An Overview on Implementation of lean construction techniques for minimizing the risk effect on construction time

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ABSTRACT: The productivity of the construction industry worldwide has been declining over past years. Productivity minimization is due to involvement of various risk factors which have a major impact on time and cost. This productivity minimization leads to time and cost overruns. One approach of improving this situation is using lean construction principles and techniques. Lean construction is a combination of operational research and practical development in design and construction with an adaptation of lean construction principles and practices to the construction process. Essential features of lean construction include a clear set of objectives for the delivery process, aimed at maximizing performance for the customer at the project level, concurrent design, construction, and the application of project control throughout the life cycle of the project from design to delivery.

There are various lean techniques that have analyzed and adopted throughout the construction research field. Process mapping technique, 5s techniques, last planner technique, increased visualization etc. Implementation of these techniques in simple and complex projects makes the projects easier to manage, safer, completed sooner, and cost less and is of better quality.

KEYWORDS: Lean, Lean construction, minimizing risk, Last Planner technique

I. INTRODUCTION:

There has been a worldwide declination on the productivity of the construction industry over past few years. The declination of productivity is due to time and cost overruns and dissatisfaction of the customers. One approach for improving the situation is using lean construction. This approach tries to manage and improve construction processes with minimum cost and maximum value by considering customer's need. Essential features of lean construction include a clear set of objectives for the delivery process, aimed at maximizing performance for the customer at the project level, concurrent design, construction, and the application of project control throughout the life cycle of the project from design to delivery. Lean construction is implemented through various lean-based tools or in other words lean techniques.

Lean construction is a "way design production systems to minimize waste of materials, time, and efforts in order to generate the maximum possible amount of value" [Koskela et al 2002]. Lean Construction (LC) is aimed at reducing waste, increasing productivity and health and safety in fulfilling the of the construction industry. The construction projects involve various risk factors which have various impacts on time objective that may lead to time-overrun. This study overviews technique for minimizing risk factors effect on time using lean construction principles.

Managing construction under lean is different from typical contemporary practices because it; [11]

- has clear set of objectives for the delivery process,
- is aimed at maximizing performance for the customers at the project level,
- designs concurrently product and process, and
- Applies production control throughout the life of project.

II. LITERATURE REVIEW:

1. **A critical study of various lean techniques in practice and developing a framework for different construction building projects, (2016)**

The authors U. Vimal Kumar and Ganapathy Ramasamy have given information about different tools and principles of lean construction. They have also stated about the conceptual study of lean construction theory. They concludes that there are various techniques of lean construction but they have focused on four main techniques which are the required technique

to modify the present Indian society and that techniques are increased visualization, 5S technique, last planner technique and daily huddle meeting. According to the authors these study aims at introducing a system into Indian construction production department to avoid confusion, commotion, delays, waits and loss in productivity. This framework is mainly focused on residential project; it can enhance to suit any type of projects.

This paper involves the study of principles, methods, and implementation phases of lean construction showing the waste in construction and how it could be minimized. A field study was conducted to evaluate the effectiveness of some lean construction techniques including last planner, increased visualization, daily huddle meetings and the 5s process. The data collected through direct observations, interviews, questionnaires, and documentary analysis from Indian as well as foreign organizations. Thus, the data obtained is used to develop a framework which will provide an environment for construction organization to survive in any economic condition of our Indian society. Therefore, this project aims at managing the construction site as well as organization efficiently with minimum waste.

2. Applying lean thinking in construction and performance improvement, (2013)

The authors Remon Fayek Aziz *, Sherif Mohamed Hafez have applied the process of lean thinking in construction and observe the improvement in the performance of the construction. They have concluded that the research has confirmed the following objectives.

- Determine the implementation of lean ideal
- Identify the source of wastes classified under lean construction industry
- Examine general perceptions of the construction industry with the lean construction principles of practices.
- Study reduction and elimination of wastes as classified under development of Last Planner System as a technique of lean construction implementation and to evaluate the effectiveness of implementing last planner to increase plan reliability.
- Examine the relationship between lean construction and performance improvement programs in construction organizations.
- Analyze the characteristics of successful performance improvement programs, and develop a model that identifies three critical elements.

3. Barriers to Implementation of Lean Principles in the Indian Construction Industry, (2014)

Devaki M. P. R. Jayanthi have aimed this study for identification of barriers to successful implementation of lean construction in the Indian construction sector. The data was collected by questionnaire survey of project managers of building construction organizations and senior consultants of architectural and project management firms. The data collected was then analyzed to rank the main barriers and lean principles are suggested to overcome these barriers. Most of the respondents who have not heard about lean management principles are from the public sector executing huge projects along with big firms. Though the big firms are using lean principles, people from the government sector should also be educated about the savings due to adopting lean principles, so that they can mandate it on all government sponsored projects.

