

Construction Value by Lean Management

Ms. Snehal C. Jejurkar^{1*}, Prof. R. B. Kesarkar²

Abstract - Construction is one of the fastest-growing industries in the world and the second largest employer in India after agriculture. There is usually agreement that the construction industry generates a very high percentage of waste. Eliminating or reducing waste can result in significant cost savings for the construction industry. Lean production optimized production system performance against maturity standards to meet unique customer requirements. This article describes the application of Lean principles in the construction industry using suitable Lean Construction tools and relevant case studies.

To improve efficiency and reduce waste, Lean Construction was introduced as a new management principle for better execution. Achieving lean concepts in the construction industry presents many challenges. The adoption of lean management in the construction industry is a major challenge in India. Due to a lack of attention and ignorance of the principle of lean management, owners, contractors, engineers, etc. are in the development stage to implement this principle in their projects. In this paper, we discuss past work in this lean management concept which will help us for adopting a new methodology of work for further research.

Keywords – Lean Management, Construction Waste, Optimization.

-----X-----

INTRODUCTION

Lean construction is an amalgamation of original research and development in design and construction with a mutation of lean manufacturing principles and practices to the end-to-end design and construction process. Unlike manufacturing construction is a project based-production process. Lean construction is concerned with the holistic approach of concurrent and continuous improvements in all dimensions of the built approach and tries to manage and improve construction processes with minimum cost and maximum value by considering customer needs. The term "Lean Construction" was coined by the International Group for Lean Construction in its first meeting in 1993 As the construction industry gets competitive, thinking and applying Lean to Construction activity is critical to winning customers and ensuring profitability. The aim of Lean Systems is to design, produce and deliver products/services, which exceed customer expectations in terms of Cost/Quality/Time/Performance. Lean construction is a new way to manage construction. The objective, principles, and techniques of Lean Construction taken together form the basis for a new project delivery process. Value Stream Mapping is a logical chart methodology for process tracking which helps the tracker to identify value-adding activities and non-value-adding activities.

OBJECTIVES

Lean is just way far greater than just a philosophy. In the construction industry, eliminating waste and satisfying clients' requirements are of utmost importance. Quality Assurance can be only attained if

everything goes with standards and advanced thinking and furthermore implementation of the newest trends in technology. Lean Construction Technology is one of them tied up for the betterment of Construction Industry. Objectives of this research are:

1. To identify and record the perception of different construction project participants on lean-based wastes on construction sites and quantify them via. Questionnaire Survey.
2. To study and demonstrate Value Stream Mapping on residential projects as a Lean Tool and identify possible benefits emerging from the application of this tool.
3. To increase output value through a systematic consideration of customer requirements and to examine non-value-adding activities from the current state map and then give provision for process improvement in future state maps.
4. To access lean construction techniques from the viewpoint of various experts and top management and to enhance the quality of the project and profit by minimizing wastage.

LITERATURE REVIEW

We discuss past work in this lean management concept which will help us for adopting the new methodology of work for further research.

Alarcon, L et al (2015) Last Planner System and other Lean Construction techniques in over one hundred Construction for five years in Chile were selected for study by author. Benefits of the concerned study was 7% to 48% performance improvement reported by 8 companies along with improved reliability of planning and PPC. The concluding remark by the author was that IT tools can support a complete and more standard implementation of LPS.

Ballard G (2015) This literature review is an attempt to answer the questions about implementing lean in India's Construction Industry: Why bring lean thinking and practice into India's construction Industry? Heathrow Airport's Terminal 5 began construction in 2001 with a budget in excess of 7 billion British pounds-fully 80% of the airport owner/operators net worth. Gillen Ballard was personally involved in the civil phase of the Terminal 5 project, working as technical director for Strategic Project Solutions, a management consultant for both BAA and Laing O' Rourke, the prime civil contractor.

