

## Implementation of Construction Project Management Using Lean Technology

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**Abstract:** Sustainability is a major concern in public opinions all around the planet, it has become a constant issue for most industries. The Construction Sector is not an exception to this trend, and efforts have been reported on seeking to adopt metrics that can measure sustainability on site. On the other hand, the concept of lean Construction (LC) is becoming a reality more and more present in this sector. its effectiveness in controlling and eliminating wastes are becoming more and more acknowledged. Both concepts appear to have significant principles in common, hence this paper intends to examine and establish a relationship between LC and sustainability, and assess their complementarity. This paper portrays a case study where LC tools and techniques were applied on a construction site, and to find the waste during construction. To prepare questionnaire about how waste produce in construction site and to find the reason and causes. Finally to give the solution for minimize the waste and cost using lean technology. Result and conclusion of this paper is overall project management by Lean Technology by DMAIC tool in SPSS software.

**Key word:** Construction Management, Reduce waste, Reduce cost and Improve Overall project tools

### I. Introduction

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. It is also a holistic design and delivery philosophy with an overarching aim of maximizing value to all stakeholders through systematic, synergistic and continuous improvements in the contractual arrangements, product design and method of selection, the supply chain and the workflow reliability of site operations. Lean construction much like current practice has the goal of better meeting customer needs while using less of everything. But unlike current practice, lean construction rests on production management principles, the “Physics” of construction. The result is a new project delivery system that can be applied to any kind of construction.

#### 1.1 Lean construction

Lean construction is defined as the continuous process of eliminating waste, meeting or exceeding all customer requirements, focusing on the entire stream and pursuing perfection in the execution of the project work.



Fig 1 Lean principles

**1.2 comparison between conventional to lean construction**

<b>Construction process</b>	Forecast-product is pushed through facility	Customer order-product is pulled through facility
<b>Waste</b>	High	Low
<b>Construction cycle times</b>	Long-weeks/months	Short-hours/days
<b>Cost of the project</b>	High	low

**1.3benefits of lean construction**

- More satisfied clients,
- Productivity gains,
- Greater predictability,
- Shorter construction periods
- Improved design
- Reduced cost and less waste.

**II. Waste**

**2.1 Types of waste**

• **Design and operation waste**

Mostly it happens due to error in contract documents, incomplete at the commencement of project, change in design after commencement of project. Designers have to be compelled to embody rationalization of specification in every material and element that's required within the contract.

• **Resource waste**

The resource waste (cement, brick, steel etc) is the major problems in the construction sites. It's calculable that on the average construction resource waste constitutes 15-30% of the entire construction sites. It happens frequently in all sites because of carelessness of unskilled labours.

• **Management waste**

Construction and demolition waste has been defined as wastage which are arising from construction, renovation, explosion activities ,surplus and damaged products and material arising in the course of construction work and on site work. Waste in construction is important not only from the perspective of productivity but also from the environmental considerations.

• **Transportation waste**

Concerned with the internal movement of materials on site. Excessive handling, the use of inadequate equipment or bad conditions of pathways can cause this kind of waste. It is usually related to poor layout, and the lack of planning of material flows. Its main consequences are: waste of man hours, waste of energy, waste of space on site, and the possibility of material waste during transportation.

**2.2waste minimization**

The building industry is using a considerable amount of resources, but if the life cycle of the material on site is closely examined, it is generally known that there is a relatively large portion of the materials being wasted because of poor material control on building sites.Re-use is a form of waste reduction that: (1) extends resource supplies; (2) keeps high-quality-matter resources from being reduced to low-matter-quality waste; and (3) reduces energy and pollution even more than recycling.

**2.3 Identification Of Waste**

In this step, the wastages which produced during the project are to be identified and examined, causes are analyzed. Based on the questionnaire survey collected from the companies they are cluster together and formulated related to their usage and divided in to seven categories as follows,

