

Overview of Lean Concept in Construction Industry

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Abstract

The construction industry faces different challenges and problem which results in cost and time overrun contributes low productivity. The paper presents the set of information on the lean construction and its tool last planner system of production control. Then paper present whole regarding last planner system and its essentials employs percent plan complete, anticipated assignment and assignment made ready to improve productivity and workflow reliability. So this paper aims to overview and discuss the applicability of lean construction project which helps to reduce wastages in construction and brings the quality of work in product developing process with raising the profit level and productivity.

Keyword- Lean Construction, Last Planner System

I. INTRODUCTION

The construction industry deals with different challenges and problems compare to other industries all over the world. Construction projects are well known for being over budget, late and burdened with scope creep facing decline in profit margins and increased competition. Successful project management can be achieved by bringing together the tasks and resources necessary to accomplish the project objectives and deliverables within the specified time constraints and within the planned budget.

As per Lean Construction Institute (LCI), at the moment even 70% of the projects are over budget and delivered late. In this context, it was essential to enhance the traditional management methods in solving the problems with novel management methods. In 1992, Koskela introduced the idea of understanding construction as a production process. The application of Lean-to construction is based upon treating the construction site as a temporary production line and is referred to as 'Lean Construction' (Smith, 2011). Lean is pure management term often utilize in various Industries. Lean has universal term, it has different meanings in each term or subject. It is use as many different tools and techniques in production and construction industries. But at the end concept of lean is same to improve productivity by minimizing waste.

II. PAST STUDIES

Huseyin Erol et. al (2016), they did literature review on lean construction and identified 21 practical application of lean construction principles. The research proved that application of lean construction principles results in 6.15% to 9.15% decrease amount of total project duration. Further there is future scope of lean in construction which can be applied for large scale with involvement of owner, supplier, contractor and other project participant's point of view including more parameters like cost, quality, safety, health and sustainability.

Katarzyna Cwik and Jerzy Roslon (2017), investigated that last planner system abandons the concept of traditional approach in building project and proposed a new concept which is lean construction. He presented the comparison of CPM and last planner system. The auhtor mentioned that LPS applies common sense in planning and focuses on smooth workflow, logistic planning, show interdependencies between activities which clearly depict that CPM has many disadvantages as it emphasis on forecasts which leads to failure and delay of project compare to LPS.

Marion M. Russell et. al (2014), did literature review on time buffer and last planner system. The author conducted two different case studies: a. mechanical contractor case study which employed traditional planning method and b. general contractor case study which employed LPS in planning. LPS could fill the gap to achieve more precise and accurate task duration results in an increased PPC and productivity.

Farook R. Hamzeh et. al (2015), in their investigated task made ready in lookahead planning impact for reliable workflow and project duration. Lookahead planning involved transforming work that 'should be done' into work that 'can be done'. TMR and TA are used to remove constraints in lookahead planning and PPC is considered in weekly work plan to check reliability. It was identified that more TMR could result in reducing project duration because it removes constraints during lookahead process which indicate that TMR is more reliable compared to PPC for project duration.

III. LEAN CONSTRUCTION

A Lean construction is a “way to design production systems to minimize waste of materials, time, and effort in order to generate the maximum possible amount of value,” here waste is different from pure construction waste. Designing a production system to achieve the stated ends is only possible through the collaboration of all project participants (Owner, Architect/Engineer, contractors, Facility Managers, End-user) at every stages of the project. Lean Construction is believed to be particularly useful on complex, uncertain and quick projects.

Primarily, lean construction aims to reduce the waste caused by unpredictable workflow. Here Waste is defined in following categories: defects, delays due to waiting for upstream activities to finish before another job can begin, maintaining excess inventory, unnecessary transport of materials and unnecessary movement of people, over allocated equipment and material on site, accident on site etc. Work is structured throughout the process to maximize value and to reduce waste at the project delivery level. Efforts to manage and improve performance are aimed at improving total project performance, because this is more important than reducing the cost or increasing the speed of any particular activity.

Lean construction is composed of the following principles and techniques.

