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Applying the Last Planner System to Improve Workflow and Project Performance in an Industrial Construction Case Study in India

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Abstract – *Purpose This case study examines the application of the Last Planner System (LPS) to improve workflow reliability, coordination, resource utilization, and project performance in an industrial construction project. Method: A case study was conducted on a 42,000 sq. ft. pre-engineered industrial shed project in Wai, Maharashtra, India. LPS practices included master scheduling, look-ahead planning, weekly work planning, daily coordination, constraint identification, and Percent Plan Complete (PPC) monitoring. Value Stream Mapping (VSM) was used to identify non-value-adding activities and workflow bottlenecks. Findings: PPC increased from 65% to 88%, while project duration decreased from 365 to 320 days, a 45-day (12.32%) saving. The project recorded reported cost savings of Rs. 18.60 lakh (3%), including Rs. 10.89 lakh from material procurement optimization and Rs. 5.21 lakh associated with improved labour productivity. VSM identified approximately 30–35% of observed process time as non-value-adding, particularly waiting, rework, and material handling. Limitations: Findings are based on a single industrial project and environmental impacts were not independently quantified. Implication: The case indicates that combining LPS with VSM can support more reliable workflow, reduced waste, and improved project performance while providing a practical implementation sequence for industrial construction.*

Key Words: Lean Construction; Last Planner System; Workflow Reliability; Percent Plan Complete; Value Stream Mapping; Industrial Construction; Waste Reduction; Project Performance.

1. INTRODUCTION

Construction projects frequently experience delays, cost overruns, interruptions in workflow, and inefficient use of labour, materials, and equipment. These problems are often associated with variability in production, incomplete planning, unreliable commitments, and ineffective coordination among project participants. Lean Construction views construction as a production system and seeks to improve flow and value delivery by reducing waste and improving the reliability of work processes, [1], [2].

The Last Planner System® (LPS) was developed as a production planning and control approach within Lean Construction. Rather than relying only on top-down schedules, LPS involves those responsible for executing the work in planning and making reliable commitments. Its planning process progressively moves from project-level milestones to phase planning, look-ahead planning, weekly work planning, and measurement of completed commitments. The approach is intended to identify and remove constraints before work is scheduled and thereby improve workflow reliability. Recent studies continue to demonstrate the application of LPS in different construction contexts, while also identifying the importance of stakeholder participation, implementation capability, and organizational support, [3], [4], [5].

Industrial construction provides a particularly relevant context for Lean Construction because projects involve multiple trades, specialized materials and equipment, procurement dependencies, subcontractor interfaces, and tightly connected construction activities. Interruptions in one activity can consequently affect several downstream activities. Lean approaches such as collaborative planning, visual management, constraint removal, and Value Stream Mapping (VSM) can help project teams identify sources of delay and non-value-adding work and improve the flow of construction activities [6], [7], [8].

Although LPS has been applied in different construction environments, its practical implementation in Indian industrial construction projects remains less documented, particularly through detailed project-level measurements of planning reliability, cost, schedule, productivity, and waste. This case study therefore examines the application of LPS on a 42,000 sq. ft. industrial shed project in Wai, Maharashtra, India, using collaborative planning, look-ahead planning, weekly commitments, daily coordination, constraint management, PPC monitoring, and VSM. The study focuses on what was implemented, what changed, what constraints were encountered, and what was learned from the implementation [9], [10].

2. LEAN CONSTRUCTION AND LAST PLANNER SYSTEM

Lean Construction applies the principles of lean production to the delivery of construction projects, with emphasis on improving flow, reducing waste, increasing value for the customer, and continuously improving production processes. The foundations of Lean Construction can be traced to the application of the new production philosophy to construction, which emphasized the importance of viewing construction as a production system rather than only as a sequence of transformation activities. Subsequent developments have expanded Lean Construction into a broader management approach addressing production control, workflow, value generation, waste reduction, and project delivery, [1], [2], [6].

