

LEAN-MANAGEMENT AN APPROACH FOR IMPROVING PRODUCTIVITY

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Abstract: construction industry has very low productivity as compare to other industries since many years even after the use of new technologies and new techniques use in construction. Lean concept is very popular in manufacturing industries to improve productivity by smooth work flow and minimize the waste. In past, Application of lean concept was apply in construction project and the result of that was positive in each trial. Lean concepts can change the way of work throughout the life cycle.so this paper give overview of lean, lean waste and lean approach in terms of construction industries to improve productivity.

Keywords: lean, lean construction, productivity, lean waste, lean approach.

I. INTRODUCTION OF LEAN

Lean is a term to describe an effective, high-performance method for managing organisations and delivering their core purpose in the most efficient and effective manner while continuing to develop for a sustainable future. Lean is an ethos, a way of doing business. It seeks to maximise the generation of customer value by driving out all forms of waste, ensuring ‘right first time’ quality, reducing timescales and minimising cost.

Lean production was developed by Toyota led by Engineer Ohno. He was a smart if difficult person dedicated to eliminating waste. The term “lean” was coined by the research team working on international auto production to reflect both the waste reduction nature of the Toyota production system and to contrast it with craft and mass forms of production (Womack et al. 1991). Engineer Ohno shifted attention to the entire production system from the narrow focus of craft production on worker productivity and mass production on machine. Lean production continues to evolve but the basic outline is clear. Design a production system that will deliver a custom product instantly on order but maintain no intermediate inventories. The concepts include:

- Identify and deliver value to the customer value: eliminate anything that does not add value.
- Organize production as a continuous flow.
- Perfect the product and create reliable flow² through stopping the line, pulling inventory, and distributing information and decision making.

- Pursue perfection: Deliver on order a product meeting customer requirements with nothing in inventory.

II. INTRODUCTION OF LEAN CONSTRUCTION

A 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," here waste is different from pure construction waste. Designing a production system to achieve the stated ends is only possible through the collaboration of all project participants (Owner, Architect/Engineer, contractors, Facility Managers, End-user) at every stages of the project.

Lean Construction is believed to be particularly useful on complex, uncertain and quick projects. There are substantial researches that have been focused on Lean Construction theory. Some of the lean principles that are related to the construction industry are such improvements as the construction planning process, eliminating waste, construction supply chain, and downstream performance.

An attempt has also been made to apply lean principles on the entire project management processes. Some of the main focused areas are lean project delivery system, production control, work structuring, design, lean supply, project controls, and project management in the construction industry (Lean Construction Organization 2006).

Lean construction draws upon the principles of project-level management and upon the principles that govern production-level management. Lean construction recognizes that any successful project undertaking will inevitably involve the interaction between project and production management.

- Primarily, lean construction aims to reduce the waste caused by unpredictable workflow. Here **Waste** is defined in following categories: defects, delays due to waiting for upstream activities to finish before another job can begin, maintaining excess inventory, unnecessary transport of materials and unnecessary movement of people, over allocated equipment and material on site, accident on site etc.
- Work is structured throughout the process to maximize value and to reduce waste-at the project delivery level.
- Efforts to manage and improve performance are aimed at improving total project performance, because this is more important than reducing the cost or increasing the speed of any particular activity.

III. LEAN CONSTRUCTION WASTE

There are so many waste in construction and it is totally different from pure construction waste. There are seven to eight types of lean waste enlisted below.

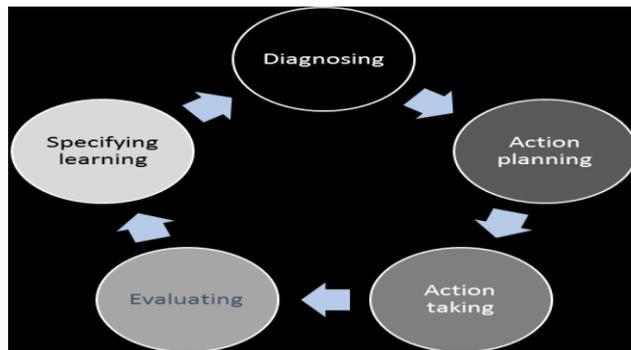
Lean construction Waste	Waste specification
Waiting /delay	<ul style="list-style-type: none"> • Waiting due to preceding activity was not completed. • Workers unable to do value-creating work, and capacity bottlenecks. • Waiting time between processes or for capacity to take the next step. • Documents awaiting updating or processing equipment downtime.

