

A Review Paper on Lean Management in Construction Sites

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Abstract – Lean Construction is an effective management tool to enhance the productivity in construction field. Large research is being done in recent past to adopt lean management principles in construction sites across the world. There are many challenges in implementing the lean concept in construction industries. This paper emphasizes on various lean management studies conducted in construction sites across the world and the results obtained in those studies and to analyze its importance on adopting in construction sites.

Key Words: LC, Questionnaire, Waste, Lean, Construction Sites, Productivity

1. INTRODUCTION

The concept of lean construction is derived from the concepts and theory of lean production. The concept of lean is developed by Ohno in Toyota Production System (TPS). Lean is a way of thinking to improve the value and minimize the waste associated in it. The term LC is defined as the combination of operational research and practical development in design and construction with an adaption of lean manufacturing principles and practices to the end to end design and construction process. LC has become one of the primary performative improvement recipes for the construction Industry. Firstly, LC emphasizes on waste reduction from the technical and operational point of view and secondly on the elimination of harmful relationships in the process while promoting teamwork between the supply chain managers. These are wastes generated from all the activities involved in the construction processes. Waste is defined as any construction activities or process that incur costs which do not directly or indirectly add value to the construction project. These construction activities can be value-adding activities (conversion of raw materials to the final product) and non-value adding activities (wastes, wasteful operations). Construction waste could be because of errors in design, modifications, redoing of work, defects and the use of excess materials. It is therefore important to ensure waste generation is minimized in construction processes and activities. The various construction wastes include transportation, inventory, motion, over processing, over production, waiting and correction. These all can occur one or another way in construction sites.

2. LITERATURE REVIEWS

The literatures of various studies conducted around the world and its reviews are provided below: -

Oguntona and Aigbavboa (2018) conducted a study on “An Assessment of Lean Construction Practices in the Construction Industry”. This study aims to assess the use of LC practices to effectively improve productivity and performance of the construction industry. A well-structured questionnaire was administered, with construction professionals as respondents. A quantitative approach to data analysis was adopted using the mean item scores of the identified variables. Findings revealed waste reduction, effective administration of materials on site, improved lifecycle cost, good project coordination, improved safety on site and greater productivity as the six benefits of implementing LC practices. By adopting LC practices, productivity will be increased thereby leading to successful delivery of construction projects.

Abbasian Hosseini and Nikakhtar (2012) discussed on “Flow production of Construction Processes through Implementing Lean Construction Principles and Simulation”. This study seeks to test the applicability of lean principles to one of construction operations using discrete-event simulation. One of the general simulation tools with a powerful 3D animation in this regard is ARENA, which is used in this paper. Data required to simulation model development were gathered from the construction site. It concluded that the concepts of lean construction can be applied properly using simulation as means of testing lean concepts prior to actual field implementation. Results showed that lean principles enhanced the performance of the selected processes by reducing the total time of the project and increasing the process efficiency.

Amin Nikakhtar and Abbasian Hosseini (2015) conducted a study on “Application of lean construction principles to reduce construction process waste using computer simulation: a case study”. The main aim of this study is at examining the ability of lean construction principles to reduce construction process waste through a case study (reinforcement process). Computer simulation is utilized to reveal the results of lean principles application prior to real implementation. Results show that different kinds of waste in a construction process can be reduced via adopting lean construction principles using computer simulation.

Luis Alarcon and Loreto Seguel (2002) discussed on “Developing Incentive Strategies for Implementation of Lean Construction”. This study describes a methodology that has been developed by a group of Chilean construction companies to select employee and organizational incentives to encourage participation and commitment to the implementation of improvement actions in their organizations. The result obtained as part of diagnosis, and the further analysis realized on them has permitted to determine agents of change that boost improvements inside the organization, but also to validate perception and inferences established in the preliminary experiences of implementation of Lean improvement methodologies in the Chilean Construction companies.

Sevani Senaratne and Duleesha Wijesiri (2008) conducted a study on “Lean Construction as a Strategic Option: Testing its suitability and Acceptability in Sri Lanka”. Lean construction can be argued as a strategic option when implementing in a new setting, where certain tests such as its suitability and acceptability needs to be done prior to its implementation. This study aimed to explore the suitability and acceptability of Lean construction in Sri Lanka. The study adopted an opinion survey using Delphi method to collect empirical data. The findings reveal frequent flow activities that generate waste and their causes in the Sri Lankan construction industry. The study concludes that Lean construction is suitable and acceptable in the Sri Lankan context and offers an approach to test Lean construction in a new construction industry using an opinion survey.

O Salem and J Solomon (2005) conducted a study on “Site Implementation and Assessment of Lean Construction Techniques”. The aim of this study is to test the effectiveness of some lean construction tools, those tools that can be applied in medium size construction firms. A field study was conducted to evaluate the effectiveness of some lean construction techniques including last planner, increased visualization, daily huddle meetings, first run studies, the 5s process and fail safe for quality. The data collection methods included direct observations, interviews, questionnaires and documentary analysis. The effectiveness of the lean construction tools was evaluated through the lean implementation measurement standard and performance criteria. It was found that last planner, increased visualization, daily huddle meetings and first run studies achieved more effective outcomes than expected.