Within this context, the Last Planner System (LPS) is a production planning and control system designed to improve the reliability and predictability of workflow. The system involves the people responsible for executing the work in planning and making commitments, rather than relying exclusively on top-down scheduling. Its planning process progressively connects project and phase planning with look-ahead planning, weekly work planning, and learning from plan failures. The purpose is to make work ready before it is committed, identify and remove constraints, and improve the reliability of production [3], [4].

Recent research continues to demonstrate the application of LPS in different construction contexts, while also identifying the importance of stakeholder participation, implementation capability, and organizational support [5], [10].

A central performance measure in LPS is Percent Plan Complete (PPC), which measures the proportion of planned commitments completed as promised during a defined planning period. PPC does not measure overall project progress directly; rather, it provides feedback on the reliability of weekly commitments and helps teams investigate the reasons for plan failures. This learning process allows recurring constraints and sources of variability to be identified and addressed. The LPS approach therefore combines planning, commitment management, constraint removal, performance measurement, and continuous learning rather than treating the schedule as a fixed control document [3].

For the present case study, LPS was implemented through master scheduling, look-ahead planning, weekly work planning, daily coordination, constraint identification and removal, and PPC monitoring. Value Stream Mapping (VSM) was additionally used to examine workflow and identify non-value-adding activities. The combination was intended to improve workflow reliability while identifying waiting, rework, unnecessary movement, and other sources of waste. This application is consistent with previous construction studies that have used VSM to identify opportunities for improving construction flow and environmental and production performance, [7], [8].

3. PROJECT CONTEXT AND CASE STUDY METHOD

3.1 Project Context

The case study was conducted on a 42,000 sq. ft. pre-engineered steel industrial shed project in Wai, Maharashtra, India. The project was delivered through an Engineering, Procurement and Construction (EPC) arrangement and had a planned duration of 12 months. The project involved several interdependent activities, including site preparation, foundation works, structural steel erection, roofing and cladding, flooring, services, and final handover. The project therefore required coordination among different work teams, subcontractors, material suppliers, and project management personnel.

The project initially followed conventional planning and execution practices. During execution, variability in material availability, coordination between trades, labour productivity, weather conditions, and other site constraints affected the reliability of planned activities. These conditions provided an opportunity to introduce the Last Planner System (LPS) and examine its practical effect on workflow and project performance.

Table 1. Project characteristics

Parameter	Description
Project type	Industrial shed – pre-engineered steel structure
Built-up area	42,000 sq. ft.
Location	Wai, Maharashtra, India
Client	Malas Fruits, Wai
Delivery mode	Engineering, Procurement and Construction (EPC)
Planned duration	12 months
Contractor	DYP Infraprojects Pvt. Ltd., Pune

3.2 Case Study Approach

A single-project case study approach was used to document the implementation of Lean Construction practices and examine changes in project performance. This approach is appropriate for the present study because the objective was to understand how LPS was applied in an actual construction environment and what practical results and implementation challenges followed [11], [12].

Project information was obtained from planning records, project performance data, site observations, and records generated during project execution. The analysis compared project performance before and after implementation of LPS. The principal performance measures were:

- Percent Plan Complete (PPC);
- planned and actual activity durations;
- project cost and identified cost savings;

- labour productivity;
- material and machinery waste; and non-value-adding activities identified through Value Stream Mapping (VSM).

The analysis was primarily quantitative, supported by observations of planning meetings, coordination activities, constraints, and workflow conditions during implementation. The purpose was not to establish statistical generalization across construction projects, but to document the practical experience of implementing LPS on an industrial project [13], [12], [14], [15].

3.3 LPS Implementation

LPS was introduced progressively into the project planning and control process. The implementation included:

- Master scheduling to establish major project milestones and overall sequencing.
- Look-ahead planning to identify upcoming activities and constraints before work was committed.
- Weekly work planning to establish short-term commitments by the project teams.
- Daily coordination meetings or huddles to review progress, identify immediate problems, and coordinate resources.
- Constraint identification and removal to improve the readiness of planned work.
- Visual progress monitoring to improve transparency among project participants.
- PPC monitoring to assess the reliability of weekly commitments.

The project records indicate that active look-ahead planning helped the team identify constraints earlier, while commitment-based task assignment and daily coordination improved communication among project participants [3], [4].