Lucia h, et al (2015) The above article presents how HA of UK has benefited by using Lean Techniques on their Road Schemes and displayed few examples over it. The Highways Agency (HA) is an executive Agency of the UK Department for Transport (DfT). The UK government has been instrumental in encouraging the UK public sector to find ways to improve efficiency and has launched a Continuous Improvement (CI) initiative across all government departments. The HA has successfully applied Lean Techniques as a driver to delivering CI.

The Author concluded that, from 2009 to date the HA has achieved solid savings by application of Lean methodology in the UK Road schemes. Savings of over £100 Million have been attributed to Lean Intervention. These savings made considerable contribution to the efficiency savings of £114 Million demanded by the UK Treasury. Savings of up to 30% on scheme completion have been reported by encouraging discussions among stakeholders at Collaborative planning meetings.

Maitreya Yadav (2015) The above article presents the outcome of how the PPC (Percent Plan Complete) rate has changed from adopting lean principles. A comparison of data is done by keeping tally of establishing a Lean Team before and after implementation of lean principles. The key learning from the experience is that for lean to become self-sustainable at a project the implementation efforts have to be initiated by the project team with the command coming from the project leader/manager and not from the senior leaders at head office. Concluded that both the top down and bottom-up approaches were ineffective for a full-scale lean implementation to

become self-sustainable. In the presence of continuous monitoring – IITM in case of the Project 1 & Project 2 and lean coordinator in case of PS1-PS9, lean implementation continued successfully.

Sonali D (2015) Excelize has worked as a BIM Consultant on IT SEZ Projects for TCS at Pan India locations. 4D helped the project to track the schedule and monitor delays, eradicate sequential issues in construction and streamline the construction process. Excelize team linked the project plan (from Primavera) with the BIM model. To the 3D model, they added the 4th dimension of time and generated the construction simulation for every activity. This linking was done initially for a baseline project plan and routinely updated (every 2 weeks) for actual updates to the project plan. The results show a difference of 2-3 % between the BIM estimated quantities and consumed quantities. Using the model, the Clash Detection & Resolution (CDR), phase of the project was completed in one month as compared to the three months required using the conventional process.

Bygballe, L (2014) The Lean Construction concept is created and recreated as people at various levels in the internal project-based organization learn and engage in the new practice. Second, as Lean Construction at a project site will involve people from various companies, we also need to consider how the external project-based organization would engage in the translation and transformation process of the Lean Construction concept.

Dhivyamenaga (2014) The objective of this study was to assess the application of lean construction of construction companies and give quality rating model to construction companies. The main tool for the collection of data was structured questionnaire. As a result, the performance level of construction companies in relation to the use of Lean Construction was obtained, to check how it was understood and how its principles were applied. After this, the results were evaluated and suggestions were made to the companies to help them implement Lean Thinking.

Fatima A. (2014) The objective of the study is to analyse the Last Planner System in reducing the construction complexities involved in the project and to analyse the last planner system to complete the project within the stipulated time and cost and to study the concept of lean construction and how it is being implied in the local construction industry. The researchers kept keen control over project master schedule, look ahead schedule and prepared a weekly work plan for the upcoming works scheduled to be attained. After analysing the Last Planner system, it is observed that there is a saving of Rs.1, 15, 5800.00 for the total project.

Harsha (2013) This paper has strongly addressed the application of lean practices in construction.

Overall it was very effective, giving a great summary of what the current state of practice is. But the paper gives a great summary of applicable steps toward becoming lean and likely benefits to a construction organization. Significant research remains to be complete for the translation of construction to lean thinking. There has however, been relatively little research on case studies, research based on quantitative data or research making categorization of the types of waste that exist in construction. The Last Planner System is briefly explained in above article along with Indian Construction Overview, Analysis of Waste, Core elements of lean construction, Lean Models, and case studies of Pacific Contracting and IIT Guwahati.

