

# Identification of the Barriers of Lean Construction Implementation in Construction Projects- A Review

Sakshi Gupta, Mujib Ahmad Ahmadi, Lalit Kumar

**ABSTRACT-** In the current era of industrial and enterprise evolution, time and resource are the fundamental need of any industry. Utilizing the time and resource has always been the primary goal of especially a construction project in order to reduce the expenses, meet the project deadlines and accomplish the work successfully. Lean approach in the construction industry has been introduced to facilitate and manage such procedure to achieve the above-mentioned goals of a company. Construction industry has also adapted this approach under the title of lean construction to give boast in the process of construction projects by applying the lean construction techniques. In this research, we have tried to discover the lean construction barriers in the construction industry and limitations of implementing lean construction in construction industry worldwide. The barriers have been gathered through an extant literature survey and then concluded by defining them among different categories of professionals. It is concluded that overcoming the barriers would lead to less wastage in the construction industry and lead to more efficiency and productivity.

**KEYWORDS-** Lean construction, barriers, construction, industry, construction projects.

## I. INTRODUCTION

The construction industry plays a significant role in any economy. Since this industry assemble a powerful chain of resources before, during and after its activities, it expresses a considerable part of the country's gross domestic product.

**Manuscript received May 21, 2020**

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On the other side, the benefit margins are lowering every year in construction industry because of rivalry, the resource cost and other economic issues, such as fees and taxes.

This clearly indicates that the construction industry demand to reform managerial tools and gain sufficient levels of efficiency and productivity to last its advantages [1] An easy explanation of lean construction was assumed in various literature [2-4]. Lean construction is an approach to plan production system to decrease waste of materials, time, and effort to produce the highest likely amount of value. According to the lean construction institute (LCI), "Lean construction is a managerial based production system to project delivery and that is mainly effective on multifaceted, indeterminate, and rapid projects" [5]. Lean construction is a way of designing and planning production system in a construction project. The foremost goal of lean construction is to minimize the duration of project, labors and wastage of material so as to produce the highest likely amount of value. It is a method that attempts to accomplish and enhance the construction method with optimized least cost and maximum possible amount of value by taking into consideration the customer requirements. The elementary concept of lean construction originated from the lean manufacturing principles that were executed by Toyota manufacturing successfully in their renowned in the year 1950's. Today, the construction industry is not as 'conventional' as it was 20 years ago, there are modern methods such as building information system and more collaborative variants of project delivery methods whose aim is to enhance the productivity. This would help to incline the construction industry more towards a lean industry. There is always scope for productivity improvements in construction industry. One way of contributing to the productivity betterment is to accomplish lean. Lean or lean thinking is used in the manufacturing industry for many years now. Lean have not been used in construction industry in a similar way like the manufacturing industry. So, there is a scope to take lean further in construction industry [6]. The prime objective of lean in construction projects is to use the resources such as labour and material in a way to get less waste and more productivity with few delays and with less price or, to remove the non-value activities. The lean construction approach is particularly compatible for complicated projects. Traditional method of completing a construction projects is to make optimal the projects at every activity and

assuming that the customer value is increase in the design period. Optimizing each activity separately will not precede to make optimal project procedure. Because of the doubt in the procedure, particularly in complicate projects where many performers and activities are involved. Therefore, new production management including lean has developed. One of the most significant points with lean approach in construction projects are to optimize the subordination a modification between the tasks with different period such as design and construction. Actually, lean production does not comprise of any new philosophies of management techniques but only combines the prevailing principles into a new system. The primary goal of lean production is to avoid waste of time, money, equipment, etc. which has been explored through the extant literature in this work [7].

### II. WASTE REALTED TO LEAN CONSTRUCTION

Waste is everything that uses resources but generate no value. The seven types of waste or “muda” has been recognized by Ohno [6], which are as follows:

- Overproduction
- Waiting
- Transportation
- Over processing
- Inventory
- Movement
- Defects

These wastes are sometimes abbreviated as ‘TIMWOOD’ for better remembrance.