3.4 Value Stream Mapping

VSM was used alongside LPS to examine the flow of construction activities and identify sources of non-value-adding time. The analysis considered activities such as waiting, material movement, rework, equipment-related delays, and other interruptions to workflow.

The purpose of using VSM was not to develop a new VSM methodology, but to make sources of waste visible to the project team and support decisions about workflow improvement. This complemented LPS by connecting planning reliability with observations of how work and resources moved through the project [11], [16], [13], [12], [14], [15].

3.5 Performance Comparison

Project performance was evaluated by comparing conditions before and after implementation of LPS. PPC was used as an indicator of planning reliability, while project duration and cost were used to evaluate time and economic performance. Labour productivity and material/machinery waste were also examined [17].

The case records show an increase in overall PPC from 65% to 88%, while project duration decreased from the planned 365 days to 320 days. The project also recorded an overall reported cost saving of18.60 lakh (3%).

4. RESULTS

4.1 Planning Reliability and PPC

The implementation of the Last Planner System improved the reliability of weekly planning commitments. At the beginning of the implementation, the project's Percent Plan Complete (PPC) was approximately 65%. Through look-ahead planning, weekly work planning, constraint identification, and regular coordination, PPC progressively improved and reached 88%.

The improvement indicates that a greater proportion of weekly commitments were completed as planned. The project team used PPC not only as a performance measure but also to identify reasons for missed commitments and address recurring constraints.

Table 2. PPC performance before and after LPS implementation

Performance measure	Before LPS	After LPS
PPC	65%	88%
Improvement	—	23 percentage points

This result should be presented as a project-specific observation, rather than as evidence that LPS will always produce a 23-percentage-point improvement.

4.2 Project Duration

The planned project duration was 365 days. Following implementation of LPS practices, the project was completed in approximately 320 days, representing a saving of 45 days (12.32%).

Table 3. Project duration

Measure	Planned	Actual	Difference
Project duration	365 days	320 days	45 days
Percentage saving	—	—	12.32%

The reduction in duration was associated with improved coordination, earlier identification of constraints, better sequencing of activities, and more reliable short-term commitments. However, because the study is based on a single project, the result should be interpreted as an observed project outcome rather than a controlled measurement of the isolated effect of LPS [18], [19].

4.3 Cost Performance

The project records indicated an overall reported cost saving of18.60 lakh, equivalent to approximately 3% of the project cost. The principal sources identified in the case records were material procurement and utilization, labour productivity, and improved coordination of project resources.

Table 4. Reported cost savings

Source of saving	Reported saving
Material procurement and utilization	Rs. 10.89 lakh
Labour productivity	Rs. 5.21 lakh
Other/coordination-related savings	Rs. 2.50 lakh
Total	Rs. 18.60 lakh

The cost results suggest that the benefits of improved planning extended beyond schedule performance. Better coordination reduced avoidable resource use and helped the project team respond earlier to procurement and execution constraints.

4.4 Labour Productivity

Labour productivity improved during the implementation period. The project team attributed this improvement mainly to better work sequencing, improved coordination between trades, reduced waiting, and clearer weekly commitments.

The observed improvement is important because unreliable workflow can result in labour waiting for preceding activities, materials, equipment, or information. By making upcoming work and constraints more visible, the LPS process helped the project team coordinate resources before work was committed.

4.5 Waste and Non-Value-Adding Activities

Value Stream Mapping was used to examine the flow of activities and identify sources of non-value-adding time. The case study identified approximately 30–35% of observed process time as associated with non-value-adding activities, including waiting, material movement, rework, and equipment-related interruptions.

Table 5. Main sources of non-value-adding activity

Source	Observed effect on workflow
Waiting	Delays between dependent activities
Material movement	Additional handling and movement
Rework	Repetition of completed work
Equipment-related delays	Interruption of planned activities
Coordination delays	Waiting for information/resources

The VSM exercise helped make these sources of waste visible to the project team. Rather than treating each delay as an isolated problem, the team could identify recurring workflow interruptions and consider them during look-ahead and weekly planning.

4.6 Overall Project Performance

The principal outcomes observed in the case are summarized in Table 6.