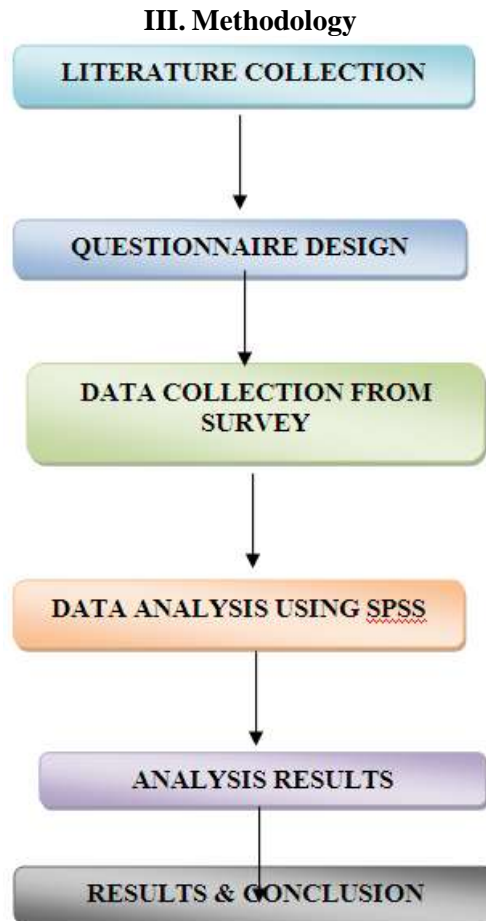
- Resource Wastes
- Management Related Waste
- Design Related Waste
- Operational Related Waste
- Waste due to Labour
- Waste while Procurement
- Miscellaneous Waste

### 2.4 problem identification

A problem arise when there is a distinction between what “should be” and what “is”, between the optimal and the definite situation. A problem expresses the difference between the hoped for and the actual situation. It is directly or indirectly related to an expected outcome or standard of behaviour. Identifying a very clearly characterized and exact problem is the first step to implement the problem solving process successfully.

The problems identified in this research are:

- Lack of materials due to waste,
- Transport difficulties
- Improve handling on site,
- Lack of work plan
- Delays due to climate changes
- Equipment break downs
- Poor work planning
- Repeated work
- High labour turn over
- Poor communication



### IV. Literature Survey

**Sukumar. S & Radhika. R [2017]** In India, the construction industry is one of the largest industries after agriculture industry. It produces a large quantity of waste and consumes more resources that make construction a troubling task. The application of a new technology, Lean Six Sigma concept is likely to be effective for improving the efficiency of construction industry. It aims to eliminate all defects and also to minimize the wastage of materials, time and effort in order to generate the maximum possible amount of value. The aim of this study is to evaluate Lean six sigma as a process improvement method to improve the construction processes by understanding and analyzing the factors affecting the formation of construction wastes.

**P. Abhiram, SS. Asadi [2016]** Indian construction industries play a vital role in economic growth of the country. But the construction industry is very much challenging because of 3D's in industry difficult, dangerous and demanding so it lag far more years from manufacturing industries. To overcome this, Lean technique of manufacturing industry were applied to construction industry to minimize waste, inefficiency. Questionnaire survey is prepared on different wastes and analyzing them using Statistical Package of Social Sciences (SPSS) software and comparing the result with manual methods. Manual ranking is given to highest waste producing factor of Friedman mean rank Technique which is an outcome of SPSS.

**Venkatakrishnaiah, S.Saranya [2015]** The construction sector is undergoing important technological and organizational changes, and construction companies will have to adapt to these changes in order to survive. For this to happen, we need to incorporate and apply production and organizational techniques from other more advanced sectors. For this, the application of lean production principles to the construction industry - known as lean construction - takes on special importance. This study deals with the various lean practices which should be adopted to achieve lean construction. Also Value Stream Mapping (VSM) a lean tool has been used to take survey at two different construction sites.

## V. Software

Statistical Package for Social sciences is a software used for executing analysis in social sciences. It is also used by market, education and health researchers and also various organizations. The 'Data View' shows a spreadsheet using rows and columns. The following table shows the mean, Standard deviation and rank of the major seven lean wastes. These values are obtained as a result of the responses obtained from the Respondents of 25 Construction companies and the obtained data's are analyzed and ranked using the software.

