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STRUCTURAL AND NON-STRUCTURAL BEHAVIOR ANALYSIS OF STRUCTURES (BRICK, CONCRETE, STONE, WOOD, STEEL STRUCTURES)

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***Abstract*—** The construction industry is inefficient in many aspects. Wastage, inability to complete the work in stipulated time, semi-skilled labours, poor planning, improper supervision etc. are some of the leading problems in construction industry. To minimize these problems to a certain extent LEAN can be introduced. Lean is commonly understood in manufacturing to be the elimination of waste from a process in order to increase process speed and improve quality. Lean has a great history with other industries. Thus its scope in civil engineering is very high as construction industry is the most unorganized industry in India. Our project includes some of the important methodologies related with lean that can be applied on the field. Such methodologies will help in improving the quantity of work without compromising on quality. The concepts, principles, scope, importance, applications of lean in various industries, methodologies; limitations; applications of the concept of lean in civil engineering construction industry etc. will be the focus of our topic.

***Keywords*—** Lean,,Semiskilled, Elimination Of Waste

I. INTRODUCTION

The Indian construction industry is marred by the various wastes that are generated due to the construction and demolition industry and hence it is necessary to take care of this waste. The construction industry is regarded as the most unorganized industry all over the world. Various other industries such as garment industry, automobile industry, oil and gas industry, etc. have been using various methods such as lean, six sigma, JIT etc. to improve its production speed without compromising on quality. But these methodologies which have received so many appraisals from these industries aren't being accepted in the construction industry due to the mindset of various people. The use of lean in construction industry can increase the output without compromising on quality which is a major drawback of our industry. With the help of this project we aim to spread awareness of these methodologies so that it can be used in the construction industry for the betterment of everyone..

The focus of lean is on the use of simple common sense which can result in the progress of the industry. By the use of lean the wastes generated can be reduced to a considerable extent. Lean methodologies do not cast much as there is no equipment needed to implement this, only a few brains required. The initial costs may be more and setting up may also be time consuming but as soon as it start yielding the outcome would be drastically impressive.

II. LITERATURE REVIEW

Generally in an industry more focus is given on profit. Though there are different issues involved in cost reduction internally spent by an industry through finding wastages, preventing and correcting defective work would result in huge savings. The prevalent theory of construction has been seen as a hindrance to construction innovation. The concept of lean construction is concerned with the application of lean thinking to the construction industry. However, in lean construction there are many arguments supporting the view that 'the prevalent theory of production (or specifically, theory of construction) is counterproductive, and leads to added costs and reduced overall performance through the deficient production control principles based on the theory'. Presently, the construction industry and all other organizations face various problems as a result of the uncertainties of the global economic climate; including labour redundancies, delayed projects and zero margin contract bids. The construction industry is seen as one of the worst performing industry as regards innovation. This calls for concern about the poor state of construction innovation. The emergence of lean construction is to bring significant reform to the construction industry to achieve the objectives of sustainability within the built environment in the critical social, economic and environmental aspects. Increasingly, lean construction offers new techniques of constructing sustainable projects. It is about reducing costs by cutting waste, innovating by engaging people and organizing the work-place to be more efficient. Lean construction impacts significantly on innovation by enhancing competitiveness, innovativeness, and resource efficiency within the construction industry.

WHAT IS LEAN?

- Lean is a philosophy, not a set of tools and techniques. Lean merely provides ideas and principles for organizations to improve operations by using any number of different and innovative tools and techniques.
- Initiatives and terminology can be intimidating, but it is a simple philosophy that can be clouded by tools and techniques.
- Lean involves simple common-sense principles, which can be implemented from the most basic level of operations across the entire organization.
- Lean thinking can deliver dramatic improvements, particularly attractive to clients.
- In Lean thinking, it should be noted that cost is targeted for reduction, not profit. This needs to be understood by the supply-chain for the principles to be embraced.
- Relationships of trust between client and suppliers are very important for providing these dramatic savings.
- Focus on Cost, Time and Quality – measure these and know where it is you are trying to get to.

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III. METHODOLOGY

Target Value Design

Target Value Design (TVD) or “designing to a target cost” is an approach to design where the final project cost is a design parameter. TVD requires the establishment of a Target Cost by the team (including the owner) at the start of a project. The team then cannot exceed that cost without owner approval and uses various techniques to maintain this discipline. In some cases, the cost will go up but the team must be committed to bringing it back down and make every effort to do so without compromising other parameters. By continually estimating the current cost of the project and designing accordingly, rework due to cost overruns is avoided.

Information Centre Meetings

Information Centre Meetings are 10 – 15 minute stand up meetings around a whiteboard to review key performance metrics the team on a daily basis. Information Centre Meetings form the nerve centres of the project, ensuring each person on site is aware of their role, delivering at the site KPIs and enabling problem solving around concerns as they arise.