Liker [7] mentioned one more waste i.e. waste of unused employee creativity. This leads to loss in various items such as time, idea, skills, developments, learning opportunities, etc. by not engaging or paying attention to the employees. For instance, construction companies hire their employees for physical work, but most of them seem to overlook the fact that staff members have the ability to think [8]. The fact is that by funding on staff’s creativities, companies can remove the other seven wastes to endlessly advance their performance and productivity at the same time. The first five wastes i.e. Overproduction, Waiting, Transportation, Over processing and Inventory; refer to the flow of materials. The last two wastes i.e. Movement and Defects are related to work of labour.

### III. LITERATURE SURVEY

Though lean construction is still in its beginning there are different sets of practices that have been planned, tested and implemented by various practitioners in the construction industry worldwide. the below segment discussed the different frameworks of lean construction that have been implemented. These involve lean construction as a socio-technical system which consider human and technical features; lean creativities in eight areas of the construction business. The lean construction controls, and the three leading models of lean construction as shortened by Green and May [10] from the perspective of policy-makers in the business. Socio-technical system of lean construction design is well-defined as the mixture of practical and human subsystem into the identical work design. And it has contained lean manufacturing and lean

construction with the similar goal, activities, and staff abilities but with divers’ technical systems [11]. In developing countries, investigation is concerned with two main topics about lean construction [12]:

1. Feasibility study and investigation into awareness of lean construction.
2. Discovering the barriers to the implementation of lean construction.

Executing lean starts with recognizing the waste in construction, which agrees to the primary phase of Green and May’s [10] outline of lean construction implementation. Feasibility study and awareness of lean, lean construction can be viewed as a planned choice when its application is placed in a new setting [13]. Senaratne and Wijesiri [15] applied suitability and acceptability examinations to accomplish that lean construction is appropriate and satisfactory in the Sri Lankan situation. Furthermore, Abduh and Roza [14] exposed that the huge Indonesian contractors have already applied “macro” lean construction principles (such as the rule of continuous development and promoting transparency). Yet when it comes to the “micro” principles of lean construction (such as the decrease of cycle time and variability), the big Indonesian contractors still lack understanding and the capability to apply principles and methods, because of insufficient ability to plan work-flow well. Barriers for Implementation of Lean Forbes et al [8] approved that the key problem to the application of lean in developing countries is that construction companies do not emphasize productivity and quality creativities. Furthermore, numerous barriers to the lean production under various management ideas identified. Like JIT, TQM, concurrent engineering, etc. in Uganda’s construction business. The researchers [7] elaborated the barriers by grouping these into (1) barriers that powerfully effect workers’ productivity, and (2) barriers that are easier to overcome. In Forbes et al [8]work, the challenges to application of lean was characterized under seven collections, namely: (1) skills and information related, (2) management related, (3) government related, (4) attitude related, (5) resource related, (6) logistics related, and (7) others. Low and Gao [15] discussed the possible barriers to applying the idea of JIT in the Chinese construction business from a project life-cycle perspective. A group of researchers [4] recognized many barriers to lean construction under various management ideas, including just in time, total quality management, concurrent engineering, and etc. the importance of finding barriers could be used to help researchers, practitioners and companies in Afghanistan construction industry to focus their attention and resources on the significant issues, vital to support the successful implementation of lean construction. The barriers to application of lean is characterized under six groups, specifically: (1) Management related, (2) Financial related, (3) Educational related, (4) Government related, (5) Technical related, (6) Human Attitudinal related. [16].

Based on a comprehensive literature review concerning to the barriers to the application the lean construction concept, this study classifies these barriers in to ten different groups as shown below [18].