Fiona Keru Mwacharo (2013) discussed on “Challenges of Lean Management: Investigating the challenges and developing a recommendation for Lean Management Techniques”. This paper aims to find out what the main challenges of implementing Lean management techniques and to develop a recommendation on how to manage these challenges. A qualitative research was conducted via questionnaire and interviews on several companies in Finland. The study finds that the main challenge that the companies had was in having workers who were not motivated or not accepting the change, at least initially. Another challenge was in maintaining Lean. Lean management is meant to be a continuing process (it never ends), thus it is challenging for some of the companies to sustain it.

Saad Sarhan (2018) conducted a study on “Institutional Waste within the UK Construction Industry: An Exploratory Study”. The UK construction industry is often criticized for being wasteful compared to other industries, confrontational, and for lacking capacity for learning and improvement. This study was aimed to explore the institutional, procurement and commercial environments surrounding the design and delivery of construction projects and reveal the consequential wastes. A reflexive grounded-theory methodology was adopted to explore the institutional factors influencing construction procurement, and to facilitate an in-depth understanding of the impact of prevailing construction procurement arrangements on project performance and outcomes. Data were primarily collected through in-depth and iterative interviews with 24 senior professionals within the UK construction industry, including a review of supporting documentations provided by the interviewees. The findings reveal that the entire construction process should be followed in a proper plan and leadership from the initial stage onwards and thus the institutional wastes can be minimized.

Carlos T Formoso and Lucio Soibelman M (2002) conducted a study on “Material Waste in Building Industry: Main Causes and Preventions”. Material waste has been recognized as a major problem in the construction industry that has important implications both for the efficiency industry and for the environmental impact of construction projects. This paper describes

the main results of two research studies carried out in Brazil that investigated the occurrence of material waste at 74 building sites located in different regions of that country. Some typical figures for the waste of some key construction materials are provided, and the main causes of waste in the sector are discussed. The results indicate that the waste of materials in the Brazilian building industry is high and that a large variability in waste incidence is found across different projects. Most of this waste can be avoided by implementing inexpensive preventive measures, mostly related to managerial improvements.

Azam Forsberg and Lasse Saukkoriipi (2007) discussed on “Measurement of Waste and Productivity in Relation to Lean Thinking”. The aim of this paper is to do a literature review on measurement of waste and productivity. This paper highlighted the use of lean philosophy to reduce waste and improve productivity in the Swedish construction industries. The findings include expenses like labour wages and cost of material is difficult to control because of high level of construction demand caused by the strong economic growth in the Swedish economy in the recent years. Hence labour productivity can be improved by improving human performance.

Sven Bertelsen (2004) conducted a study on “Lean Construction: Where are we and How to Proceed?”. The study tried to establish a brief overview of the development over the past 12 years and to establish the state of the art. The primary objective is to open a discussion of the future effort within the lean construction environment. The paper proposed that a new research agenda should be established with an outset in the lean understanding of the construction process as it is known from the construction sites and with a complex system understanding of the nature of this process. Elements are outlined and areas for research identified within the areas of maximizing value for the client, minimizing waste in delivering the value and managing the project delivery.

Carlos Torres Formoso and Eduardo Luis Isatto (1999) discussed on “Method for Waste Control in the Building Industry”. This paper presents the preliminary results of an ongoing research project which aims to develop a method for controlling waste on building sites. The study also intends to make some contributions for the consolidation of the Lean Construction theory, through the application of some of its principles in practice. The findings concerned with the need to integrate waste control into the production planning and control process.

K P Ramaswamy and Satyanarayana N Kalidindi (2016) conducted a study on “Waste in Indian Building Construction Projects”. The Indian construction industry is characterized by challenges such as low productivity, lack of skilled labour, time and cost overruns etc. The main objective of the study is to investigate waste in Indian construction industry, focusing mainly on building projects. Six ongoing projects were taken up for the study and the wastes identified were quantified in terms of project cost by collecting data through direct observations, records and using tools such as work sampling. The results showed that waste due to non-value-added activities by labour and equipment was much higher.

3. CONCLUSION

Waste reduction, effective administration of materials on site, improved lifecycle cost, good project coordination, improved safety on site and greater productivity as the six benefits of implementing LC practices. By adopting LC practices, productivity will be increased thereby leading to successful delivery of construction projects. It also showed that lean principles enhanced the performance of the selected processes by reducing the total time of the project and increasing the process efficiency and the different kinds of waste in a construction process can be reduced via adopting lean construction principles using computer simulation. It was also found that last planner, increased visualization, daily huddle meetings and first run studies achieved more effective outcomes than expected and also the entire construction process should be followed in a proper plan and leadership from the initial stage onwards and thus the institutional wastes can be minimized. The labour productivity can be improved by improving human performance. The waste due to non-value-added activities by labour and equipment was much higher compared to material waste generated in the sites. This can also be avoided by adopting LC practices.

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