

# Lean Thinking in Construction: Indian Construction Prospects

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***Abstract***— Construction industry in India is growing at a rapid pace. Along with this growth, the industry is facing numerous challenges that are making delivery of projects inefficient. Most of the Indian contractors are not well equipped to handle the growing demand of infrastructure development and hence construction projects frequently run in to time and cost overruns, disputes and quality issues etc., In this context, Last planner technique (LPS) as lean tool can act as a lever to make project delivery more efficient and improve the productivity level of Indian construction industry. In this paper studied an intensive literature review of previous research related to lean construction principle and its progressive growth to develop the performance and productivity improvement in construction industry. This paper also analyzes some of the main impacts observed in the studied projects, and some of the lessons learned from implementations. The paper discusses difficulties and barriers for implementation, productivity improvements, variability reduction, and effectiveness of implementation strategies and also creates awareness of the percent project completion (PPC) report by using LPS as a lean tool in construction sectors.

***Keywords:*** Construction industry, LPS, PPC, Productivity, lean.

## I. INTRODUCTION

Construction industry is accused with several issues such as poor quality, unreliable budget, failures & reworks, improper planning & scheduling and safety problems, decreasing the project performance. There is a great need for enriching the construction process to improve the productivity. To overcome this, the industries must upgrade the current construction practice that is globally competitive in nature. The emergence of the lean construction concept is seen as a current approach that can be used to produce best practices because it was viewed as an effort to bring construction industry towards a more optimum productivity level with the efficient usage of resources as well as to produce the utmost value. Around the globe lean principles are showing positive results on the projects.

Construction projects have considered as temporary based production systems which need to be designed, produced and delivered within a specified time. It has been asserted by a number of researchers that fast, complex and uncertain projects cannot be managed through the conventional ways. The conceptual models of construction management and the tools it utilizes (work breakdown structure, critical path method, and earned value management) have been criticized to be deficient in handling the present unique challenges of projects. As a result, the industry is characterized by a number of wastes including: overproduction, lead time, transportation, inappropriate processing, inventories, unnecessary movements, rework and making do wastes. Therefore the need for practical and strong models and techniques that will help projects teams deal with the issues of wastes in projects. This can only be achieved through the adoption of lean production systems in the construction industry, thus, Lean Construction (LC). In this paper, LC approach and the importance for its implementation has been discussed as the robust approach for project management. Thus, the aim of this study is to assess lean construction practices implementation, barriers and effectiveness with a view to know the present state in the indian construction industry. To achieve this, the level of awareness of lean concept among construction professionals in the Indian construction industry and to assess the productivity enhancement level of construction process.

## II. LITERATURE REVIEW

The contractor completed the construction project two months before than the actual completion date allocated to the project. The contractor had a better allocation of resources, an organized flow and access of materials and this reduced interference amongst working teams by making all the team members aware of what to do and when to do each assignment [1]. Thus implementation of Last Planner System helped the project team to receive information regularly of the project success and failures during weekly meetings. The use of a Lean-driven buffered schedule in improvement of productivity in construction. A systematically buffered schedule can improve the reliability of construction plans [2]. The improvement is apparent where considerations are given to the probable non-alignment between the planned and the actual progresses. Consequently, waste in the form of waiting time or slow work can be minimized which addresses the Lean ideal requirements. It is shown that a systematic buffered construction schedule can decrease project delivery time by 31% to 41%, and increase productivity level up to 30% when combines with variation mitigation strategies such as LPS.

The industry is beset with a number of problems, such as too many small-sized contractors, poor planning strengths, diverse cultures, ill-trained labour, dependence on low technology processes, hierarchical controls, etc. Lean construction practices have developed quite well over the last few decades and have lived up to their potential in many different countries, bringing in continuous improvement, inclusive culture and improved levels of

certainty in project delivery [3]. Institute for Lean Construction Excellence (ILCE), IIT Madras (IITM), a leading educational and research institution in the country, was chosen as the academic partner by ILCE. During the last five years, ILCE has conducted a number of seminars and workshops across the country to familiarise the Indian construction Industry with Lean concepts [3]. International experts such as Dr. Lauri Koskela, Mr. Greg Howell and Dr. Carlos Formoso were invited to conduct seminars. The development of flexible capacity management practices seems to be a better application of lean thinking to the management of variability in construction than workflow management [4]. It is possible to have minimal variability in labor productivity even though there is variability in the quantities installed. In one of the projects analyzed, even though there was high workflow variability, there was low variability in labor productivity [4]. The LPS implementation brings along effective relationship which form the backbone of a stabilized project based production system that the tool advocates [5]. The implementation of the new tool on a construction site progresses through a learning curve which ultimately results in creating value. This study identified and tested the effectiveness of LPS, a lean construction tool in improving the PPC. The study recommends that contractors and construction managers should pay keen attention to the prevalent causes of failure during planning in order to minimise their occurrence at construction stage [5]. Implementation of LPS on this case study has been identified as a successful tool to increase the productivity on site demonstrating proficient results by achieving an increase in PPC. LPS implementation amongst construction industry users in New Zealand is very usefulness. It determines from the study the level of LPS implementation and provides empirical evidence of the benefits of its implementation in New Zealand [6]. The study finds that there are some few challenges needed to be overcome within construction organizations before fuller benefits of LPS can be realised. The application of the Malcolm Baldrige Model criteria enables the construction organization to assess its productivity enhancement empirically against a number of internationally accepted criteria, to identify the strengths of the organization and to put focus on areas where performance needs improvement. This study will help the Indian construction industry and the research community to gain insights into the adoption of five key productivity attributes in Indian construction projects and their practical implications to construction professionals to enhance productivity through MBNQA concepts [7].

