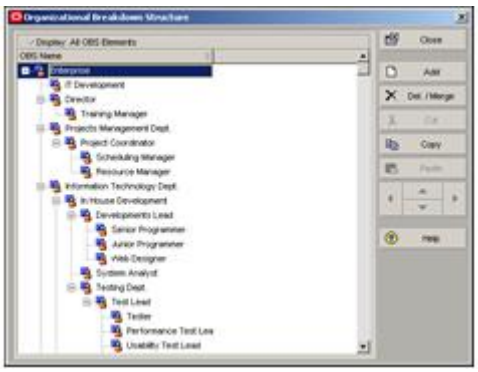

Fig. 6. Organizational Breakdown Structure

3.3 Setting up scheduling of activities

Activities are the project's core work aspects. They are the lowest level of a work breakdown structure (WBS), and therefore the smallest component of a project that directly affects the module. When we divide activities into stages, the principal resource typically manages and monitors the progress of the steps, while the project manager typically manages and tracks the progress of the entire activity.

Fig. 7. Work Breakdown structure and activity list

3.4 Embarking new project

Go to File and choose New. This will open a screen for a blank project; click OK. You may now add your project details, such as the start and end dates, as well as how you want to arrange the project starting from either date.
From the view menu, choose Gantt chart view. You will now have a spreadsheet where you may add information about all of the activities, such as the task name, length, start date, finish date, predecessors, and several other variables. You can input required information in two ways: in the spreadsheet or by double-clicking on a cell, which opens a pop-up window in which you can enter all of the information for that specific action. You must provide the activity number for the preceding activity. The SW will compute the start and finish dates. We have now completed the Gantt chart [7].

3.5 Adding tasks and milestones to a Project File

1. On the View menu, click Gantt chart.
2. In the Task Name field, type a task name, and then press TAB. (Microsoft Project enters an estimated duration of one day for the task followed by a question mark)
3. In the Duration field, type the amount of time each task will take in months, weeks, days, hours, or minutes, not counting nonworking time. (By default the time period will be days, but that can be changed to hours, months, etc.)
4. Press ENTER.
5. To add a milestone the only difference is that the duration of the activity must be zero.

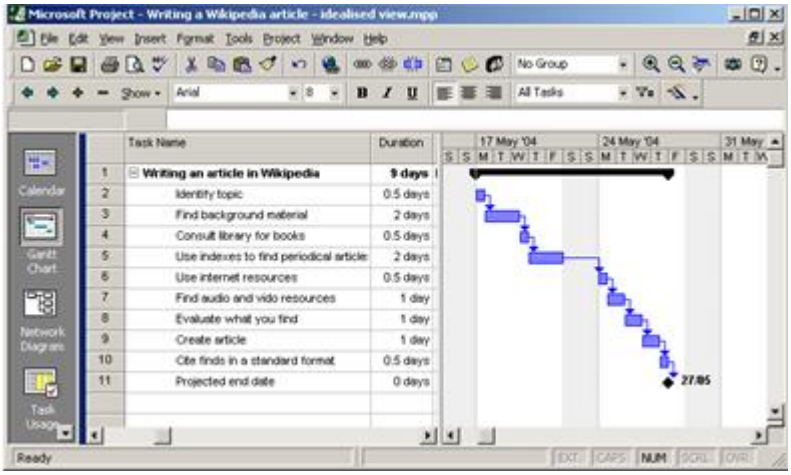

Fig. 8. Activity linking in Project

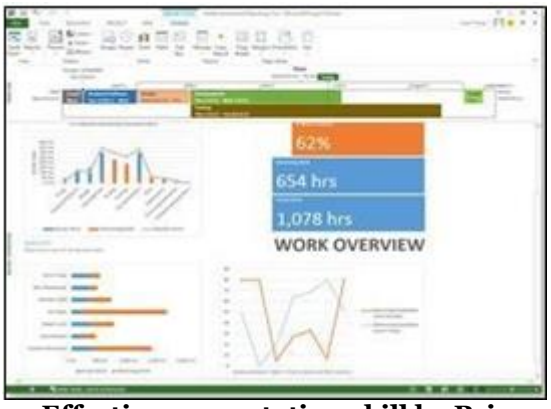

Fig. 9. Effective presentation skill by Primavera

The Timeline view helps you visualize your project to delivers presentations to your team, executives, and stakeholders. And because Project lets you design and print your reports, you can easily share insights that help you better communicate progress and achieve results.

