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# Study on Lean Principle Application in Construction Industries

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## Abstract

**Background/Objectives**: The unbiased of this study is to assess the application of lean construction of construction firms and give eminence grade model to construction enterprises. **Methods/Statistical Analysis**: Wastage in the construction companies has been subject of several research projects around the world in recent years. It is commonly recognized that very high level of waste exists in construction companies. Lean Construction considers construction wastes as prospective wastes that obstruct flow of value to the user and should be eliminated or avoided. The creation of this waste can be eliminated or prevented by applying lean construction principles. The data for this study will be gathered through a detailed questionnaire survey. The target population for the data collection is project managers of building construction organizations. The questionnaires consist of major factors that influencing the implementation of lean construction. By knowing the major factors gives better understanding in allocating them to parties/stake holders involved. Statistical Package for Social Scientists (SPSS) was employed to analyze data. **Findings:** As a result, the execution level of construction companies in order to the use of lean construction was acquired, to check how it was implicit and in what way its principles were realistic. After this, the results were determined and suggestions stood through to the concerns to help them contrivance Lean Thinking. **Application/Improvements:** This study results are used for Construction Industries.

**Keywords:** Execution Level, Eminence Grade Model, Lean Construction, Risk Factors

## 1. Introduction

Construction companies are required to be completed their projects faster than ever before and are at the same time becoming more complex and capricious[1]. Construction corporations consequently cannot run industry as usual; they can advance their competitive advantage and also can turn out to be cost resourceful by approving Lean thinking-focusing on process waste elimination[2]. Lean construction adopts the views of lean discerning and lean principles haggard from production management to create a new way to manage construction projects[3]. The goal is to build the project to make large possible value and reduction in waste and pursuing perfection. Lean construction is a mishmash of unique research and practical development in design and construction with an amendment of lean industrial doctrines and practices to the end-to-end design and construction program[4]. This approach strings to manage and improve construction processes with minimum cost and maximum value by considering customer needs.

### 1.1 Problem Statement

The construction industries in India are facing the same generic wastes on construction activities which were also

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handled by their foils irrespective those in developed countries or developing countries[2]. New measurement limits such as surplus, charge, progression time or variability that was not enclosed under unfashionable discernments are to be make known to into this study, the resident construction personnel will be consequently look at with those first-hand parameters to appraisal the flat of understanding and feasibility in local construction industry associate to the supplies and the views set forward by lean construction thinking.

### 1.2 Need of the Study

The construction industry gets competitive, rational and spread over Lean to construction bustle is critical to appealing customers and confirming profitability. Lean construction is a smart way to handle construction[5]. The aim of lean systems is to design, generate and deliver products and amenities, which go beyond customer outlooks in positions of cost, eminence, time and performance. The objective, principles and practices of lean construction occupied self-possessed form the basis for a new project delivery process.

### 1.3 Lean Operating System

Lean operation system consists of projects as production system, impeccable coordination and projects as collective enterprise.

### 1.4 Goals of Lean Construction

Main goal of lean construction includes eliminating waste, maximizing value from customer and creating reliable flow of activity.

### 1.5 Objective of the Study

The main objective of this study is to assess the application of lean construction of construction companies and stretch feature rating ideal to construction companies[6]. The subsequent phases are carried out to accomplish the core objective:

- To examine among construction project managers and identify the uses of lean construction.
- To analyze the construction project manager's lean construction performance level from the obtained data.
- To identify obstacles for successful process of lean construction.
- To express an eminence rating ideal to construction companies.

## 2. Methodology of the Study

Methodology of the present study is represented in Figure 1. Lean construction is a systematic approach to identifying and eliminating waste through continuous improvement by flowing the product at the demand of the customer. Lean construction considers construction wastes as potential wastes that hinder flow of value to the client and should be eliminated. The main objective is to waste minimization through the application of lean principles in construction site. Questionnaire survey was conducted among construction companies to identify their performance level in relation to the use of lean construction was obtained. The obtained data is analyzed to check how lean construction was understood and how its principles were applied in construction companies.