Devaki M, Jayanthi R (2012) The researchers led a comprehensive survey to identify barriers in implementing Lean Principles in local construction industries and came to conclusion that there are several factors contributing as barriers. According to the research, lack of exposure on the need for Lean Construction, uncertainty in the supply chain, tendency to apply traditional management, culture and human attitudinal issues (mindset issues), lack of commitment from top management, non-participative management style for workforce, attitude and ability to work in group, difficulties in understanding the concept of lean construction, fragmentation and subcontracting, lack of client and supplier involvement and lack of proper training are main factors contributing.

Garrett et al (2011) A lean tool, value stream mapping (VSM), and various other lean concepts were used, electronic versions of the submittals. Part of the coordination effort was eliminated. Activities in the process were reduced from (8 to 5), decrease lead time (40%) and process time (25%). E-copies affected review time of the submittal.

Yoder's J (2009) Building Information Modelling (BIM) as a Lean Construction tool was used by Turner Construction Company for Tennessee Medical Centre, US. Concerned tool led the project to reduction in cost from estimated at \$286 million by \$3 Million, shortening the delivery time.

Howell G et al (1998) In this paper, authors gave advice on implementation of Lean application. They claimed that implementing lean thinking will lead to change in almost every aspect of project and company management. On the commercial side, begin to form long term alliances with like minds along the value stream. As a citizen of the industry, spend time and effort developing lean thinking in others, even competitors. More than one firm changing to lean has come up against the inability of their suppliers to support lean projects. Once on the way to becoming lean, these suppliers become almost schizophrenic as part of their customers work one way and the others lean. If this advice sounds wrong, it probably means

you have not confronted the depth of opportunity and change lean offers you and your organization.

Lauri Koskela (1993) In this paper, the concepts, principles, and methods of lean production are reviewed, and their applicability in construction is analysed. The implications of lean production to construction practice and research are considered. Author also described difference between conventional production philosophy and new lean production philosophy. According to author, conventional production consists of all activities as value adding activities whereas in lean philosophy there are both value adding and non-value adding activities. Conventional production philosophy focuses on control over cost of activities and lean philosophy focuses on cost, time, and value of flows. In conventional practice there is scope of improvement by increasing efficiency using new technologies whereas in lean philosophy improvement can be achieved by elimination or suppression of non-value adding activities, and increase of efficiency of value-adding activities through continuous improvement and new technology.

METHODOLOGY

The following methodology has been adopted to collect and analyse the necessary data.

Data Collection: Collection of various data, literature, and methodologies available in various sources like Journals, Articles, and with the help of the Internet.

Literature Review: Thorough study of relevant articles, at least 15, from various nationally and internationally recognized journals showing prior implementation and results that are available by using Lean Philosophy in the Construction industry.

Deciding objectives and scope of the study: Based on the literature reviewed, objectives that are important to be implemented for completion of the project are necessary to be decided and these objectives will act towards actual completion of the project. Furthermore, the scope or limitations of this study are also decided well in hand. Scope of study will help in only prioritizing on important factors that are supposed to fulfil the requirements of objectives decided.

Tool selection: After all, above works are completed, Lean tools that can be effective to be selected, in this case Value Stream Mapping and implemented in three phases on a construction site.

Phases: The three phases will include domains

1st Phase- Training on Lean, interviews with Project Managers and Planning engineers, Questionnaire Surveys.

2nd Phase- Collection of survey responses, analysis of responses, identification of cycle times, resources required, inventory time, lead time and customer demands for each activity.

3rd Phase- Plot current state map and identify value adding activities, analysis of current state map and preparation of future state map.

CONCLUDING REMARK

Lean Construction has been introduced as a new management approach to improve productivity in the construction industry. Much research has been done on lean concepts and principles, resulting in successful adaptations of lean ideas from the automotive industry to the construction industry. Construction companies are striving to transform their current form of project management into a lean management approach. Construction is the second largest industry in India after agriculture. Diverse and involved in all areas of construction: roads, railways, urban infrastructure, ports, and airports. A project was seen as a temporary production system that had to be designed, planned, produced, and delivered within a certain time. Fast track projects with long and complex supply chains involving many parties and subject to multiple major process design changes have complex flow management with disastrous results.