3.6 Study timely completion of projects Primavera P6 Software:

Usually, building projects have delays in implementation. The primary cause for project delays is the use of less modern machinery. As a result, building projects may be completed more smoothly and quickly with the aid of cutting-edge technology-equipped equipment.

Fig. 10. Project Management in Primavera software Life Cycle

3.7 The 5 Phases of the Project Management Lifecycle

The phases associated with project management fall into five categories including:

1. initiation
2. planning
3. execution
4. Monitoring and controlling
5. closing

3.8 Use Of Lean Construction Tools/Principles

We used lean construction tools to identify and remove these wastes: the last planner system (LPS) ,5s approach and work sampling. The main aim of using Lean construction tools is to look into the prevalence of waste and improve efficiency in the construction projects in pune city with a focus on small and medium residential building projects. Lean is all about minimizing all types of Construction Waste, increasing productivity, improving Collaborative Working, fostering Continuous Improvement and enhancing Customer Value.

1)Last Planner System (LPS)/ Collaborative Planning System :

Glenn Ballard specifically developed LPS for the construction industry in 1992. Glenn Ballard designed it to achieve more consistent scheduling and predictability. The main idea of LPS is based on active participation and dedication from those closest to the job, including those doing the activities and those overseeing or managing them. Including all stakeholders in the building process can achieve this, enhancing communication clarity and efficiency. LPS focuses on stringent time management, progress tracking, and variance analysis. LPS seeks to accomplish standardization, quality control, scalability, efficiency, and risk reduction in projects, eventually enhancing overall performance and producing consistent and high-quality goods or services.

2) 5s Approach(Sort, set in order, Shine, Standardize, Sustain):

5s is a method for organizing standardizing cleaning and continually improving a workplace. 55 is not just a housekeeping method; it is one of the most effectre Lean tools. A philosophy based on five Japanese terms used to create and maintain a well-organized workplace that is more productive and efficient. It consists of five S words: Seiri. Seiton Seiso, Seiketsu and Shitsuke, which respectively denote Sort. Set. Shine Standardize and Sustain

Table 1. 5S approach and related question

Sr no	5S approach and related question	Ratings		
		1	2	3
1	Sort			
	Are tools are located in the convenient locations?		√	
	Workplace management	√		
	Are all unnecessary things are removed from site?	√		
2	Set in order			
	Are walkways and work areas clearly defined and unobstructed?	√		
	Are personal belongings stored in designated areas?		√	
	Are safety ppe's used?	√		
	Is safety given importance at site?	√		
3	Shine			
	Are the work areas kept clean, tidy and neat?		√	
	Are the debris bins properly maintained and emptied on regular basis?	√		
	Is anyone responsible for routine inspection maintenance?	√		
4	Standardize			
	Is everyone aware of their responsibilities?			√
	Is information to carry out daily work routine, clear and in use?			√
	Are improvement ideas being generated and regularly acted on?		√	
5	Sustain			
	Are checklists available and being used?	√		
	Is everyone adequately trained to carry out their job role?			√
	Are everyone aware of 5S?	√		
	Can everyone in the area explain the benefits of 5s?	√		

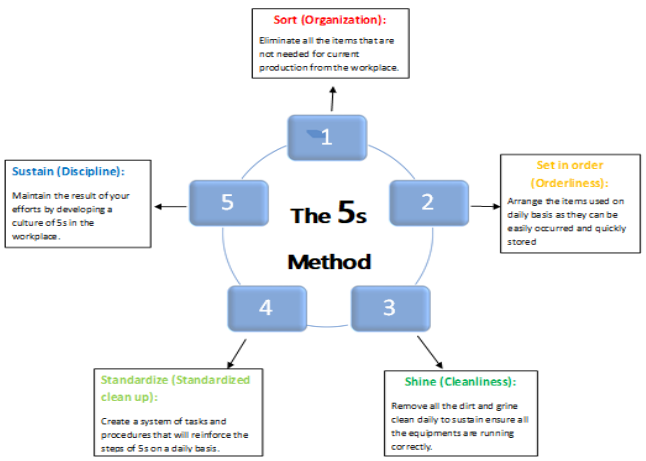

Fig. 11. 5S approach

3)Work Sampling:

The primary goal of work sampling is to obtain a representative and unbiased picture of how labor resources are utilized in a construction setting. This data-driven approach is particularly useful in situations where continuous monitoring of workers activities might be impractical or cost- prohibitive. Instead of continuously observing each worker, work sampling relies on periodic sampling intervals to gather sufficient data for analysis.

3.9 Work sampling(Crew based sampling-brickwork)

In crew-based work, three sampling techniques are used. They take random samples. Both periodic and continuous sampling is possible. Periodically, site staff sample bricks. Two masons and two male coolies (helpers). The observation took 3 hours and 45 minutes, with 15-minute intervals. We monitor the crew's work every 15 minutes and classify it as value-added, non-value-added, essential, or no contact. The lack of a contact category indicates the absence of the site.

We monitored Mason 1 for three hours and 45 minutes. During the 15 observations, Mason 1 performed 12 value-added actions, such as setting bricks, spreading mortar, and placing mortar, as well as three non-value-added activities, such as taking a break for tea, lunch, and chatting. Mason 1 performs his tasks effectively, avoiding idle chatter. Figure 12 shows Mason's VA and NVA activity. Mason 1 does 20% NVA, 80% VA, and 0% NVA as needed. Mason 2 provides 20% NVA, 80% VA, and 0% NVA as required.