The Lean five principles:

- 1) Value specification: Precisely specify what creates value from the client’s perspective.
- 2) Value stream identification: Clearly identify all the steps in the processes (value stream) that deliver exactly what the customer values and remove everything that do not add value to the customer.
- 3) Flow: Take actions that ensure continuous flow in the value stream,
- 4) Pull: This means to produce only what the customer wants just in time; and
- 5) Perfection: Always strive for perfection by delivering what the customer wants and expects through a continuous removal of waste. Through process improvement to deal with the challenges in the construction.

IV. LAST PLANNER SYSTEM

Ballard (2000) and Howell (1999) presented the LPS as a construction planning and control system with an attempt to increase the reliability of the schedule, which could lead to increased productivity at the construction site. Further, reduce variations in construction work flow, improving future planning, and eliminating construction operation uncertainty. Last Planner System (LPS) focuses on reducing workflow uncertainty. It has been developed to assist the project planner in reducing the uncertainty inherent in the planning process. The last planner is simply the field supervisor who assigns work to the crew as it allows the conversations between the site management and the trade foreman at proper level of detail preventing critical issues on site to happen. It includes Reverse Phase Scheduling, Six-week Look-ahead schedule, weekly work plan and Percentage Plan Completed Charts (PPC).

This Last Planner System tool enables for abandoning the concept of traditional approach in building projects and introduces management approach as new type of thinking. However, to achieve a satisfactory result, one should implement the measures of Last Planner System in an appropriate way.

The Lean Construction Institute (LCI) describes last planner as below:

“Last Planner System- system for project production planning and control, aimed at creating a workflow that achieves reliable execution, developed by Glenn Ballard and Greg Howell, with documentation by Ballard in 2000. LPS is the collaborative, commitment-based planning system that integrates should-can-will, did planning: pull planning, make-ready look-ahead planning with constraint analysis, weekly work planning based upon reliable promises, and learning based upon analysis of PPC and Reasons for Variance.”

A. LPS Essentials

1) Master and Phase Plan

The master schedule is the overall project schedule, which is developed from the design criteria and supports the client's project objectives. It consists of milestones and items with long lead times. Milestone dates are determined by using the “pull” process from successor milestones (Ballard, 2000).