REFERENCES

1. Thomas B. Treacy, "Use of Alternative Dispute Resolution in the Construction Industry", *Manage. Eng.*, 1995, Volume 11, Issue (1): 58-63.
2. Krishna Agrawal, "Justice Dispensation through the Alternative Dispute Resolution System in India", *RUSSIAN LAW JOURNAL*, 2014, Volume 2, Issue (2).
3. Murali Jagannathan, and Venkata Santosh Kumar, "Litigation in Construction Contracts: Literature Review", *J. Leg. Aff. Dispute Resolut. Eng. Constr.*, 2020, Volume 12, Issue (1).
4. Louis Flannery, and Robert Merkin, "Emirates Trading, good faith, and pre-arbitral ADR clauses: a jurisdictional precondition?" *Arbitration International*, 2015, Volume 31, 63–106.
5. Baris Nazlim, "Resolving Construction Disputes in Dubai", *Management, Procurement and Law*, Volume 165, Issue (2).
6. Murali Jagannathan, and Venkata Santosh Kumar, "Litigation Proneness of Dispute Resolution Clauses in Construction Contracts", *J. Leg. Aff. Dispute Resolut. Eng. Constr.*, 2019, Volume 11, Issue (3).
7. Richard H. Steen, "Five Steps to Resolving Construction Disputes: Without Litigation", *J. Manage. Eng.*, 1994, Volume 10, Issue (4): 19-21.
8. Kathleen M. J. Harmon, "Effectiveness of Dispute Review Boards", *J. Constr. Eng. Manage.*, 2003, Volume 129, Issue (6): 674-679.
9. David Arditi, and Bhupendra K Patel, "Expert system for claim management in construction projects", *Butterworth & Co (Publishers) Ltd*, 1989, Volume 7, issue (3).
10. N.B. Chaphalkar, K.C. Iyer, Smita K. Patil, "Prediction of outcome of construction dispute claims using multilayer perceptron neural network model", *International Journal of Project Management*, 2015, Volume 33, 1827–1835
11. Nitin Chaphalkar, and K. C. Iyer, "Factors Influencing Decisions on Delay Claims in Construction Contracts for Indian Scenario", *Australasian Journal of Construction Economics and Building*, Volume 14, Issue (1), 32-44.
12. K. C. Iyer, N. B. Chaphalkar, Smita K. Patil, "Intrinsic Factors Influencing Decision making of Arbitrators in Dispute Resolution of variation Claims", *J. Inst. Eng. India Ser. A*, June 2018, Volume 99, Issue (2):287–293.
13. Smita K. Patil, K. C. Iyer, and N. B. Chaphalkar, "Influence of Extrinsic Factors on Construction Arbitrators' Decision Making", *J. Leg. Aff. Dispute Resolut. Eng. Constr.*, 2019, Volume 11, Issue (4).
14. Ajit K. Sinha, and Kumar Neeraj Jha, "Critical Analysis of Contract Clauses in Road Sector: Case Study", *J. Leg. Aff. Dispute Resolut. Eng. Constr.*, 2020, Volume 12, Issue (3).
15. Amit Moza, and Virendra Kumar Paul, "Analysis of Claims in Public Works Construction Contracts in India", *Journal of Construction in Developing Countries*, 2018, Volume 23, Issue (2), 7–26.
16. Ajit Kumar Sinha, and Kumar Neeraj Jha, "Dispute Resolution and Litigation in PPP Road Projects: Evidence from Select Cases", *J. Leg. Aff. Dispute Resolute. Eng. Constr.*, 2020, Volume 12, Issue (1).
17. Timothy Tunde Oladokun, and Bioye Tajudeen Aluko, "Dispute resolution in corporate multi-tenanted property management: a case study", *Journal of Corporate Real Estate*, 2014, Volume. 16, Issue (1), 22-32.

Corresponding Author

Ms. Snehal C. Jejurkar*