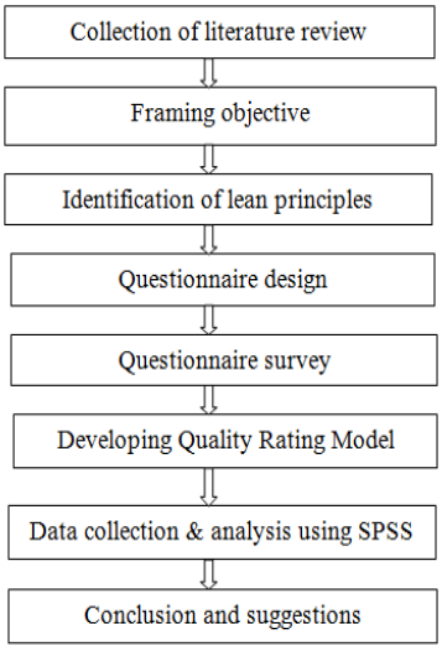


**Figure 1.** Methodology of the present study.

### 2.1 Customers Value

Value is what the customer needs and only what the customer needs. This requires an exact sympathetic of the definite desires of the customer. It is said that up to 95% of process activities are non - value adding. This is perhaps true, depending on your definition of value adding vs supporting and waste in a system.

## 2.2 Understanding Value Stream

The assessment stream are those events that, when done correctly and in the right demand, create the item for consumption or facility that the customer values[7]. A lean organization traces and manages all the events in the business that carry value where on earth they are and whichever department they are in.

Activities can be:

- In unabridged or part superfluous and extravagant (and therefore, should be eliminated).
- Supporting the value-adding events (which should be summary to the degree that promising).
- Customer value-adding (which should be continuously improved).

## 2.3 Improvement of Flow

In a bony business work ought to flow steadily and without interruption from one value adding or supporting activity to the next. This is marked with contrast with the "batching" of work where, for instance seven days outlays entitlements are calm for a superior to authorize in one go. Where it is suitable, flow significantly swiftness the dealing out and every single exertion ought to be made to eliminate obstacles and bottlenecks that prevent flow.

## 2.4 Establish Pull

The organization be duty-bound to respond to client demand, in disputes, customers pull the work through the system[3]. In non-lean firms exertion is hard up though the organization at the convenience of the operators and so you produce outputs that are not vital. Supreme services retort to client demand and so pull the work through the system.

## 2.5 Seek Perfection

As the first four values are executed you should get to understand the system ever better and from this empathetic you ought to engender accepted perception for further improvement. A lean system becomes yet leaner and faster and left-over is ever easier to isolate and eliminate[8]. A flawless process delivers just the right amount of value to the customer.

# 3. Results and Discussion

Data's are unruffled from project managers and site engineers. The Questionnaire preparation based on lean construction principles and its techniques[4]. According to the discussion had with project manager, contractor and site engineers, the lean construction principles are mainly according due to waste and material management. Once the data have been collected the researcher turns to the task on resolving them, the data requires a several class of closely related operations such as establishment of categories, the applying of these categories of unprocessed statistics over and done with coding, arrangement and then illustration arithmetical inference.

## 3.1 Interpretation

Interpretation refers to the tasks of illustrations insinuations from the calm evidences after an analytical and/or experimental study.

## 3.2 Tools used for Analysis

There are two tools used for this study are Statistical Package for Social Sciences (SPSS) and Simple Percentage Method.

## 3.3 Simple Percentage Method

Simple Percentage Method is used in data presentation for simplifying number through the ratios of the data in customary from with the same to whom it facilitates the relative comparisons[7]. The questionnaire of lean principle is presented in Table 1 and analysis of lean principle is shown in Figure 2.

**Table 1.** Questionnaire of lean principle

| 1. How familiar are you with the concept of Lean construction? | | | | | |
|---|---|---|---|---|---|
| | | Frequency | % | Valid % | Cumulative % |
| Valid | Not aware | 9 | 22.5 | 22.5 | 22.5 |
| | Aware | 9 | 22.5 | 22.5 | 45.0 |
| | Partially involved | 13 | 32.5 | 32.5 | 77.5 |
| | Fully involved | 9 | 22.5 | 22.5 | 100 |
| | Total | 40 | 100 | 100 | |

## 3.4 Quality Rating Model

Quality rating model (Figure 3.) is mainly developed using lean principles such as reduce waste, reduce variability, enhance process transparency, simplify by reducing steps and parts, increase product value, material flow and pull production, organization, planning and information flow and continuous improvements[6].