. Standardised Work

Standardised Work increases productivity, quality and safety by having an agreed best practice for doing a specific work task. It:

- Forms the foundation for Continuous Improvement and the involvement of the workforce in Continuous Improvement.
- Enables us to balance our processes and ensure no-one is overloaded or under-utilised.
- Is written by the team themselves to include a detailed description of the work; with key safety, quality and knack points included.
- Is valuable for training, with new workers being taken through the Standardised Work Document to ensure that the task is clear and all safety, quality and knack points are covered.
- Is a work group based method of recording the safest, best quality and most efficient way to do a particular job

Built in Quality and Error Proofing

One of the pillars of LEAN is Built in Quality, which is used to avoid the waste of rework and the cost of repairs to a job. In a LEAN organisation a worker has three responsibilities:

- Do not accept poor quality
- Do not make poor quality
- Do not pass on poor quality

Just in Time (JIT)

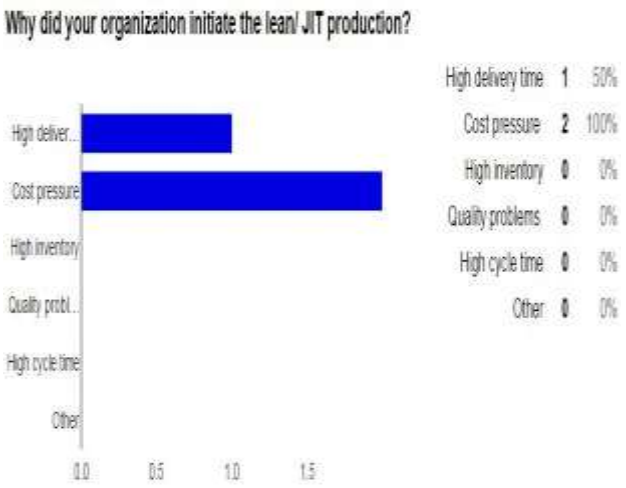
Just in Time means producing or providing only what is needed, when it is needed, and in the amount needed – no more, no less. It is the right part, at the right time, in the right place. Just in Time has become shorthand for the LEAN Material Management functions, encompassing Push versus Pull Systems for inventory delivery. JIT is a Pull System that responds to actual customer demand. In essence, products are "pulled from" the JIT system. JIT only commits the resources needed to meet the customer's needs. It leads to reduced inventories and space, higher human productivity, better equipment productivity and utilisation, shorter lead times, fewer errors, and higher morale, as follows:

- Part costs — low scrap cost, low inventory cost.
- Quality — fast detection and corrections, and higher quality of parts purchased.
- Design — fast response to engineering change.
- Administrative efficiency — fewer suppliers, minimal expediting and simple communication and receiving.
- Productivity — reduced rework, reduced inspection and reduced parts delay.

- **Continuous Improvement (CI)**

- Continuous Improvement in all its forms is done with the aim of improving safety, quality and productivity on site. In addition to the returns from each small Operational Continuous Improvement, LEAN seeks to develop the people themselves. The more someone experiments, the more they will learn and the better they will become at Continuous Improvement. Continuous Improvement is an activity that must be done by the crews, team leaders and superintendents themselves. In this way they will own the process and start to see opportunities more clearly. Engineers will also have Continuous Improvement targets which they will be monitored against.

