

IMPLEMENTATION OF LEAN TECHNIQUES IN INDIAN SCENARIO AND TESTING ITS FITNESS

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Abstract - — *As a popular saying goes 'A penny saved is a penny gained' this will be apt in the field of construction because it is facing huge losses because of internal reasons like wastage, delay, poor quality of work, improper planning etc. Lean construction is a concept which is derived from TPS which was designed by Toyota for manufacturing purpose, after a lot of improvisation by many people it had been brought into the field of construction. The main concept of Lean method is 'Minimizing waste and Maximizing value', main goal of this method is to reduce the overall cost of the project, improve the quality of work done, reducing wastage on site and increasing value and respect the workers.*

In construction industry we don't need to generate extra profits instead the savings we'll manage will leave us with huge profits. This industry is a typical type where in the product is manufactured on site rather than in factory and there will be very less repeated task unlike manufacturing. Most of techniques which exist today are trying to improve the things on the site from off site in which they are miserably failing; more over the major reasons for losses are on the site effects rather than off-site reasons. The techniques majorly used are:

- 5s,
- Daily huddle meetings,
- Increased visualization and
- Last planner.

Keywords— 5S, Last Planner Increased Visualization.

1. INTRODUCTION

As a famous saying goes "a Penny saved is a Penny Gained". In construction industry we don't need to generate extra profits instead the savings we'll manage will leave us with huge profits. This industry is a typical type where in the product is manufactured on site rather than in factory and there will be very less repeated task unlike manufacturing. Most of techniques which exist today are trying to improve the things on the site from off site in which they are miserably failing; more over the major reasons for losses are on the site effects rather than off-site reasons

The construction industry in India is a vast industry which is contributing about 8.3% of the country's GDP; it is one of the fastest developing industries in world, and in country like India with its infrastructure playing a major role in doing that. In India Construction has accounted for around 40 per cent of the development investment during the past 50 years. About 16% of the nation's working population depends on construction for its livelihood. The Indian construction industry employs over 30 million people and

creates assets worth over 200 billion, even though there is lot of innovation in the field till date. It is the industry which is highly dependent on human resource. It has both advantage and disadvantages. Creating employment is an advantage where as handling human resource is a tough task. This is a one side of it, in spite of many advantages the industry is still running in huge losses because of many reasons like project over run, improper planning techniques, visible and invisible wastages in many forms, un-skilled and uneducated labor, not using latest techniques, not adopting new technology, very much dependent on man power, improper safety measures at site, not adopting alternative raw materials, not maintaining standard quality, delay in cash payments, wastage of raw material, exploiting raw material and many more. Out of all these factors the major factors are project over run, visible and invisible wastages, not believing in new techniques.

2. Objectives of the Study

The construction industry is kind which is growing changing and improving day by day. The objective of this study is to implement the lean techniques in Indian scenario and testing its fitness. Lean Techniques have been widely accepted in many countries but where as in India it is not the case because only few companies are implementing these techniques and most of them are in large scale constructions. The sites for this study are selected from medium and small scale constructions locally reflecting Indian scenario.

- In the initial stages a thorough study on lean construction and it's techniques is done
- Six sites are selected for observation where there can be some freedom to implement new things
- In the second stage the sites have been visited for 10 working days, few teams have been selected and their quantity of work done is calculated
- The different events selected are Brick work in different levels, Plastering and painting. Only these events are selected because the chances of wastage is very high here
- In the third stage the techniques are implemented on sites
- Daily data had been collected both in the morning and evening for about ten weeks depending upon the continuity of work

- The performance of technique individually had been measured
- The challenges in the implementation are listed
- The cost per square feet and cubic feet are measured so as to conclude which teaming is more effective
- Various graphs included in order to represent the data before and after implementation.

3. METHODOLOGY

• While implementing the 5S method the things more specified are cleanliness at site, proper placing of tools, the same type of work done is being repeated such that it can be completed with ease, instead of mixing the cement on floor steel sheets were provided such that material wastage is reduced and cleanliness is also improved, the sorting out of unnecessary materials is performed regularly such that no waste is accumulated at the work place for this a separate place was allotted where unnecessary tools are dumped safely for future use. By employing this technique material wastage was more focused

• Daily Huddle Meetings

• Two-way communication is the key of the daily huddle meeting process in order to achieve employee involvement. As part of the improvement cycle, a brief daily start-up meeting was conducted where team members quickly give the status of what they had been working on since the previous day's meeting, especially if an issue might prevent the completion of an assignment. This tool is similar to the lean manufacturing concept of employee involvement, which ensures rapid response to problems through empowerment of workers, and continuous open communication through the tool box meetings. These meetings are held for a time of 5-10 minutes, these are helpful in speed up the work of the teams which are lagging behind and hence increasing productivity for the day. There is no particular time for this meet it can be done at any time in working hours

3.1 5S

The 5 S's in 5S stand for Sort, Set-In-Order, Shine, Standardize and Sustain. The main focus of this method lies upon the cleanliness, appearance & movement at the site.