- Fragmentation and subcontracting

- Procurement and contracts
- Culture and human attitudinal issues
- Adherence to traditional management concepts due to time and commercial pressure
- Financial issuance
- Lack of top management commitment and support
- Design/ construction contrast
- Lack of adequate lean awareness/ understanding
- Educational issues
- Lack of customer- focused and process- based performance measurement systems

Based on the achievement of lean in manufacturing and growth of lean construction in countries around the world, the application of lean construction is currently discussed in India. The purpose of the study was to identify the barriers to successful application of lean construction in Indian construction industry. The data for this research was collected by a questionnaire survey from practitioners, such a project manager, architectural advisors and etc. after the data collection, the data analyzed to find the main barriers and lean principles are suggested to overcome these barriers [19]. After analyzing the data the significant barriers for implementing lean principles in construction business identified as

- Lack of exposure on the need to adopt lean construction
- Uncertainty in the supply chain
- The tendency to apply traditional management
- Culture & human attitudinal issues (Mindset issues)
- Lack of commitment from top management
- Non- participative management style for workforce

The summary of all literatures reviewed related to lean construction in different parts of the world have been presented in Table 1.

**Table 1: Summary of the literatures studied related to lean construction and the barriers related to its implementation** [References in table]

Author (s)	Year	Major barriers to Implementing lean construction in different countries around the world
Lim and Jin	2008	<ul style="list-style-type: none"> <li>• Barrier found are:                             <ol style="list-style-type: none"> <li>i. Ineffective management practices (Traditional)</li> <li>ii. Just-in -time (JIT) delivery of materials on site (IBS)</li> <li>iii. Cut and paste from pervious project (Traditional and IBS)</li> </ol> </li> </ul>
Sarhan and Fox	2013	Barriers found in the study are: <ul style="list-style-type: none"> <li>• Lack of satisfactory lean awareness and considerate</li> <li>• Lack of top management commitment</li> <li>• Culture and human attitudinal problems</li> </ul>

Devaki and Jayanthi	2014	<ul style="list-style-type: none"> <li>• Lack of experience on the necessity to implement lean construction</li> <li>• Ambiguity in the supply chain</li> <li>• Inclination for applying traditional management approaches.</li> <li>• Culture &amp; human attitudinal issues (Mindset issues)</li> <li>• Lack of commitment from top management officials.</li> <li>• Non- participative management style for workforce</li> </ul>
Tomas Lindholm	2014	<ul style="list-style-type: none"> <li>• Lean concepts and tools could be utilized in a larger amount in construction projects without difficulties.</li> <li>• The concepts and tools utilized in the car manufacturing business. For instance: just-in-time, other ideas and tools have to be added in the field of construction to increase the productivity and efficiency of the construction projects.</li> </ul>
Kumar and Kumar	2014	The following barriers were found through the study: <ul style="list-style-type: none"> <li>• Management</li> <li>• Knowledge</li> <li>• Conflicts</li> <li>• Financial</li> <li>• Employee</li> <li>• Resources</li> <li>• Past experience</li> </ul>
Nifla K. and Reshma. P	2014	<ul style="list-style-type: none"> <li>•The analysis found the following barriers:                             <ol style="list-style-type: none"> <li>i. Lack of lean awareness and understanding</li> <li>ii. Problems related with Human attitude</li> <li>iii. Commercial issues</li> <li>iv. Lack of appropriate training for the employees</li> <li>v. Lack of consultants accessible for direction, supervision and implementation</li> <li>vi. Extensive implementation time needed</li> <li>vii. Issues with Employee attitude</li> <li>viii. Lack of appropriate communication between client and contractor</li> </ol> </li> </ul>

