

Lean Construction Tool – A Literature Review

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Abstract - Construction is an array of interdependent activities and is in general characterized by delays in possession, budget overruns and problems in maintaining proper quality. Every construction firm whether it is big or small faces the issue of construction managerial skills. India's construction industry has been volatile due to demonetization, GST, New government regulations (RERA Act 2016). The productivity of construction industry has been declining over the past decades. One approach for improving situation is using lean construction management. Lean management is first practiced in the automotive industry as means to optimize the flow of production by reducing waste in any process in order to generate maximum possible amount of value. Lean wastes are (DOWN TIME) Defects, Overproduction, Waiting, not utilizing talent, Transportation, Inventory excess, Motion waste, Excess processing. The aim of this case study is to apply Lean construction methodologies on selected construction processes and the purpose of the study is to demonstrate its influence on cost and time of the project.

Key Words: lean construction, Lean wastes, 5's, value stream mapping and Pareto analysis.

1. INTRODUCTION

The concept of Lean Production has been continuously evolving since the Toyota Automatic Loom Works, the parent firm of Toyota Group, was established in 1926 (Liker 16). A combination of early ideas of Toyota and a study trip to Henry Ford's plants laid the foundation for the Toyota Production System, which has been known as Lean since 1990 (Womack et al.). The car manufacturer Henry Ford revolutionized the production process as he in 1913 standardized work tasks so that regularly made parts could be produced at a faster rate, termed "flow production". Ford wrote in his book "Today and Tomorrow" about "the importance of creating continuous material flow throughout the manufacturing process, standardizing processes, and eliminating waste" However, Ford did not fully practice what he preached (Liker 22). He emphasized batch production methods, which created batches of parts and products instead of continuous material flow (Howell,). Toyota Group, inspired by Henry Ford, used Ford's original idea of continuous material flow and further developed it by creating their own "one-piece flow." Toyota wanted to master fluctuations of customer demand and deliver products immediately. They brought Ford's original ideas to life and shifted focus "from individual machines and their

utilization, to the flow of the product through the total process

Lean production can be summarized into four point

- Identify and deliver value to the customer value: eliminate anything that does not add value
- Organize production as a continuous flow
- Perfect the product and create reliable flow through stopping the line, pulling Inventory, and distributing information and decision making
- Pursue perfection: Deliver on order a product meeting customer requirements with nothing in inventory.

1.1 Background

This study has chosen 5'S, VSM, Pareto Analysis are the main tool for improvement in lean construction because it has been tested in the field and refined over the last decade with achievement of great benefits (Junior et al., 1998 Fiallo and Revelo, 2002; Koskenvesa and Koskela, 2005, Thomassen et al., 2003 Kim and Yang, 2005). This technique promises to make project programmes more predictable by making assignments ready. By supporting short-term planning and by minimizing waste and non-value-adding work. In addition, it enables the collaborative management of the entire network of relationships and communications needed to guarantee effective programed co-ordination, production planning and project delivery (Ballard, 2000, Koskela and Ballard, 2006: Mossman, 2009) It aims to improve management practice by solving practical problems and create new knowledge. That is to say, this study is concerned with the application of existing principles (LC) to a new context and different working environment where commitment and attitude to time make it likely to operate differently. This study was undertaken to improve the quality of work in practice, to solve practical problems and to contribute to knowledge. The research described in this paper is devoted to evaluating the effectiveness of implementing LC to improve construction planning practice and to enhance site management in the Indian construction industry.

2. Lean Tool:

2.1 Value Stream Mapping

This paper also describes the concept of value stream mapping, a lean construction management tool to reduce

Non value added activity in RCC slab cycle and increase the productivity. The main purpose is to recognize the application of value stream mapping in construction industry.

VSM is described as an iterative method for mapping and analyzing value streams. VSM purpose is to quantify and communicate production process characteristics such as material and information as well as non-value adding activities.

VSM consist of element of the current state mapping and the further state mapping.

- **Current state mapping:**

The goal of VSM is to create the clear picture of the exiting process and to identify waste Mapping the current state reveals both value and non-value adding activity

- **Further state mapping:**

Mapping the future state helps to reduce time cost incurred in slab casting by eliminating wastes generated due excess processing, transportation, faulty workmanship, tight schedule

2.2 5'S (Five Step)

This dissertation discusses about the 5'S lean methodology for Storage area and site infra planning and execution. It has been successfully used in many building process due to low financial outlay required for its implementation. Method 5'S has 5 steps from the initial Japanese word representing successive stage of its implementation.

1. **Seiri (sorting)** - the removal of all unnecessary tools and parts, putting in order;
2. **Seiton (set in order)** - deployment of work, workers, equipment, parts and instructions in such a way that the flow of work is free from inefficient tasks
3. **Seiso (Shine)** - cleaning workplace and the all of the devices used
4. **Seiketsu (standardization)** - making sure procedures are standardized and reproducible
5. **Shitsuke (sustain)** - helps maintain introduced procedures and rules.

The phases - to be effective - should be implemented in order.

2.3 Pareto Analysis

Many times, in construction there are problems of uncertainties since most of the work is labor intensive. Pareto diagram proves helpful to identify problems and to focus on the inputs with greatest impact. Pareto analysis is a statistical decision-making technique that identifies a limited

number of input factors as having a greater impact on outcomes, whether they are positive or negative. It is based on the Pareto Principle, popularly known as the '80/20 rule', that stipulates that 80% of the outputs result from 20% of the inputs.

Taking quality improvement, for example, a vast majority of problems (80%) are produced by a few key causes (20%). This technique is also called the vital few and the trivial many. In the late 1940s Romanian-born American engineer and management consultant, Joseph M. Juran suggested the principle and named it after Italian economist Vilfredo Pareto, who observed that 80% of income in Italy went to 20% of the population. Pareto later carried out surveys in some other countries and found to his surprise that a similar distribution applied.

We can apply the 80/20 rule to almost anything:

- 80% of customer complaints arise from 20% of your products and services.
- 80% of delays in the schedule result from 20% of the possible causes of the delays.
- 20% of your products and services account for 80% of your profit.
- 20% of your sales force produces 80% of your company revenues.
- 20% of a systems defects cause 80% of its problems.

The Pareto Principle has many applications in quality control. It is the basis for the Pareto diagram, one of the key tools used in total quality control and Six Sigma.

3. CONCLUSIONS

Lean construction is found to be very effective as to minimize wastes in construction industry. The study during this paper has primarily identified the wastes and their causes. From this literature review we found that several studies have been came out to check the effectiveness of lean construction methods. This section explains the theory behind lean construction methods and explanation of best possible procedure to implement the methodology through literature study: Study highlights that though this method has been extensively used in developed countries it has very few applications in developing countries like India. The most common controllable factors identified are ineffective planning and control, poor site management, material procurement problems, low labor productivity and weak communication and coordination.

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