Lean Construction in the Nigerian Construction Industry and they had following conclusion: A good number of construction professionals in Ondo State are well aware of Lean Construction through professional practice [8]. Identification of client needs, project needing immediate attention given more importance and look – ahead schedule are the popular approaches of delivering lean construction among professionals, while the most used is project needing immediate attention given more importance. Improvement of project delivery methods, provision of client satisfaction and delivery of products or services that enable clients to better accomplish their goals are some of the main benefits of applying lean in construction. LPS can only improve productivity for the stage and team where it is being

implemented. If the procurement method does not allow it to be used before construction stage, it can only achieve a limited amount. To fully utilise all the aspects of LPS it should be implemented from the design stage, to coordinate and manage the design process and combine construction information into the design in the form of buildability and construction methods. Sharing knowledge among the project team as early as possible minimises the need for changes later in the project and frees up time and money to give better value for the client in the form of better functionality and quality. LPS, as for Lean Construction methods in general, works best when applied together with integrated procurement practices [9]. In India some research argued that lean practices can enable BIM adoption and the two reinforce each other. This paper contributes to knowledge on BIM adoption by showing how lean practices reduce coordination-related issues within the project organization, paving the way for BIM adoption [10]. Building information modeling in conjunction with lean practices can therefore be used on construction projects to improve project performance. Researcher focuses on the rural market, because the rural India is growing fast and construction industry in india has not been strongly influenced by many of the trends and innovation in construction internationally. Construction and procurement methods remain mainly traditional. A wide body of literature supports the view that Lean Construction provides a new paradigm for project management, a cognitive way of thinking and planning. Such a planning approach may better meet customer needs while reducing waste and using less of everything.

### III. LEAN CONSTRUCTION

Lean construction, a concept that is not entirely new, emerged from the successful application of lean philosophy in manufacturing with a fundamental intention of identification and elimination of waste while simultaneously accomplishing client needs by Toyota's engineer. Lean construction is defined as 'a production management based approach to project delivery—a new way to design and build capital facilities' with 'A pursuit of concurrent and continuous improvements'. Koskela was the first to challenge the construction industry upon finding this novel concept's adoptability and similarity to construction and project delivery processes. The first ever documentation of the expression 'Lean Construction' was at the 1993 conference by the International Group of Lean Construction (IGLC).

Although the implementation of lean is possible at the project level or at the organization level, many implementers of lean focus on the construction site level. While the lean philosophy is viewed as 'commonsensical', implementation can be quite challenging. In countries like India additional challenges are anticipated. Low availability of core professionals, limited use of standards and project management techniques, cultural and social issues, low awareness and other mindset barriers need to be overcome when implementing in these countries. Like any approach, lean construction is applied to projects

using a variety of tools and techniques that focuses on improving the delivery of projects throughout its lifecycle and generating value for all stakeholders.

The majority of the respondents indicated that there is a significant influence of implementing lean tools on safety in construction sites. The study indicated that there is a strong relationship between occurring accidents and bad visualization in the construction sites [14]. It was found that there is a significant weakness in the learning environment in construction projects and there is very limited amount of knowledge about lean construction tools and other new safety techniques. Training will be a key aspect of implementation and success of the lean construction techniques to increase safety conditions at the site.

#### IV. LEAN CONSTRUCTION IN INDIA

Industry experts suggested the following reasons for non-adoption of Lean practices in Indian Construction [2]:

- Lack of established and successful examples of implementation of the new Lean process within the country and belief that Lean is more applicable to manufacturing process. Cultural problems such as general reluctance to shed old, inefficient methods and adopt new methods; hierarchical tendencies and non-consultative processes restricting planning processes to a few in the planning office.
- General tendency to avoid formal planning processes and systems and using ad-hoc working methods, which is not aligned with the Lean philosophy.
- Lack of a committed, trained and reliable labour force coming in the way of systematic planning and training.

