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Prithviraj Patil and Nimita Gujar

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Prithviraj B.Patil[1],Nimita Gujar[2]

[1]*Student in Civil Engineering Department at Parul University,Vadodara,391760 Gujarat,India*
[2]*Assistant Professor in Civil Engineering Department at Parul University,Vadodara,391760 Gujarat,India*

[a)]*prithvirajp691@gmail.com*
[b)]*nimita.gujar20235@paruluniversity.ac.in*

Abstract. Lean construction is a useful management approach for increasing productivity in the construction industry. More study is being done on this, and the process of transferring lean principles from the manufacturing to the construction industries is still underway. Construction projects entail a variety of risk variables, each of which has a different influence on the time goal, potentially resulting in time overruns and waste. Using lean construction concepts, this study proposes and implements a novel approach for reducing risk variables' impact on time and waste. The last planner system is used in lean design to identify the difficulties that arise in the construction sector, where resource management and scheduling are the main concepts.In this study, the last planner system is employed to apply the lean construction approach. The impact of adopting the new tool is measured using two metrics: percent anticipated time overrun (PET) and percent plan accomplished (PPC). While PET is calculated at the start of the project and at some point throughout the assignment execution, the most critical risk variables are recognised and appraised. In this research, we investigate the many types of techniques and tools used in projects, as well as methods to eliminate waste, and numerous risk factors that may contribute to project time-overrun and cost increases, using a questionnaire survey.
Keywords- lean construction, lean techniques, tools for lean construction, construction waste last planner system

INTRODUCTION

The building sector in India is fast growing. Along with this growth, the sector faces a variety of challenges that render traditional project management methodologies ineffective for project execution. There are a variety of management principles that may be used to address this, but lean construction management is a proven way for project management growth. Lean construction management is a new idea derived from lean manufacturing principles. Lean construction, along with numerous techniques such as the Pull method, Just-in-time (JIT), Total quality management (TQM), last planner system, and others, has acquired a lot of popularity in developed nations; nevertheless, putting it into practise in poor countries is difficult. Lean construction aims to increase productivity by removing non-value-added tasks (waste). The goal of this project is to apply the ideas of lean thinking to a contemporary building project. The strategy entails reducing the negative and maximising the positive. The goal of lean construction would be to maximise a project's value and production while reducing waste and schedule delays. This outcome is achieved by combining standard building procedures with a thorough awareness of project materials and details, as well as two management plot lines, planning and control. This is a tough concept to grasp, but the idea behind it is to utilise only what is required. Only strategic planning and intervention by a management team, as well as engagement and encouragement from all stakeholders, can achieve this. The key principles are to create a predictable environment based on data and preparation, limit waste overflow via careful planning, and increase interaction channels between the customer and the project at hand. The last planner framework was designed to reduce non-value added processes on the construction site. Feedback was also gathered to discover what was preventing the last planner approach from being used on site. The last planner system (LPS) is a popular lean construction (LC) technique for reducing project activity workflow. This is performed by focusing on detecting and then eliminating or at the very least limiting resource waste that may occur during building. Under LPS, the percentage plan complete (PPC) parameter is used to track activity progress in relation to the scheduled timeframe. In order to discover resource wastes, stakeholders must work together.

BACKGROUND

In the construction sector, it is critical to regulate and monitor project progress at each stage in order to eliminate non-value-adding activities such as delays, waste, cost overruns, and errors, which may be discovered through a well-designed project management process. By tracking the project to assess the real state on site, lean construction helps to decrease these non-value adding tasks. LPS can assist in boosting productivity in a variety of ways. LPS aids in the adaptation of project management practises and, through PPC analysis, compares actual and planned activity.

PROJECT METHODOLOGY

PROBLEM STATEMENT

Waste, time, and cost overruns are all key problems on construction projects, thus this research was undertaken to illustrate the lean tools approach and its application to save time, money, and waste.

FIRST STAGE FORMULATION OF PROBLEM STATEMENT

Extensive prior literature research are necessary in the formation of the problem statement for this investigation. Before developing an aim and scope, the notion of "Lean construction" must be further investigated and evaluated. Journals, technical reports, online publication, and books will be used as sources of information. The project's goals, objectives, and scopes will next be defined in conjunction with the discussion, leading to the formation of the project's work.

PREPARING QUESTIONNAIRE SURVEY FOR FINDING WASTE

Uncompleted work? Rework? Defects? Material wasted? Damaged material? Delays? Unnecessary material handling? Unnecessary labour movement? Classification needed?

SITE SELECTION AND DATA COLLECTION

Site selection and gathering preliminary data for planning, such as drawings, resources (manpower, material, and machinery), and so on. Preparation of a master plan for each day and activity based on the amount of work and resources available and utilising standard output. On-site implementation of a master plan that has been created.

MONITORING WASTAGES

Monitoring various wastages such as general, time, and money wastage during the implementation of the strategy. Variation is influenced by a number of things.

DATA ANALYSIS

After gathering real data for day-to-day activities and comparing it to planned and actual percentage time and cost variations. Corrective action for the affecting factor

CONCLUSION AND EVALUATION

What precautions and remedial steps should be taken to reduce waste, expense, and time? Percentage of plan completion will be displayed as a consequence (PPC).