		<ul style="list-style-type: none"> <li>ix. Disintegration and subcontracting</li> <li>x. Issues related with the finances.</li> <li>• The study revealed that nearly 82.5% of the companies that were surveyed had very clear idea about lean construction.</li> </ul>
Pasha and Naik	2016	<ul style="list-style-type: none"> <li>• The analysis revealed that about 52.42% of the surveyed companies have utilized the lean construction techniques in the project and knows the benefits of lean construction.</li> </ul>
Charhate and Sinha	2016	<p>They found that following barriers:</p> <ul style="list-style-type: none"> <li>• Lack of lean awareness and consideration.</li> <li>• Lack of approach to lean construction.</li> <li>• Cultural and human attitudinal issues</li> <li>• Economical pressure</li> <li>• Lack of proper training</li> <li>• Lack of top management support</li> <li>• Educational issues</li> <li>• Lack of proper communication between client and contractor</li> <li>• Financial issues</li> </ul>
Sarhan, Xia and Fawzia	2017	<ul style="list-style-type: none"> <li>• The main issues that originate the barriers were identified as: <ul style="list-style-type: none"> <li>i. Traditional implementation</li> <li>ii. customer related,</li> <li>iii. technological barrier,</li> <li>iv. execution related</li> <li>v. Information related</li> <li>vi. cost-related barriers.</li> </ul> </li> <li>• Suggested answers to control the main barriers.</li> <li>• This research delivers a world-wide overview of the barriers to applying lean construction.</li> </ul>
Ana Reinbold	2017	<ul style="list-style-type: none"> <li>• The application of lean construction in affordable housing project has a great positive impact.</li> <li>• This will help by reduction of waste in material and minimizing the ideal time and non-value tasks in construction procedure.</li> <li>• The organization of these kind of project will be more efficient and it will have a</li> </ul>

		positive impact on the productivity.
Bajjou and Chafi	2017	<ul style="list-style-type: none"> <li>• Construction practitioners in Morocco found that lean construction application will add positive influence to the Moroccan construction projects.</li> <li>• The concept will help in augmenting the quality of the projects that would advantage from the most of the developments according to the output of data analysis obtained by the researcher.</li> <li>• Lean construction is a high priority for the Moroccan construction projects.</li> </ul>
Hasan Gokberk Bayhan	2018	<ul style="list-style-type: none"> <li>• Lean practitioners point out to clear comprehension of practical needs in Lean to best govern Lean application procedure.</li> <li>• Highlighted the point that the lack of top management support is the utmost significant barrier for the implementation of lean concept in construction.</li> </ul>
Ahmed and Sobuz	2019	<ul style="list-style-type: none"> <li>• The results identified 41 challenges related to the lean construction application in the Bangladeshi construction industry.</li> <li>• The top challenges as mentioned in the research work are : <ul style="list-style-type: none"> <li>i. lack of awareness about lean construction</li> <li>ii. lack of skills, training and lean methods,</li> <li>iii. denial to change the current culture,</li> <li>iv. lack of management promise,</li> <li>v. disorganized and repeated nature of the construction projects.</li> </ul> </li> <li>• The study debated some university appropriate resolutions to defeat the mentioned challenges.</li> </ul>

#### IV. DISCUSSION AND CONCLUSION

On careful review of the literature, the following points have been found out in terms of barrier in the implementation of lean construction in various developing nations:

i) Top Ranked Barriers Chosen by Civil Engineers Category

1. Lack of training & awareness
2. Lack of Technical skills
3. Lack of government support
4. Inability to change the organizational culture
5. Lack of team work

ii) Top Major Barriers Chosen by Architect Category

1. Lack of Experience and information sharing
2. Lack of training & awareness
3. Lack of technical skills
4. transparency
5. leadership

iii) Top Major Barriers Chosen by Academics Category

1. Logistic Problem
2. Lack of lean concept and understanding and knowledge
3. Conditions
4. Lack of training & awareness
5. Cost of lean consultation.

iv) Top Major Barriers Chosen by Others stakeholders

1. Complexity of lean construction
2. Risk of top management support
3. Government bureaucracy and instability
4. Long implementation period
5. Lack of transparency

It is clear from the results that the top major barriers are related to the categories of Educational, Management and Technical barriers.

## V. FUTURE RECOMMENDATION

Due to various constraints like limited outreach and time this study was limited to extant literature survey which can further be done for specific construction industries in developing countries such as Afghanistan. In future, researchers can take up both quantitative and qualitative approach of analysis and carry out a questionnaire based study to find the exact barriers in different countries and suggest remedial measures for the same. This will include site investigation and interviews with a greater number of participants to make the research more reliable and accurate.

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