Identifying Key Wastes and their Sources in Indian Construction Practices through a Survey. The sources of wastes were grouped into three categories namely as below: Management related, Resources related and Information related [16]. \*"Theft" was added to L.F. Alarcon's questionnaire based on the authors' personal interviews and feedback from construction professionals at some other construction sites in India.

A. Management Related: Unnecessary Requirement, Excessive Control, Lack of Control, Poor Planning Excessive and Red Tape

B. Resources Related: Excessive Quantity, Shortage, Misuse, Poor Distribution, Poor Quality, Availability and Theft\*

C. Information Related: Unnecessary, Defective, Unclear and Late

#### V. LAST PLANNER SYSTEM

It's full name is the Last Planner System of Production Control. Production control is necessary on projects to support working toward planned accomplishments, doing what

can be done to move along a planned path, and when that becomes impossible, determine alternative paths that accomplish desired goals. The term Last Planner is a registered trademark of the Lean Construction Institute. The Last Planner is a holistic system, meaning that each of its parts is necessary to support lean project planning and execution. The system is organized into five major parts. The first two parts focus on identifying the work that should be done to complete a successful lean project. Master Planning, part one, is done at the very beginning of a project. The master planning work is focused on identifying major milestones that help gauge the pace at which the project will progress if it is to be successful. Normally milestones are completion dates for each of the major project phases and dates for releasing the purchase of major long lead building items. Ideally both design phase and construction phase last planners participate in developing the master-planning schedule.

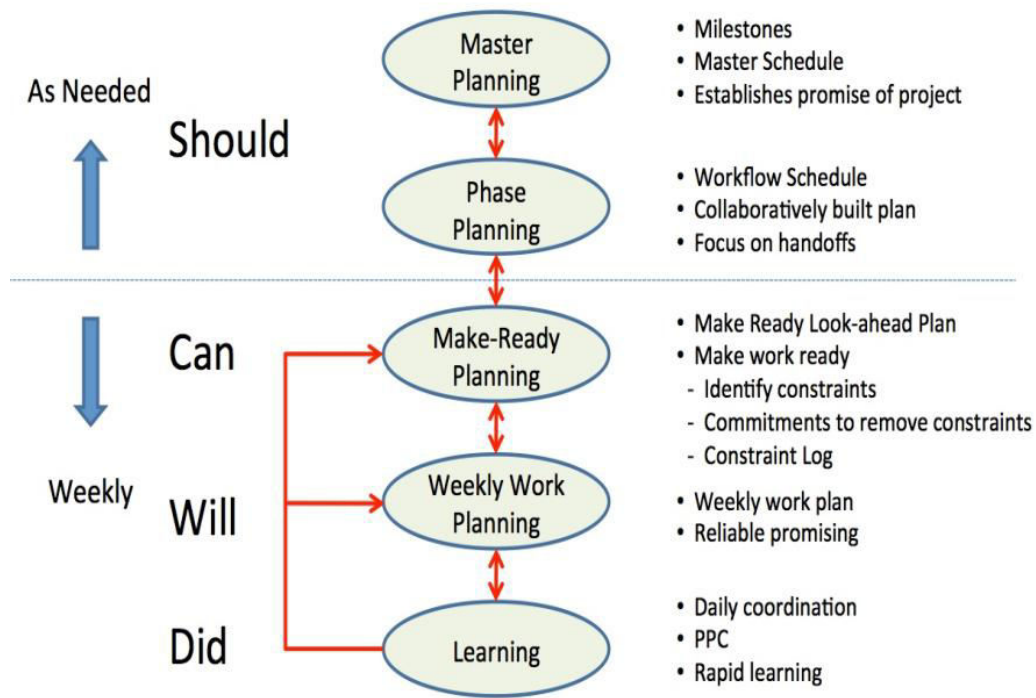


Figure 1: Last Planner System

The term “last planner” refers to the people on the team responsible for making the final assignment of work to specific performers and ensuring they have the materials, equipment and information available to complete their assignments. During the design phase, last planners are typically architectural and engineering project managers. During the construction phase, last planners are typically foremen and superintendents for the trade contractor crews.

## VI. CONCLUSION

In this paper analysis of the evidence obtained from implementation of Lean Construction practices in many projects analyzed in various countries and the result demonstrates the effectiveness and improvement of proposed practices and their multiple benefits:

- The LPS is an effective tool to improve reliability of planning in projects.
  - Improvements in PPC are usually accompanied by a more stable and less variable performance of the PPC indicator.
  - Improved PPC performance produce a shift in causes for non-compliance from internal to external causes.
  - BIM tools can support a more complete and standard implementation of the LPS in projects and increase the probability to achieve higher PPC performance.
  - Performance improvements were observed in almost all the projects under investigation.
- However, performance measurement was a difficult task for the companies.

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