## VI. Questionnaire survey

1. Name :
2. Age :
3. Designation :
4. Type of projects :

### General

1. Lean construction Technique is increase productivity compared to conventional techniques?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

2. Waste minimization enhances the productivity in construction activity?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

3. Conventional system of construction is it sustainable?

- Yes
- No

4. Which is the Major problem faced by construction industry?

- Global economic climate
- Environmental hazards
- Labor delayed projects
- Zero margin contract bids
- Others

5.unfriendly attitudes of project team and labors errors affects the construction productivity?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

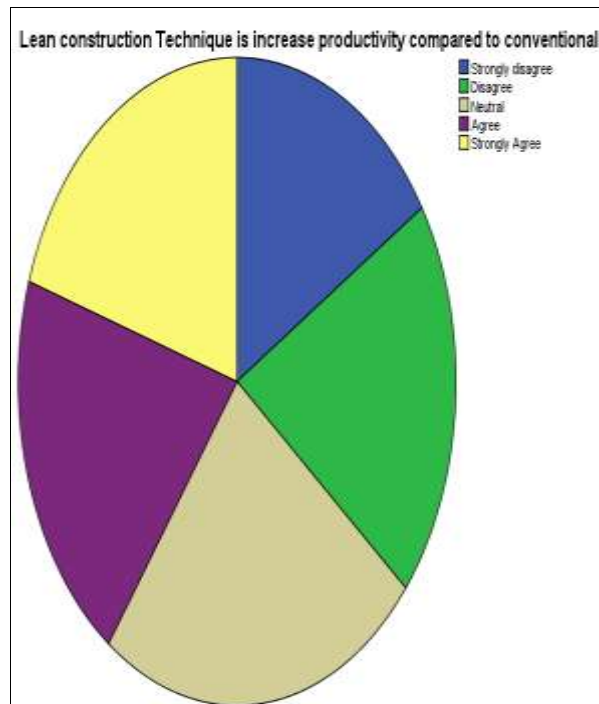
6.Complexity of detailing in the drawings

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

**VII. Software Analysis**

		Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	16.0	16.0	16.0
	Disagree	20.0	20.0	36.0
	Neutral	24.0	24.0	60.0
	Agree	20.0	20.0	80.0
	Strongly Agree	20.0	20.0	100.0
	Total	100.0	100.0	

**Table 1** SPSS results for comparison b/w lean & conventional

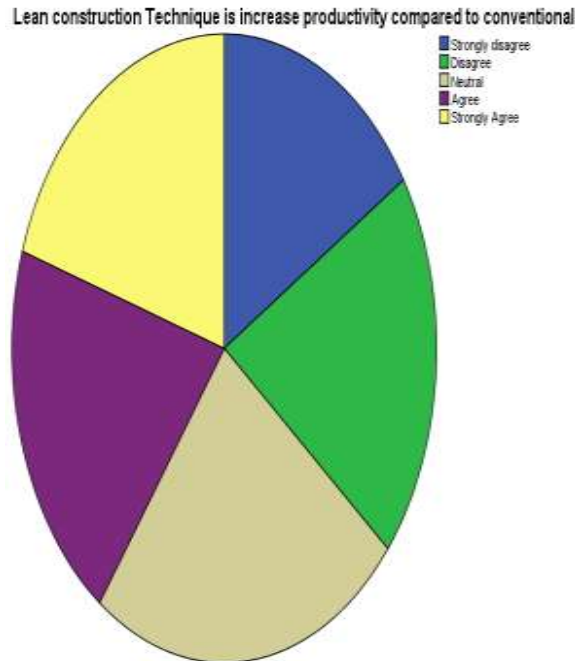


**Fig 1** pie chart shows the comparison results

		Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	16.0	16.0	16.0
	Disagree	20.0	20.0	36.0
	Neutral	24.0	24.0	60.0

d	Agree	20.0	20.0	80.0
	Strongly Agree	20.0	20.0	100.0
	Total	100.0	100.0	

**Table 2** SPSS results for comparison b/w lean & conventional



**Fig 2** pie chart shows the comparison results

### VIII. Result & conclusion

Based on the work carried out it is found that 70% of companies accepted the criteria that wastes are generated in the construction industry which is accepted by the companies according to the responds of the various project participants in construction industry. The lean principles/concepts have been studied in depth, it was understood that Lean construction system is beneficial to industry as it minimizes the waste and increase the productivity. The concept of lean construction is studied in view of India. The most affected factors are identified by ranking using Statistical Package for Social Sciences analysis. The establishment of the incidence of non – value added activities during the process enables the construction managers to identify the best actions and paths to apply new techniques for reducing waste, leading to process improvement. Since for sustainable and green growth we have to minimize the impact of construction activities on our environment, this is possible with the proper implementation of lean construction, in case of India training and consultancy is needed for acceptance of this lean system in construction.

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