	<ul style="list-style-type: none"> • Delay due to supervision.
Motion	<ul style="list-style-type: none"> • unnecessary movement of people and equipment that does not add value, including walking between different work places etc • walking between workplace and welfare facilities, manual paperwork processing • Movement of materials and drawing information. • Movement of Equipment.
Inventory	<ul style="list-style-type: none"> • Excess raw material, WIP or finished goods causing longer lead times, obsolescence, damaged goods, transportation/ storage costs and delays etc • large site stores of materials • poor stock management • Too much material compromising workspace.
Transportation	<ul style="list-style-type: none"> • Moving work-in-process from place to place etc delivering equipment, incomplete orders. • Unnecessary transportation due to miscommunication. • Moving to and from storage.
Defects/rework.	<ul style="list-style-type: none"> • production of defective work or corrections, not meeting specifications first time etc • Inspections to reduce/remove defects. • Wrong information on drawings. • Production of replacements. • Defect due to poor mixing and placing of material
Over-processing	<ul style="list-style-type: none"> • Taking unnecessary Activity • Work repeating due to miscommunication. • Poor management while execution. • Inefficient processing, especially due to poor design or work planning causing something unnecessary • Providing higher quality products than necessary, and produced to standards beyond specifications (BS) • Work done to 'fill the gaps' rather than appear to be waiting, eg 'waiting for instructions'.
Over-production	<ul style="list-style-type: none"> • producing items earlier than needed or beyond specification producing more than is needed • larger than necessary excavations, orders placed for same materials with different suppliers • generating waste through overstaffing, storage and transportation costs • Can be physical or information that is produced.
Skills misuse	<ul style="list-style-type: none"> • Losing time and ideas, skills improvements and learning opportunities etc. • Limited authority and responsibility • learning from one site not being used well on another

	<ul style="list-style-type: none"> • People working one or two levels down from their true capability. • Mismanaged health and safety.
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IV. LEAN CONSTRUCTION APPROACH

The lean principles can only be applied fully and effectively in construction by focusing on improving the whole process. This means all parties have to be committed, involved, and work to overcome obstacles that may arise from traditional contractual arrangements.



Five steps action research process

- Above figure show the action plan use in every lean resech and adopting in lean process for implementation.

Step - 1 Diagnosing

Starts with organizing an action research team consisting of researchers and practitioners. Here, the researchers should fully understand the overall organizational process as well as backgrounds of lean theory, and the practitioners should be in charge of the operational details of a given project and be able to monitor the process.

It is important in the diagnosing stage to establish the purpose of the research. For productivity improvement, which is the main purpose of lean theory, goals need to be established regarding whether to remove waste, reduce variability, or pursue both.

Step 2 - Action planning

In this stage, cooperation between the researcher and practitioner is vital to derive the methods to improve the process based on ‘lean thinking’ theory. In this stage, it is necessary for more detailed establishment of the research goals presented in the previous diagnosing stage. This is achieved by selecting the type of outcome that needs improvement, the desired level of improvement, and the indicators to measure this improvement.

Step – 3 Action taking

This stage attempts to achieve the established goals through the process improvement methods developed in the previous stages. In this stage, it is important to manage the action so that it is implemented as planned through integrated management of the process.

Step - 4 Evaluating

It is the stage where the outcomes achieved in above stage are reviewed from various angles. Similar to the general lean approach, this stage examines the improvements in productivity as well as whether the assumptions established in the previous stages have been verified. In addition, this step examines whether the improved performance resulted from the applied action and if there were any unexpected changes that were not foreseen in the action planning stage.

Step – 5 specifying learning

In the last stage, the comprehended results from the evaluating stage are generalized and organized into new knowledge so that it can be utilized or repeated in other processes or in follow-up action research. To this end, additional goals to improve the process even better is to be suggested based on the action taken and a more holistic view of the process can be achieved based on the various performance-related factors identified during the evaluation stage.

V. LEAN CONSTRUCTION TOOLS

There are so many tools and techniques for improving productivity but most effective techniques is enlisted below

- Value stream mapping
- Last planner system and collaborative scheduling
- Just in time delivery and supply chain management
- One piece flow
- Six sigma

VI. CONCLUSION

- This paper addresses how the construction companies can improve productivity by lean management Approach. It pinpoints deficiencies in current planning systems mainly due to lack of standardized planning processes.
- It also shows the proper approach to implement the lean technique on construction for future works and enlist the construction waste and lean construction techniques to improve productivity.

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