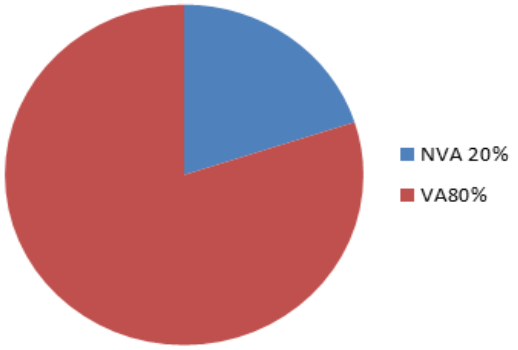

Fig .12. Mason 1 : VA and NVA

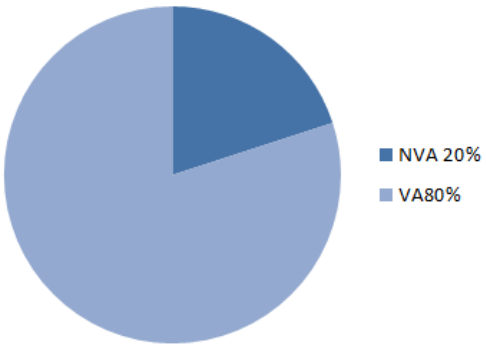

Fig.13. Mason 2 : VA and NVA

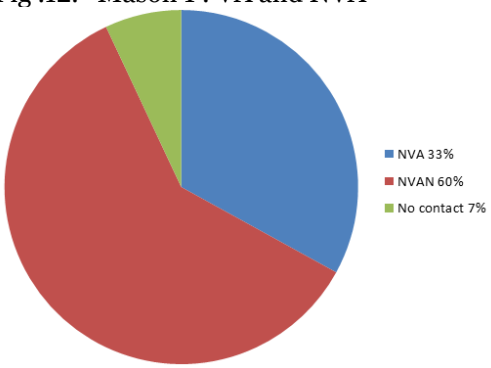

Fig. 14. Helper 1 NVA, NVAN and No contact

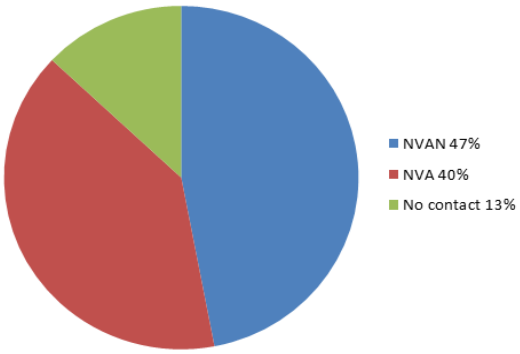

Fig. 15. Helper 2 NVA, NVAN and No contact

In 3 hours and 45 minutes, helper 1 completed 0 value-added actions from 15 observations and 5 non-value-added activities, including tea and lunch breaks. Out of 15 observations, two were idle and conversing. Helper 1 is in charge of nine necessary but non-value-added tasks, such as brick delivery and cement mixing. One of fifteen observations suggests that helper 1 is not in touch. Since Helper 1 is less productive than the mason, it is possible to avoid talking and standing idle. Figure 15 depicts Helper 1's NVAN, NVA, and no-contact behaviors.

Helper 1 completes 33% nva, 0% nva, and 60% nvan. Helper 1 is 7 percent inactive.

In 3 hours and 45 minutes, helper 2 completed 0 value-added actions from 15 observations and 6 non-value-added activities, including tea and lunch breaks. Out of 15 observations, two were idle and conversing. Helper 2 performs seven non-value-added chores, including transporting bricks and mixing mortar. Out of fifteen observations, Helper 2 is missing twice. Given that Helper 2's productivity is lower than Mason's and Helper 1's, we may consider eliminating his talking and idle time. Helper 2 generates 40% nva and 0% va, or 47% of non-value-added but necessary chores. Helper 2's non-contact rate is %. A team carried out the brickwork sampling. Helpers 1 and 2 produce less than masons 1 and 2. Masons 1 and 2 do 20% of the non-value-added duties. Helper 1 accounts for 33% of the NVA. Helper 2 has the highest NYA percentage, at 40%. Motion

waste is common with Helper 2 because of a lack of on-site engagement.

4. CASE STUDY AND RESULTS

4.1 Delay analysis

The following reasons were observed during this thesis work, which can be heldresponsible for delays; Lack of knowledge about advanced tracking methods and software's.

1. Insufficiently skilled staff.
2. Lack of proper fund flow throughout the project progress
3. A major portion of labor force was from West Bengal and Orissa. Regionalfestivals in these areas cause sudden delays in work progress.
4. Even though delay due to monsoon rain was already accounted in the baseline schedule, unexpected extension of monsoon caused further delay in project progress.
5. Sand unavailability due to legal restrictions.
6. Late delivery of resources.
7. Delays in getting statutory approvals from various Authories
8. Lack of use of modern Technology for faster construction.

4.2 Earned Value Management System (EVMS)

Earned Value Management System (EVMS) is a performance measurement baseline. It's a systematic process for measuring the project performance at any given point in time within the project phase. It integrates project scope baseline with cost baseline and schedule baseline.

The EVMS monitors the following three key dimensions:

- Planned Value (PV)
- Earned Value (EV)
- Actual Cost (AC)

4.3 Comparison of traditional approach and proposed PEC approach with Lean Construction Approach

Site Name	Tathwade, Mhada project, Mumbai

The results of the EV schedule analysis indicate that the project progress is favorable and it can be discussed as follows:

- Since the Schedule Variance (SV) values are positive (>1), the project is ahead of schedule.
- The percentage of work that is behind schedule is 52.28%.
- A Schedule Performance Index (SPI) higher than 1.0 (1.52) implies that the project team works efficiently. It shows that the team worked more efficiently and reached its deadlines.
- The above is a useful SV% and completed work percentage assessment. For this comparison, EVA is required. The percentage of completed work reflects project success. However, SV% indicates that the work was accomplished as expected. Thus, project progress is satisfactory.
- Subtracting AC from EV gives CV. This project's positive value suggests a favorable result. To calculate the percentage, divide the CV by the EV. The CV% is 23.66% overall. It indicates that the project's progress was outstanding at the end. If the CV exceeds zero, the project is under budget.
- We display the CPI values for project durations above. CPI assesses project resource efficiency. For optimal performance, it should be 1.00 or higher. In this case study, the CPI is 1.31. The project's cost efficiency is high in comparison to expenditures.
- A positive schedule variance (Rs. 1707377/-) and an SPI greater than one indicate that the project will be completed early.
- The cost variance is positive for projects that are under budget and have a CPI greater than one (Rs. 11793864/-).