Table 6. Summary of observed project outcomes

Indicator	Observed outcome
PPC	65% → 88%
Project duration	365 → 320 days
Time saving	45 days (12.32%)
Reported cost saving	Rs. 18.60 lakh (3%)
Non-value-adding activities	Approximately 30–35%

Taken together, the results indicate that the implementation of LPS was associated with improvements in planning reliability, project duration, cost performance, and visibility of workflow waste. The results should nevertheless be understood within the context of the individual industrial project rather than generalized to all construction projects.

5. LESSONS LEARNED

The implementation of the Last Planner System on the project provided several practical lessons concerning planning, coordination, constraint management, and workflow reliability. The experience showed that the effectiveness of LPS depended not only on introducing planning tools but also on the willingness of project participants to use them consistently.

5.1 Reliable Planning Requires Early Constraint Identification

One of the main lessons from the project was the importance of identifying constraints before activities were committed to weekly plans. Look-ahead planning provided an opportunity to identify issues related to materials, labour, equipment, information, and preceding activities before they affected site execution. Earlier visibility of these constraints allowed the project team to take corrective action and improved the reliability of weekly commitments.

5.2 Weekly Commitments Improved Coordination

Weekly work planning created a clearer connection between the overall project schedule and day-to-day execution. Rather than relying only on the master schedule, the project team reviewed near-term activities and agreed on achievable commitments. Daily coordination further helped identify deviations and coordinate resources among different work teams.

The improvement in PPC from 65% to 88% suggests that the combination of short-term planning, commitment management, and follow-up was useful in improving planning reliability. However, the case does not establish that LPS alone caused the improvement, because other project-management actions occurred during the same period.

5.3 LPS Made Workflow Problems More Visible

The implementation also changed how project problems were discussed. Waiting, material movement, rework, equipment interruptions, and coordination problems became more visible through regular planning discussions and VSM analysis.

This was useful because the project team could discuss the reasons for workflow disruption, rather than simply recording that an activity was delayed. Such learning is consistent with the broader purpose of LPS as a production-control system that uses plan failures to identify and address recurring constraints.

5.4 Management and Participant Involvement Were Important

The case indicated that LPS implementation required active participation from project personnel and coordination among the different parties involved in execution. Planning meetings and weekly commitments were useful only when participants provided realistic information about work readiness and constraints.

This suggests that LPS should not be introduced simply as an additional reporting procedure. It needs to become part of the project's normal planning and coordination process.

5.5 VSM Complemented LPS

LPS and VSM served different but complementary purposes in the case. LPS helped the team plan and coordinate when and how work should be executed, while VSM helped identify where time and resources were being lost within the workflow.

Using both approaches provided a more complete view of project performance. Planning reliability could be considered together with sources of waiting, movement, rework, and other non-value-adding activities.

5.6 The Results Should Be Interpreted Carefully

The project achieved several positive outcomes, including an increase in PPC from 65% to 88%, a reduction of 45 days in project duration, and reported cost savings of18.60 lakh. These results indicate that the Lean approach was beneficial within the project context.

However, this was one industrial construction project, and the study did not use a controlled comparison with another project. Therefore, the results should not be interpreted as evidence that the same percentage improvements will necessarily occur on other projects. Other factors, including management decisions, project conditions, resource availability, and normal project learning, may also have contributed to the observed outcomes.

5.7 Lessons for Future Projects

Based on this experience, future industrial projects intending to implement LPS should:

- Involve key project participants early in planning;
- Use look-ahead planning to identify constraints before weekly commitments;
- Make realistic weekly commitments rather than maximizing the number of planned activities;
- Record and review the reasons for incomplete commitments;
- Use daily coordination to resolve short-term workflow problems;
- Combine PPC monitoring with investigation of the causes of plan failure; and
- Use VSM or similar tools to identify recurring sources of waste.

The main lesson from the case is therefore that Lean Construction is not simply a set of planning tools; its effectiveness depends on using planning, commitment, constraint removal, communication, and learning as a connected process.

6. IMPLICATIONS FOR LEAN CONSTRUCTION PRACTICE

The case provides several practical implications for construction organizations seeking to introduce Lean Construction practices on industrial projects.