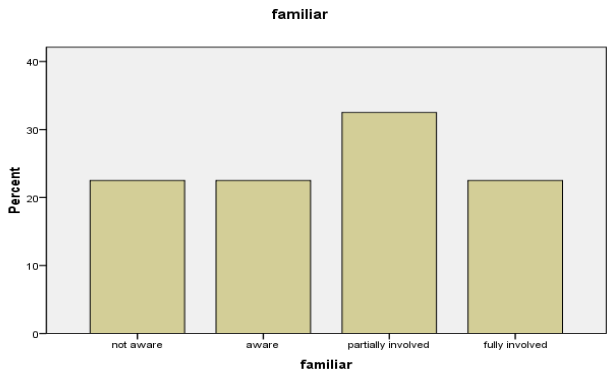


**Figure 2.** Analysis of lean principle.

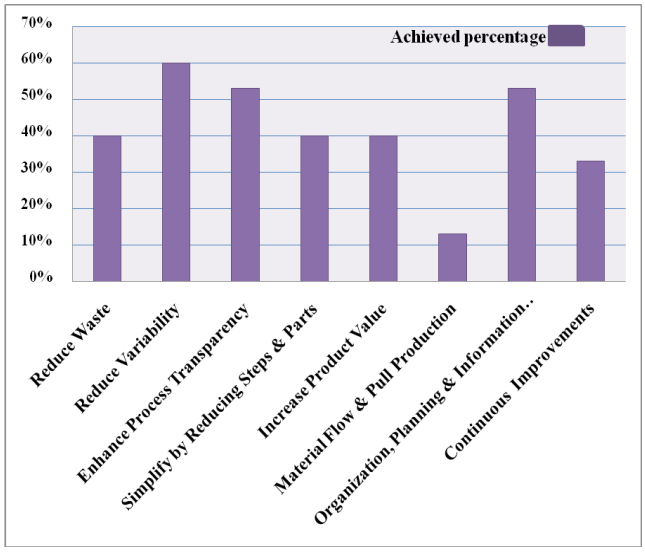


**Figure 3.** Quality rating model.

## 3.5 Final LCR Model Outcome: Project Classification

The LC-A class (from A to AAA) is defined as the top-end of excellence attention, endeavor for precision in the Lean construction principles, so to say the "Lean Construction Project".

Ventures and concerns in the LC-B class (from B to BBB) even now from head to foot feature focus[1]. They evidence efforts to learn and improve.

LC-C class (from C to CCC) is projects with a substantial eminence realization but squat, or nope lean construction knowledge.

The lowest classification group LC-D class (from D to DDD) includes projects with a squat eminence focus, very low improvement focus and a lot of waste in production process[9]. The final LCR model outcome-project classification is presented in Table 2.

**Table 2.** Final LCR model outcome- project classification

| Level | Sub level | Percentage | Characteristics |
|---|---|---|---|
| A | AAA | 70% to 75% | Continuous improvement in application of the Lean Construction. |
| | AA | 80% to 86% | |
| | A | 75% to 79% | |
| B | BBB | 70% to 74% | Awareness of the Lean Thinking. |
| | BB | 65% to 69% | |
| | B | 60% to 64% | |
| C | CCC | 55% to 59% | Improvement and knowledge of LC but not implemented. |
| | CC | 50% to 54% | |
| | C | 45% to 49% | |
| D | DDD | 40% to 44% | No focus on improvements or waste and no knowledge of LC. |
| | DD | 35% to 39% | |
| | D | 0% to 34% | |

## 3.6 Benchmark of Lean Construction Principles

Figure 4 shows the benchmark of lean construction principles. Benchmark is calculated by the data analysis of lean construction principles such reduce waste, reduce variability, enhance process transparency, simplify by reducing steps and parts, increase product value, material flow and pull production, organization, planning and information flow and continuous improvements[10].