- Sort frequently needed things and lesser needed things so that frequently needed things are available nearby and as easy to find as possible.
- Set in order means Relocate or get rid of unnecessary things. Arrange essential things as accessible as possible to reduce the waste related to a worker's motion in locating or acquiring a needed things and also specifies setting things in a proper manner so that they can be easily accessible when ever needed if they are not set in order it would be difficult to use

when ever required materials it also covers placing of tools, materials etc in a proper manner so that it doesn't cause any hindrance while work in progress.

- Shine indicates clean and sharp, the tools at work area and machines should be cleaned every day after the work is completed so that they are in perfect condition without any dust, cement etc upon it they cleaned so that it is easy to work with the next time they are used, even the site should be properly cleaned at the end of the day
- Standardize and diffuse the first 3 S's throughout the working place by means of clear procedures.
- Sustain means continuing all the above activities every time required so that all of them are repeated on regular bases which will in turn improve the productivity.

5S is one of the most effective tools of lean manufacturing because it is the basis for 5S is an effective lean implementation. Recently 5S was changed to 6S (5S+Safety) which is a method used to create and maintain a clean, orderly and safe work environment. Lean implementation in the construction industry show this integration by adding a sixth S, to the lean tool 5S, for safety by conducting a process improvement event in the continuous improvement process dedicated to safety

3.2 Last Planner

Last Planner System (LPS) is a technique that shapes workflow and addresses project variability in construction. The Last Planner is the person or group accountable for operational planning, that is, the structuring of product design to facilitate improved work flow, and production unit control, that is, the completion of individual assignments at the operational level. In the last planner system, the sequences of implementation (master schedule, reverse phase schedules (RPS), six-week look ahead, weekly work plan (WWP), percent plan complete (PPC) sets up an efficient schedule planning framework through a pull technique, which shapes work flow, sequence, and rate; matches work flow and capacity; develops methods for executing work; and improves communication between trades. The important role of the Last Planner tool is to replace optimistic planning with realistic planning by evaluating the performance of workers based on their ability to reliably achieve their commitments. The goals of Last Planner are to pull activities by reverse phase scheduling through team planning and optimize resources in the long-term.

3.3 Increased Visualization

The increased visualization lean tool is about communicating key information effectively to workforce

through posting various signs and labels around the construction site. Workers can remember elements such as workflow, performance targets, and specific required actions if they visualize them. This includes signs related to safety, schedule, and quality. This tool is similar to the lean manufacturing tool, Visual Controls, which is a continuous improvement activity that relates to the process control. As a part of increased visualization a safety pledge is taken before beginning of work every day. A good way to maximize the safety on the construction site is to use commitment charts. Mobile signs were also used to promote safety on the job site. These signs were designed to be colorful and humorous in order to attract the attention of the workers better. Establishing guidelines for material and equipment storage reduces waste, such as, lay down space, searching time, transportation and double handling of material. Diverting or managing site water (rain or snow) can greatly improve efficiency with respect to transportation, material handling and movement of people. The project logistics plan lays out the expectations for the subcontractors in words and as site layout drawings. These plans can then be posted (visual management) and referred to communicate the standard of performance.

4. DISCUSSION ABOUT TECHNIQUES

4.1 5S

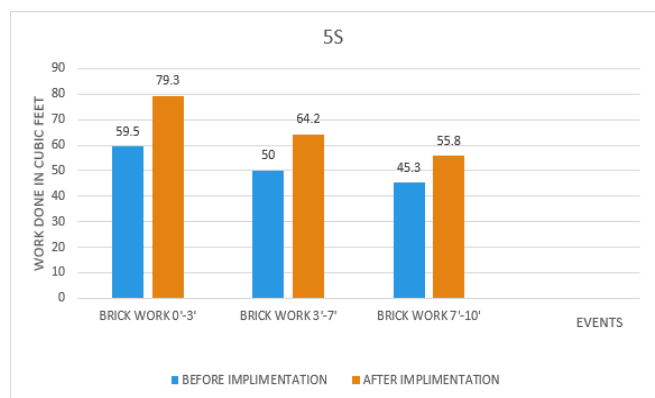
While implementing the 5 S method the things more specified are cleanliness at site, proper placing of tools, the same type of work done is being repeated such that it can be completed with ease, instead of mixing the cement on floor steel sheets were provided such that material wastage is reduced and cleanliness is also improved, the sorting out of un-necessary materials is performed regularly such that no waste is accumulated at the work place for this a separate place was allotted where in unnecessary tools are dumped safely for future use. By employing this technique material wastage was more focused.