4.4 Results Obtained From Traditional Approach

The results of the EV schedule analysis indicate that the project progress is unfavorable and it can be discussed as follows:

- The project is behind schedule due to a negative schedule variance (SV).
  SV% is -3.37%, which represents the percentage of incomplete work compared to the timeline.
- A Schedule Performance Index (SPI) below 1.0 shows that the project team is working efficiently. It illustrates that the team worked less effectively while meeting scheduling objectives.
- The above is a useful SV% and completed work percentage assessment. For this comparison, EVA is required. The percentage of completed work reflects project success. However, the SV% suggests that the task did not meet expectations. Thus, project development is inadequate and requires corrective action to

narrow the gap.

- Subtracting AC from EV gives CV. This project's value is consistently negative, suggesting a terrible condition. To calculate the percentage, divide the CV by the EV. The CV% remained at 4.26% throughout. This indicates outstanding project development. If the CV exceeds zero, the project is under budget.
- We display CPI figures for different project durations. CPI assesses project resource efficiency. A best-case scenario demands $1.00 or above. For this case study, the CPI is 1.04. The project has average cost efficiency in comparison to spending.

The traditional and primavera techniques share the same project budget of Rs 5,18,27,598. Traditional methods plan Rs 4,11,19,555, while Primavera with lean construction tools plans Rs 3,27,22,215. After calculating SPI%, it shows 0.96 in the traditional technique and 1.52 in the Primavera approach, indicating that Primavera with Lean Construction Tools required less time and expense.

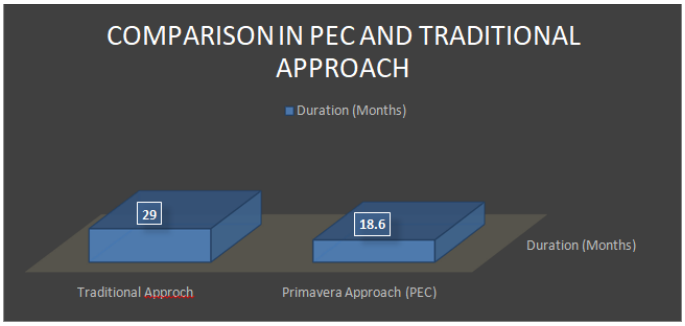

Fig. 16. Total Duration Traditional VS PEC with Lean Construction Approach.

Table 2. Total Estimate cost Traditional VS PEC with Lean Construction Approach.

Sr. No	Type Of Approach	Cost
1	Traditional Approach	Rs. 12117149 /-
2	Primavera Approach (PEC) with Lean construction approach	Rs. 4460719/-

5. Case Study 2

Site Name:	Talegaon Dabhade PMAY scheme

5.1 Results Obtained From Traditional Approach.

The results of the EV schedule analysis indicate that the project progress is unfavorable and it can be discussed as follows:

- The project is behind schedule due to a negative schedule variance (SV).
- The SV% is -5.00%, which is the percentage of undone work vs. the timeline.
- A Schedule Performance Index (SPI) below 1.0 shows that the project team is working efficiently. It illustrates that the team worked less effectively while meeting scheduling objectives.
- The above is a useful SV% and completed work percentage assessment. For this comparison, EVA is required. The percentage of completed work reflects project success. However, the SV% suggests that the task did not meet expectations. Thus, project development is inadequate and requires corrective action to narrow the gap.
- Subtracting AC from EV gives CV. This project's value is consistently negative, suggesting a terrible condition. To calculate the percentage, divide the CV by the EV. The CV% remains at 44.7% throughout. This indicates outstanding project development. If the CV exceeds zero, the project is under budget.
- We display CPI figures for different project durations. CPI assesses project resource efficiency. A best-case scenario demands $1.00 or above. For this case study, the CPI is 1.04. The project has average cost efficiency in comparison to spending.

