

Investigation and Minimization of Construction Wastage Using Lean Technology in Construction

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Abstract

Construction site waste contributes to the large quantities of construction waste that are generated by the construction industry every year. Increased economic growth and urbanization in developing countries has led to extensive construction activities that generate large amounts of wastes. This work aimed at identifying the main sources and causes of materials waste on construction sites arising from storage and handling of high waste generating building materials and employing the Lean Construction approach to reduce such waste. Minimizing material wastage would not only improve project performance and enhance value for individual customers, but also have a positive impact on the national economy. This work will be further intended to verify and re-evaluated the status of existing productivity and performances on construction activities and processes for local construction industries. This is meant to have a clearer picture on how "lean" in local construction industry performed currently under the compilation of new measurement parameters particularly on waste and cycle time pertaining to the concepts and principles of Lean Construction. This study mainly focuses on implementation of the tool like Relative Importance Index has been done for finding the cause and the effect of the various wastages at the construction industry. By way of choosing some major construction activities and careful observation of them for the extraction of the causes of the wastage generation has been done in this report.

Key Words: Construction Project, Lean, Wastage, Relative Importance Index.

INTRODUCTION

Lean construction is the term used to define the application of lean thinking principles to the construction environment.

What is lean construction?

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". Designing a production system to achieve the stated ends is

only possible through the collaboration of all project participants (Owner, A/E, contractors, Facility Managers, End-user) at early stages of the project. This goes beyond the contractual arrangement of design/build or constructability reviews where contractors, and sometime facility managers, merely react to designs instead of informing and influencing the design.

Lean construction recognizes that desired ends affect the means to achieve these ends, and that available means will affect realized ends. Essentially, lean construction aims to embody the benefits of the Master Builder concept.

Lean construction supplements traditional construction management approaches with (1) two critical and necessary dimensions for successful capital project delivery by requiring the deliberate consideration of material and information flow and value generation in a production system; and (2) different project and production management (planning-execution-control) paradigms.

Getting work to flow reliably and predictably on a construction site requires the impeccable alignment of the entire supply chain responsible for constructed facilities such that value is maximized and waste is minimized. With such a broad scope, it is fair to say that tools found in Lean Manufacturing and Lean Production, as practiced by Toyota and others, have been adapted to be used in the fulfillment of Lean construction principles. TQM, SPC, six-sigma, have all found their way into lean construction. Similarly, tools and methods found in other areas, such as in social science and business, are used where they are applicable. The tools and methods in construction management, such as CPM and work breakdown structure, etc., are also utilized in lean construction implementations. The three unique tools and methods that were specifically conceived for lean construction are the Last Planner System, Target Value Design, and the Lean Project Delivery System.

Adopting lean thinking results in a highly flexible, profitable company but the process to achieve it requires radical change and takes a number of years.

Some Fundamental Principles Of Lean Are:

- Define value from the customer's perspective

- Understand the value stream of all steps in the process used to create the end product
- Reduce waste
- Ensure a smooth flow of value added activities
- Prefabricate and modularize building systems
- Utilize collaborative pull scheduling to provide each internal and external customer what they want, when they request it
- Seek perfection by committing to continual improvement in all areas of the process

There Are Principles To Guide The Change Work:

- Identifying value from the point of view of the customer.
- Understanding the value streams by which value is delivered.
- Achieving flow within work processes as waste is removed.
- Achieving pull so that nothing is made/delivered until it is needed.
- Perfection recognizing that improvement needs to be constantly sought.

These Principles Can Be Applied At A Number Of Levels:

- By an individual design company who recognizes its clients to be both the owner of the buildings and those downstream in the design and construction process.
- By an individual component supplier who delivers value through their component products eg. bricks, concrete etc.
- By a PFI organizations that provide value to different clients through the provision and operation of a building product e.g. a hospital or a prison.
- By a group of companies who provide value to various clients through the provision of a building product e.g. city office space.

The Benefits Of Adopting Lean Thinking Are:

- Making good profit margins whilst contributing to improving the social infrastructure by protecting the environment and respecting the people who work for you.
- Creating a construction industry for the future that attracts young people who view it as a vibrant, satisfying, healthy environment in which to employ their talents.

OBJECTIVE OF STUDY

1. To review the Lean construction technique.
2. To study in detail Lean construction and its benefits.
3. To investigate construction wastage.

METHODOLOGY

First Phase - Formulation Problem Statement

Second Phase - Project Design

Third Phase - Data Collection & Processing

Fourth Phase - Data Analysis

Fifth Phase - Conclusion & Evaluation

Sixth Phase - Project thesis Report

To apply lean technology in the construction sector, in this project a questionnaire was used as a tool or material to find out the main factor which causes maximum wastages of different materials. Method adopted is simple and classified into following steps Study of literature review and conversation with senior engineers from various sites for the preparation of questionnaire. After preparation of questionnaire, this tool were distributed to various sites to collect the information related with wastages of materials After collection of all the questionnaire, it's analysis was carried out with the help of Relative Importance Index method to find out the ranking of various factors And lastly giving remedial measures for those factors which causes more than 70% wastages.

INTRODUCTION TO RELATIVE IMPORTANCE INDEX

Relative Importance Index

Relative Importance Index method helps to determine the Relative importance of the each factors affecting to occupational health risk. Then five-point scale consist of,

- 1 - Never
- 2 - Very rare
- 3 - Seldom
- 4 - Frequent
- 5 - Very Frequent

Data is obtained from experts, processed it & Converted it to relative importance indices (RII) for each Factor as follows:

Relative Importance Index,

$$R.I.I. = \frac{5n_5+4n_4+3n_3+2n_2+1n_1}{5(n_5+n_4+n_3+n_2+n_1)}$$

Where,
1, 2, 3, 4, 5, etc. are rating scale,
n1, n2, n3, n4, n5, etc. are no. of respondents.

DATA COLLECTION

For data collection, this is research relies on primary data, which was obtained using questionnaires having both closed and Open- ended (un-coded) questions; containing varied questions on material wastage and management. It was directed at the respondents relevant to the study including engineers, architects, quantity surveyors, builders

and contractors to identify the various sources of waste encountered on construction sites and how these wastes can be minimized and managed. The data obtained were in construction analyzed using tables and statistical indices.

The scope of this research is limited to firms in every question is evaluated by giving marks in the range of 1-5. With the help of Relative Importance Index, these questions to be analyzed and ranking prepare.

CONCLUSION

1. Lean technology reduces all forms of non-value added activities and improves its performance.
2. Lean technology helps to waste elimination method which provides a significant competitive advantage for the participants.
3. This study yields a methodology for waste detection and improvement of construction process.

RECOMMENDATIONS FOR FUTURE RESEARCH

The study results indicate some recommendations for further work. This is the first pilot study in this area with a small sample size and therefore a follow up study is needed. It would be more illuminating to conduct a longitudinal study to understand the long-term effects and benefits of lean in construction industry. In addition to this, relationship with local suppliers and how to build strong and long-term relationship should be studied further.

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ISSN 2456-2580