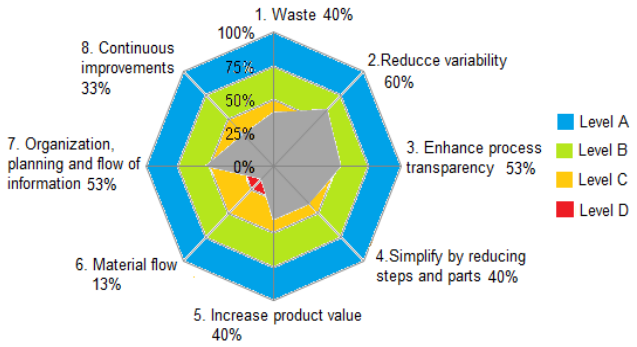


**Figure 4.** Benchmark of lean construction principles.

## 3.7 Suggestions

The following are some of the suggestions are given to implement lean construction for the improvements of the construction companies[11].

- Employees should train through lean concepts for effective execution of work.

- Communication should be enhanced among participants in construction projects.
- Construction managers should be committed to replace.
- Labors should be able to work in teams.
- Delivery of materials to construction places by proper time.
- Companies should more focus on clients' needs.
- Standardized construction elements should be promoted in the industry.
- The opinion of individual (employees) and company should be considered in decision making.
- Companies should understand customer's needs and expectations.

## 4. Future Outlook and Conclusion

The main purposes for the enlargement of this rating model be situated to preserve the LCR orthodox on a key code measure and to be responsible for a wide-ranging program for the evaluation, illustration of data and taxonomy into consistent LCR classes. Applicant of the LCR typical can swiftly assess a consistent conception of the quality and submission unit of Lean-Construction principles. This LCR can class and closely follow whether a construction project of company is in good direction (or not) with an explicit tactic emphasis on value peers and waste reduction. The LCR prototypical be duty-bound to also be fortified to economic predictors for construction ventures and also it provides good introspection into the quality, value-making and sustainability of the production process in construction projects. The suggestion for this broad view is established on thoughts among Projects managers and employees in the construction industry. Construction enterprises should be absorbed and request to get an marginal rating with the LCR classic, which will assistance them to easy know through broadcasting for some main extents to enhancement and in this way they can equate their LC-quality prestige with the national and international scales.

## 5. References


1. Al-Sudairi AA, Diekmann JE, Songer AD, Brown HM. Simulation of construction processes: Traditional practices versus lean principles. USA: University of California; 1999. p. 39–50.
2. Hofacker A, de Oliveira BF, Gehbauer F, Freitas MDCD, Mendes Jr, R, Santos A, Kirsch J. Rapid Lean Construction-quality Rating model (LCR). IGLC-conference; Berkeley, CA, USA: University of California. 2008.
3. Abdel Hamid TS. The self-destruction and renewal of lean construction theory: A prediction from Boyd's Theory. Proceedings of the 12th Annual Conference of the International Group of Lean Construction; Helsinga, Denmark. 2004.
4. Howell GA. What Is lean construction. Proceedings of IGLC-7; Berkeley, CA, USA: University of California. 1999. p. 1–10.
5. Johansen E, Walter L. Lean construction: Prospects for the German construction industry. Lean Construction Journal. 2007; 3(1):19–32.
6. Kim D, Park H-S. Innovative construction management method: Assessment of lean construction implementation. KSCE Journal of Civil Engineering. 2006; 10(6):381–8.
7. Howell G, Ballard G. Implementing lean construction: Understanding and action. Proceedings IGLC'98; 1998. p. 1–9.
8. Kim M-H, Jeon H-W, Chon M-Y. Study on the knowledge and attitudes of falls and awareness of fall risk factors among nursing students. Indian Journal of Science and Technology. 2015 Jan; 8(S1):74–80.
9. Orr C. Lean leadership in construction. Proceedings of the 13th Annual Conference of International Group for Lean Construction; Sydney, Australia: University of Sydney. 2005. p. 345–51.
10. Tzortzopoulos P, Formoso CT. Considerations on application of lean construction principles to design management. Proceedings of IGLC-7; Berkeley, CA, USA: University of California; 1999. p. 335–44.
11. Green SD. The dark side of lean construction: Exploitation and ideology. Proceedings IGLC-7; Berkeley, CA, USA: University of California. 1999. p. 21–32.