Barriers in uncertainty in the supply chain can be overcome by choosing proper suppliers who not quote less price, but deliver good quality and who also have a proven track record. By working closely with suppliers and subcontractors, problematic issues can be minimized by participative style of managing projects and establishing strategic alliances with them. This can be done effectively if one works with the same supplier again and again.

4. Implementation of lean construction techniques for minimizing the risks effect on project construction time, (2013)

The author Usama Hamed Issa has presented and discussed the results of applying the lean construction principles and thinking as a new tool to reduce the effect of risk factors on time objective for an industrial project in Egypt.
Based on the observations, model outputs, and results analysis, the conclusions can be drawn by the author is as follows:
1. Lean construction techniques and principles have a potential to be used in reducing the effects of risk factors on time objective for construction projects in developing countries.
2. The use of lean construction techniques in construction projects has significant effects on the decrease in PET values and the increase in PPC values.
3. The effect of most investigated risk factors is minimized using lean construction techniques. In this study, the effects of nine factors are minimized among the total (13) investigated factors.
4. The average of PET due to factors affected by lean construction techniques represents about 67% of PET due to all risk factors.
5. The impacts of factors affected by lean construction techniques decreased with the increase in time as supported by boxplot analysis.
6. The results proved the success and suitability of using the time-overrun quantification model for evaluating lean construction techniques implementation.
7. Based on observations and results analysis, it is recommended to apply lean techniques in construction projects in developing countries due to its simplicity and high efficiency.

5. Implementing lean concepts on Indian construction sites: Organizational aspects and lessons Learned, (2014)

N. Raghavan, Satyanarayana Kalidindi, Ashwin Mahalingam, Koshy Varghese and A. Ayesha have stated that the paper presents an overview of the programme and the analysis of result obtained/lessons learned across the different sites based on the organizational and cultural aspects of the sites. IIT Madras, an educational institution, had recently taken up a carefully-structured programme for training and implementation of Lean construction practices in nine trial projects with varying characteristics through classroom and webinar-based trainings, reporting in predefined formats, monitoring by site visits and periodic reviews.

III. PRINCIPLES OF LEAN CONSTRUCTION [14]

- Identify value from the customer's point of view
- Define the value of stream
- Eliminate waste
- Flow of work processes
- Pull Planning and Scheduling
- Continuous improvement

IV. LEAN CONSTRUCTION TECHNIQUES

- The 5S technique
- Last Planner System technique
- Increased Visualization technique
- Daily huddle meeting

V. ADVANTAGES OF LEAN CONSTRUCTION

- Lean construction reduces the wastes or sometimes even eradicates the wastes completely. Less wastes means more profit.
- Lean construction uses lesser materials which greatly reduces the overall costs. However, the goal is to provide customer satisfaction as end result with the reduced cost.
- Lean construction helps company's management to focus on smart work rather than hard work by making strategic plans for the future.
- Lean construction Promotes worker safety and fewer accidents for maximum productivity.
- Lean construction promotes focus on workers by supervisory staff. Showing Worker importance increases the productivity by the worker.
- Lean construction ensures a smooth flow of important or critical activities.
- With Lean construction, a company commits to continuous improvement to seek perfection.
- Productivity also increases all around for high rate of planning.
- By reducing the communication gap between worker and employer, the overall results are improved.

VI. DISADVANTAGES OF LEAN CONSTRUCTION

- Lean delivery method takes some time to bear fruit as immediate results are very rare.
- Training the employees requires a lot of time and resources with all the new policies and procedures.
- Frustrations of managers are very common when applying this method as it takes some time and dedication.
- Each worker should get along with one another or else there will be no teamwork and hence, less productivity.
- If a company is in the middle of a project and application of Lean occurs, then the current project will suffer.
- Management should stay strong with this procedure and eliminate all the issues as a breakdown can occur easily.

VII. BARRIERS IN IMPLEMENTATION OF LEAN PRINCIPLES [3]

- 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

VIII. CONCLUSION

After having a view on all the literatures over implementation of lean construction techniques we can conclude that

- The construction industries struggle with inefficient processes much to be desired. In order to meet this challenge the construction industry must become more efficient by using fewer resources. Small changes in the operational cost by reducing waste, which reduces the efficiency, can make substantially changes in profit.
- Lean construction comprises of many techniques but this study focuses only on four main techniques that is increased visualization, 5S technique, last planner technique and daily huddle meeting which are the required technique to modify the present Indian society.
- Lean construction techniques and principles have a potential to be used in reducing the effects of risk factors on time objective for construction projects in developing countries.
- Initial proper knowledge and information should be provided among the workers and other people in construction industry to gain maximum profit in minimum construction time.

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