6.1 Start LPS with Simple, Regular Planning

LPS does not need to begin with a complex digital system. The case demonstrates that look-ahead planning, weekly commitments, daily coordination, constraint identification, and PPC monitoring can provide a practical foundation for improving workflow reliability. Organizations implementing LPS should first establish consistent planning routines before adding more advanced tools [20], [21].

6.2 Make Constraints Visible Before Committing Work

A major practical benefit of look-ahead planning is the opportunity to identify constraints before activities are included in weekly commitments. Project teams should routinely review materials, labour, equipment, information, approvals, preceding activities, and site conditions and assign responsibility for removing identified constraints.

6.3 Use PPC for Learning, Not Just Reporting

PPC should not be treated simply as a percentage reported to management. When a commitment is not completed, the project team should identify why the plan failed and determine whether the cause can be prevented in future planning cycles. This turns PPC into a mechanism for continuous improvement rather than another reporting requirement. The importance of learning from planning failures is consistent with the underlying purpose of LPS.

6.4 Combine Planning Reliability with Waste Identification

The case suggests that LPS and VSM can be used together. LPS provides a mechanism for improving workflow planning and commitment reliability, while VSM helps make waiting, unnecessary movement, rework, and other non-value-adding activities visible. Practitioners can therefore use VSM findings to identify recurring workflow problems and feed them back into look-ahead and weekly planning.

6.5 Management and Trade-Partner Participation Are Essential

The case therefore suggests that implementation depends on coordination, participant involvement, and management support. Similar implementation barriers related to organizational and participant readiness have been reported in the Indian prefabrication context [22].

6.6 Potential Sustainability Benefits

Although environmental performance was not measured independently in this case, the observed reduction of non-value-adding activities indicates areas where Lean implementation may support more efficient use of materials, labour, equipment, and energy, [23], [24].

6.7 Implication for Similar Industrial Projects

For similar industrial construction projects, the experience suggests a practical implementation sequence:

Master schedule → Look-ahead planning → Constraint removal → Weekly commitments → Daily coordination → PPC review → Root-cause learning → Continuous improvement

This sequence can be adopted without requiring major changes to existing project-management systems and can progressively develop a more reliable production-control process [20], [21], [25].

6.8 Boundary of Application

The reported improvements PPC increasing from 65% to 88%, a 45-day reduction in project duration, and18.60 lakh reported cost savings should not be treated as expected results for every project. They represent the outcome observed in this particular industrial project. Organizations applying the approach should adapt the planning process to their project size, delivery method, supply-chain conditions, subcontracting structure, and organizational readiness.

7. CONCLUSIONS

This case study examined the application of the Last Planner System (LPS) on a 42,000 sq. ft. industrial construction project in Wai, Maharashtra, India. The implementation combined master scheduling, look-ahead planning, weekly work planning, daily coordination, constraint identification, and Percent Plan Complete (PPC) monitoring. Value Stream Mapping (VSM) was used to identify sources of non-value-adding activity and workflow disruption.

The project results indicate improvements in planning reliability and project performance. PPC increased from

65% to 88%, while the project duration was reduced from 365 to 320 days, representing a saving of 45 days (12.32%). The project records also indicated a reported18.60 lakh (3%) cost saving, associated primarily with material utilization, labour productivity, and improved coordination. VSM identified waiting, material movement, rework, and equipment-related interruptions as important sources of non-value-adding activity.

The main learning from the case is that LPS was most useful when treated as a collaborative production-control process rather than simply as a scheduling tool. Look-ahead planning and constraint removal helped improve work readiness, while weekly commitments and daily coordination increased visibility of workflow problems. VSM complemented this process by making sources of waste more visible.

The findings are specific to one industrial construction project and cannot be generalized directly to other projects. The study also cannot isolate the effect of LPS from other project-management actions that occurred during the same period. Further case studies across different project types, locations, and organizational settings would help establish how these practices perform under different conditions.

Overall, the case demonstrates that LPS combined with VSM can provide a practical approach for improving workflow reliability, reducing waste, and supporting better project performance in industrial construction.

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