OBJECTIVES

- Investigate the causes of time, cost, and waste overruns.
- To figure out ways to cut down on time, money, and waste.
- To research lean tools and put them into practise on a building project.
- Using lean tools (daily huddle meetings, improved visualisation, and the Last Planner System) on building projects to decrease waste, cost, and time.
- To determine the percentage deviation in cost and time as a result of implementing a lean process.
- To provide findings and conclusions.

MOTIVATION FOR THE PRESENT WORK

Traditional building methods generate waste, which may be reduced by using the LPS system. This final planner system is a lean construction tool. With this in mind, the present research is focused on lean tools and techniques, which aid in the reduction of waste, construction time, and cost-effective structure building.

PROJECT SCOPE

On the construction site, "last planner" and "daily huddle meetings" will be used as lean techniques. The task is confined to reducing waste and enhancing worker productivity. The analysis will be conducted using a questionnaire survey and will be focused on calculating the difference between the planned and actual time and expense of a building construction project compared to the typical management method.

TOOLS FOR LEAN CONSTRUNCTION

PULL APPROACH

This definition is the same as lean manufacturing. Historically, stocks were managed using comprehensive scheduling systems in which things were ordered according to a master plan. In construction, the pull approach uses the concept of just in time, where stockpiles are kept to a minimum and fresh inventories are purchased depending on current demand. Keeping materials in storage is inefficient. Its execution, on the other hand, demands a favourable a connection with the providers.

MULTIFUNCTIONAL TASK GROUPS

This approach goes against the belief that only trained labour can generate high-quality items. A multipurpose task group, rather than having a specialised group of employees, should be able to offer a range of services. This enables more complicated final products to be processed with a single manufacturing unit. Employees in multifunction task groups do not have to wait for each other to complete their duties. To meet the notion of multifunctional task groups, workers must be thoroughly taught in recombining thought and doing.

KAIZEN TOTAL QUALITY IMPROVEMENT

Kaizen is a Japanese concept that refers to the never-ending quest for innovative methods to improve a process while cutting costs and boosting output. It's possible that management may instruct the development team to come up with fresh ideas on a frequent basis. Kaizen involves cost savings and zero faults in completed items when it is properly executed. For site management, it includes the previously stated 5Sconcept.

BENCHMARKING

It is a necessary task for activity uniformity, which leads to increased building efficiency. New procedures produced as a result of quality improvement must be benchmarked so that they may be applied in comparable situations and improved across the board. This tool promotes high-quality work to be produced.

LAST PLANNER SYSTEM

In basic terms, this tool is a natural extension of the prior tools. It also has a few more features, which we'll go over later. The basic purposes of a production management system, such as the last planner system, are as follows:

1. Reduce the occurrence of unpredictability by managing it.
2. Assignments and timetables should be sound in terms of requirements.
3. It's crucial to maintain track of the assignments you've accomplished.
4. The reasons why the scheduled task was not completed should be studied and removed.
5. There should be a long-term backlog for each staff and production unit.
6. The requirements for subsequent assignments must be prepared.
7. Pull strategies should be incorporated into the traditional push-based building procedure.
8. Traditional project management depends on hierarchical decision-making, which means that power is concentrated in the hands of a small group of individuals who are often oblivious of the reality on the ground.

   The decision-making authority of the project team should be divided fairly.

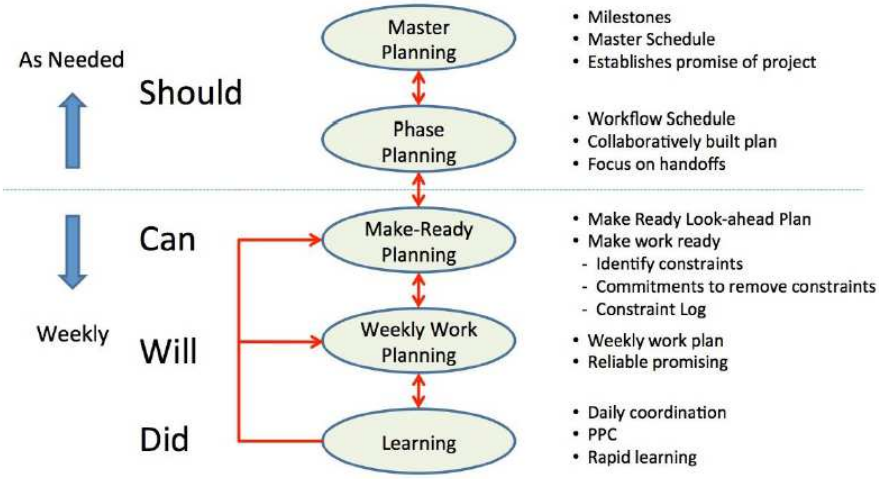

FIGURE 1 Last Planner System

CONCLUSION

The goal of this study is to reduce waste creation, as well as time and expense overruns. When different methodologies are compared, the suggested method based on lean design produces superior results, demonstrating that this proposed strategy is productive and that the trade-off between time and cost has been improved by enhancing work flow variability. In lean design, the design of the last planner system aids in waste control on the building site, as well as keeping track of other issues that reduce efficiency.

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