Table 4.1.1: Weekly average quantity of Brick Work (ft3)

| S.No | Day | Brick Work 0' - 3' | Brick Work 3' - 7' | Brick Work 7' - 10' |
|------|---------|--------------------|--------------------|---------------------|
| 1 | Week-1 | 72 | 58 | 52 |
| 2 | Week-2 | 74 | 60 | 53 |
| 3 | Week-3 | 77 | 62 | 54 |
| 4 | Week-4 | 79 | 64 | 53 |
| 5 | Week-5 | 82 | 65 | 55 |
| 6 | Week-6 | 75 | 66 | 56 |
| 7 | Week-7 | 79 | 65 | 56 |
| 8 | Week-8 | 84 | 64 | 58 |
| 9 | Week-9 | 85 | 68 | 59 |
| 10 | Week-10 | 86 | 70 | 62 |

Table 4.1.2: Weekly average quantity of Plastering (ft2)

| S.No | Day | Plastering 1 st Coat | Plastering 2 st Coat |
|------|---------|---------------------------------|---------------------------------|
| 1 | Week-1 | 115 | 430 |
| 2 | Week-2 | 115 | 430 |
| 3 | Week-3 | 119 | 450 |
| 4 | Week-4 | 123 | 450 |
| 5 | Week-5 | 125 | 460 |
| 6 | Week-6 | 128 | 460 |
| 7 | Week-7 | 128 | 480 |
| 8 | Week-8 | 132 | 480 |
| 9 | Week-9 | 134 | 480 |
| 10 | Week-10 | 135 | 480 |



Graph 4.1: Quantities of Brick work before & after implementation for 5S technique

4.2 Increased Visualization

While working on increased visualization technique the different resources used are charts, boards, posters, electronic devices like mobile tablet phone etc by which workers are put on an alert on site. The main aim of these is to remind the workers about safety, target, quality, technique, specifications. With the help of electronic devices the latest and best method to perform a task can be viewed using internet. The best method is discussed with the site engineer and then implemented and the best practices from other sites are also suggested so as to improve the quality and quantity of work done. By using all these resources the major advantages are decreased accidents, improved execution of work. The main aim of this technique is to know the latest ways of performing a task, improving safety at the site.

Table 4.2.1: Weekly average quantity of Brick Work (ft3)

| S.No | Day | Brick Work 0' - 3' | Brick Work 3' - 7' | Brick Work 7' - 10' |
|------|---------|-----------------------|-----------------------|------------------------|
| 1 | Week-1 | 70 | 59 | 51 |
| 2 | Week-2 | 73 | 59 | 53 |
| 3 | Week-3 | 75 | 59 | 53 |
| 4 | Week-4 | 77 | 61 | 56 |
| 5 | Week-5 | 80 | 61 | 56 |
| 6 | Week-6 | 81 | 66 | 57 |
| 7 | Week-7 | 82 | 65 | 59 |
| 8 | Week-8 | 83 | 65 | 60 |
| 9 | Week-9 | 85 | 68 | 60 |
| 10 | Week-10 | 87 | 69 | 59 |

Table 4.2.2: Weekly average quantity of Plastering (ft2)

| S.No | Day | Plastering 1 st Coat | Plastering 2 nd Coat |
|------|---------|------------------------------------|------------------------------------|
| 1 | Week-1 | 115 | 430 |
| 2 | Week-2 | 117 | 440 |
| 3 | Week-3 | 118 | 446 |
| 4 | Week-4 | 121 | 449 |
| 5 | Week-5 | 124 | 459 |
| 6 | Week-6 | 127 | 467 |
| 7 | Week-7 | 130 | 470 |
| 8 | Week-8 | 132 | 470 |
| 9 | Week-9 | 134 | 480 |
| 10 | Week-10 | 137 | 483 |

Table 4.2.3: Average quantities before implementation

| S.No | Event | Quantity of work done |
|------|----------------------------|-----------------------|
| 1 | BW 0' - 3' | 59.5 |
| 2 | BW 3' - 7' | 50 |
| 3 | BW 7' - 10' | 45.3 |
| 4 | Plastering 1 st | 96.7 |
| 5 | Plastering 2 nd | 284.1 |

Table 4.2.4: Average quantities after implementation

| S.No | Event | 5S | DHM | IV |
|------|----------------------------|-------|-------|-------|
| 1 | BW 0' - 3' | 79.3 | 77.4 | 79.3 |
| 2 | BW 3' - 7' | 64.2 | 66.3 | 63.2 |
| 3 | BW 7' - 10' | 55.8 | 55.6 | 56.4 |
| 4 | Plastering 1 st | 125.8 | 126.5 | 125.5 |
| 5 | Plastering 2 nd | 460 | 453.5 | 459.4 |

5. CONCLUSIONS

The literature reviewed about lean construction, specifies the contribution of various people in developing the concept of lean construction inspired from TPS a manufacturing improvement technique into the field of construction. These included developing various techniques which are suitable in field of construction. The impact of construction wastes and its effect upon the cost of the project. The study about various techniques and their implementation, different resources required for a technique. The implementation to lean techniques in different countries is also mentioned. Even though many papers specified about various techniques but there were no papers published including the quantity of work done. In Indian Scenario there were papers including large scale construction but no research had been done in middle and small scale projects. So, it is concluded to carry out work in small and medium scale projects in Indian Scenario so as to in ease the usage of lean construction.

6. REFERENCES

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7. BIOGRAPHIES


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