  Traditional and Primavera techniques have the same project cost of Rs 5,16,00,000. The traditional method has a budget of Rs. 40,000,000. The Primavera methodology and lean building equipment cost Rs 30,00,000. After calculating SPI%, it shows 0.95 in the traditional technique and 2.16 in the Primavera approach, indicating that Primavera with Lean Construction Tools required less time and expense.

5.2 Results Obtained From PEC with Lean Construction Approach

The results of the EV schedule analysis indicate that the project progress is favorable and it can be discussed as follows:

- Since the Schedule Variance (SV) values are positive (>1), the project is ahead of schedule.
- According to the SV%, 116.66% of work is done on schedule.
- The Schedule Performance Index (SPI) exceeds 1.0 (2.16), demonstrating project team efficiency. It shows

that the team worked more efficiently and reached its deadlines.

- The above is a useful SV% and completed work percentage assessment. For this comparison, EVA is required. The percentage of completed work reflects project success. However, SV% indicates that the work was accomplished as expected. Thus, project progress is satisfactory.
- Subtracting AC from EV gives CV. This project's positive value suggests a favorable result. To calculate the percentage, divide the CV by the EV. CV% remained constant at 35.00%. It indicates that the project's progress was outstanding at the end. If the CV exceeds zero, the project is under budget.
- We display the CPI values for project durations above. CPI assesses project resource efficiency. For optimal performance, it should be 1.00 or higher. In this case study, the CPI is 1.54. The project's cost efficiency is high in comparison to expenditures.
- A positive schedule variance (Rs. 3500000/-) and a SPI greater than one indicate an early completion of the project.
- If the cost variance is positive (Rs. 2300000/-), the project is within budget, and the CPI is more than 1.54.

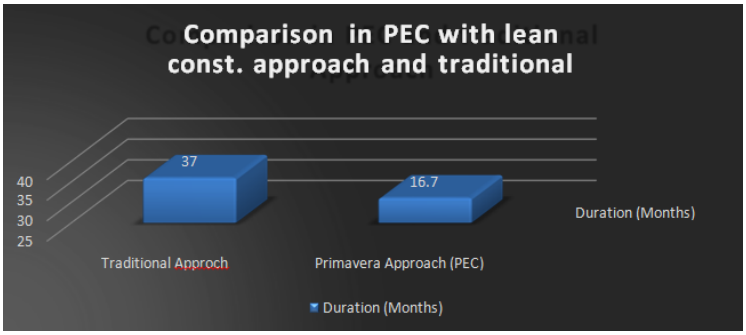

Fig. 17. Total Duration Traditional VS PEC With Lean Construction Approach.

Table 3. Total Estimate cost Traditional VS PEC With Lean Construction Approach.

Sr. No	Type of Aprroach	Cost (Cr.)
1	Traditional Approach	4.79
2	Primavera Approach with Lean construction approach	1.35

6. Conclusion

- This paper proposes a comprehensive model for predicting project performance. The model estimates two key indicators: cost and schedule overruns.
- The model provides clear equations for forecasting project cost and schedule, as well as graphs for predicting performance with little computing effort.
- The suggested model demonstrated its applicability and dependability in forecasting project performance using numerical examples from a hypothetical case study.
- The report suggests many ways to boost efficiency and profitability in the construction business. There is much research on strategies for increasing profitability, which include material monitoring, healthy and safe working conditions, and efficient management systems. It is evident that certain strategies are more effective in terms of enhancing production.
- In this research, we compare a case study using qualitative (PEC approach with lean construction methodologies) and conventional approaches for a residential structure in Tathwade, Talegaon, Pune. There is a need to investigate more efficient techniques for increasing the productivity and profitability of small and medium construction enterprises.
- Increasing profitability via these strategies has reduced costs and time, but has not established an effective baseline in the construction sector. It would also benefit small and medium-sized construction enterprises in India.

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