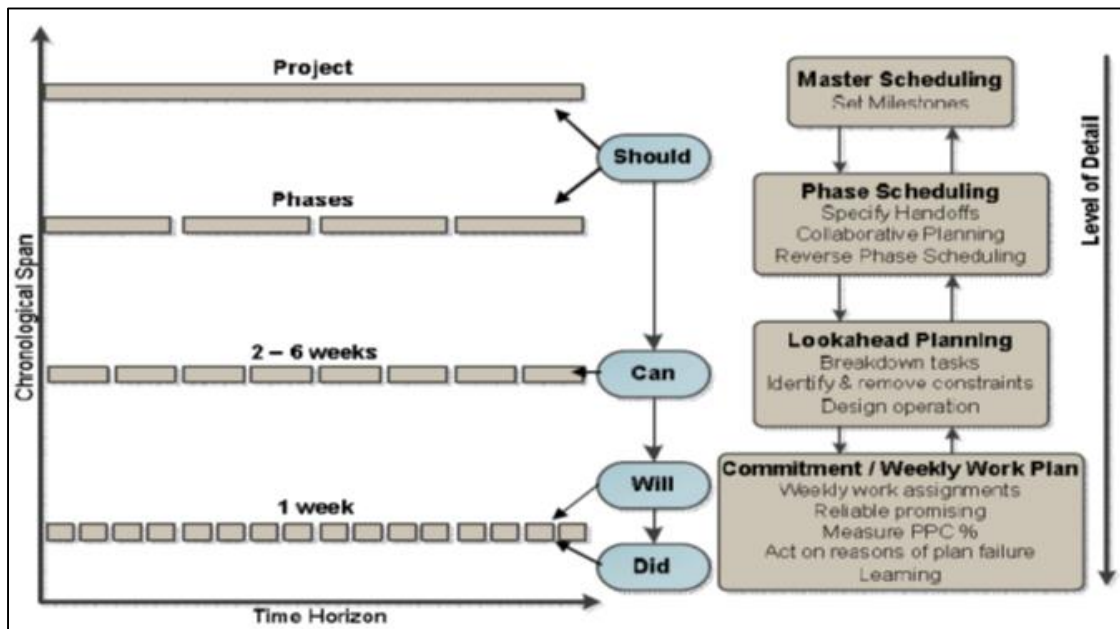


Fig. 1: LPS Planning and Scheduling Process

2) *Look-Ahead Plan*

The Look-ahead plan represents an intermediate level of planning. It is a schedule of potential assignments, typically for the next 6 to 8 weeks (Ballard, 2000). The work is planned on assignment level, continues to break down the activities into more details and screen the resulting smaller activities throughout the look-ahead window, until the activities are essentially assignment-level tasks.

3) *Weekly Work Plan (WWP)*

The weekly work plan is an assignment-level schedule. Detailed schedules are derived from the look-ahead plans on a weekly basis. It is a weekly schedule containing only the tasks without constraints so all stakeholders become responsible and engaged on the activities that will be executed the next week.

4) *Percent Plan Complete (PPC)*

This track what is known as percent plan complete. It is calculated by dividing the number of completed assignments (what “did” get done) by the total number of assignments each week (what was projected “will” get done) and reasons are identified and acted on for failures to complete assignments. Higher reliability of project is indicated by higher PPC.

B. *Case Study Calculation for Project Performance & Measurement Parameters*

1) *Percentage Plan Complete (PPC2)*

Divide the number of assignments completed in the plan week by the number of assignments listed in the Week Two plan.

2) *Assignment Made Ready (AMR2)*

Divide the number of assignments that appear in both the Week1 and Week2 plans by the number planned in Week2.

3) *Anticipated Assignment (AA2)*

Divide the number of assignments that appear in both Week1 and Week2 plans by the number planned in Week1.

Week1	Week2	Completed
A	A	A
B	B	D
D	C	
E		

Table 1: Different Activities in week1 and week2

$$\begin{aligned}
 \text{PPC1} &= \frac{AD}{ABDE} = 50\% \\
 \text{PPC2} &= \frac{A}{ABC} = 33\% \\
 \text{AMR2} &= \frac{AB}{ABC} = 67\% \\
 \text{AA2} &= \frac{AB}{ABDE} = 50\%
 \end{aligned}$$

C. The benefits of Lean Principles

- Precisely specify value from the perspective of the ultimate customer.
- Clearly identify the process that delivers what the customer values.
- Delivering projects on time or in some cases ahead of schedule and eliminates all non-value adding steps.
- Crating a smooth workflow and eliminates the waste.
- Improving relations with vendors and improving customer satisfaction.
- Pursue perfection by continuous improvement.
- Improving the project cost, quality and time.

D. Obstacles of Adopting Lean Techniques Include

- Lack of lean awareness amongst workers and management.
- No adequate training and high cost of lean training.
- Lack of lean specialist and expertise.
- The current financial crisis.
- Work pressure and fear of failing in the implementation.
- Lack of workers skills and workers are not easy to educate.

V. CONCLUSION

From the above study it is observed that the number of researchers used and applied Lean Construction Concept in their projects to improve workflow reliability and project performance affecting time, cost and quality of projects by eliminating non-value-added waste. Lean concept is well known in manufacturing industry to improve productivity but still lack in construction industry. Some of the past studies identified that lean construction increase productivity compared to traditional method.

Further, Last Planner System employs planning and scheduling process which utilize in different phases & its essentials including PPC, AMR and AA in lookahead plan and weekly work plan to improve project reliability, the applicability of lean construction project which helps to reduce wastages in construction and brings the quality of work in product developing process with raising the profit level and productivity. Therefore, from the above study concludes that last planner system in construction improve project performance and ensures productivity. The study can be extended to identify various waste been produced in construction industry in order to minimize waste and decrease the impact of waste on Cost, Quality and Time.

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