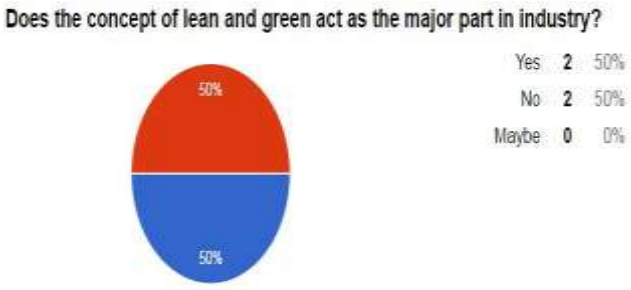
IV. RESULTS AND DISCUSSIONS

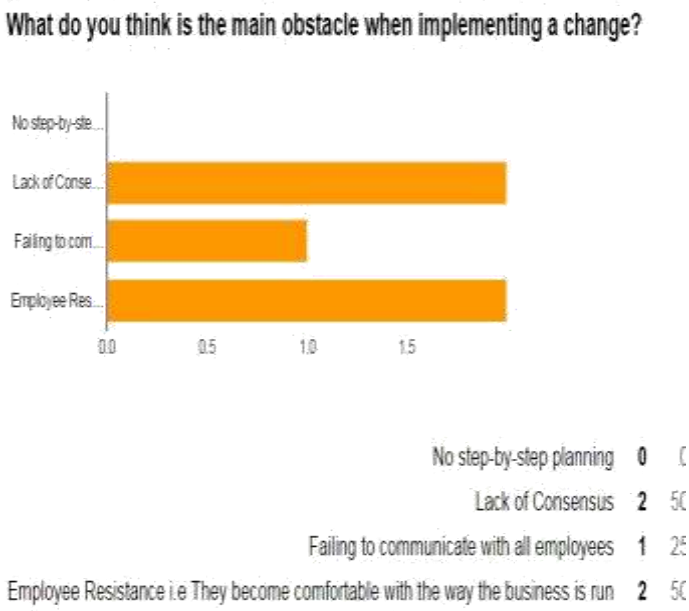


Lean technique is introduced to reduce problems arising in onstruction industries, like high delivery time, high cost, quality problems etc. Lean reduces cost pressure which is a major solution to construction industries. This technique reduces delivery time, quality problems. It also increases the recycle time, high inventory and decreases other major problems arising in industry. As per our survey the main reason that most of the companies are opting for Lean is the overall cost pressure i.e. 100%.

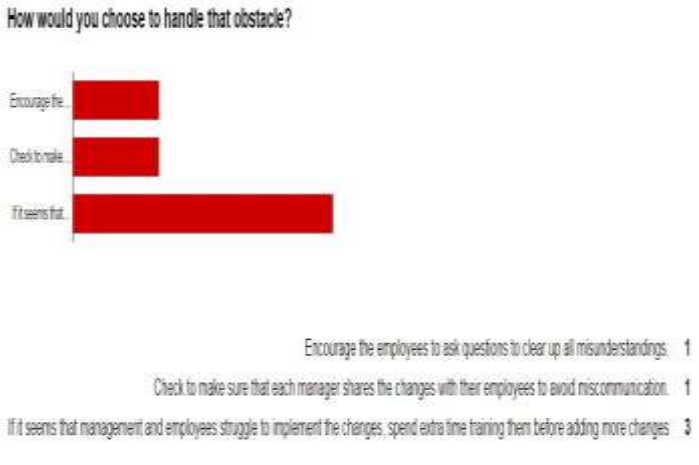
Why lean is not used in India?

It's sad to say that such advantageous technique is not being introduced in developing countries like India. The reason behind this is that people are not aware of it, and Indian construction industry is less worried about quality control. More or less it's a very new concept. Due its latest release people are not familiar to this. Insufficient training to labours doesn't make lean popular to construction firms.

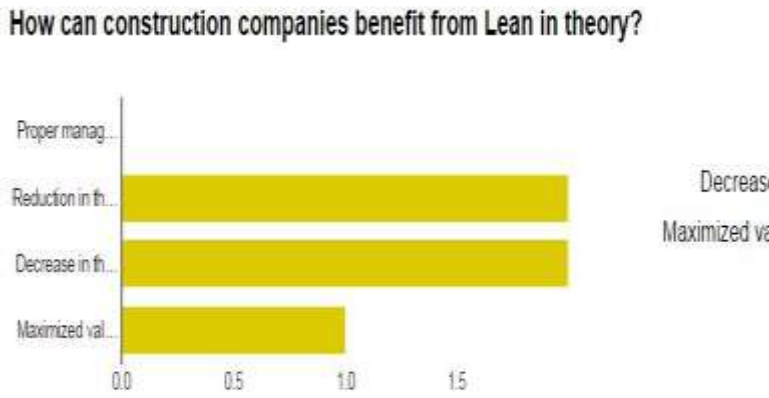




Introducing lean to construction industry does brought a change i.e. change in peoples mind, change in the behaviour of people towards the use of 'lean'. But this change has caused obstacles. There's no step by step planning, labours don't plan as per they are required, they become careless about their work. There's lack of consensus between two persons or firm. Lack of communication skills also had become one of the obstacles. Employees fail to communicate with each other. Employee resistant also comes into the picture. It means that they become comfortable with the way the business runs since past.



This obstacle can be handled easily by encouraging the employees to ask questions to clear up all misunderstandings. This will motivate them to move towards the lean. Check to make sure that each manager shares the changes with their employees to avoid miscommunication. And if it seems that management and employees struggle to implement the changes, spend extra time training them before adding more changes. This will make employees confident about lean and its boon.



Lean can be beneficial to construction firms by properly managing the construction work and minimizing the delay. Reduction in the maximum use of material and tools, this will save time, money, reduces the use of more and more materials. Decreasing the overall cost of project during project execution. Reducing the waste at the project delivery level.

What processes does the project use for eliminating waste?

The measure used by the industries to eliminate waste is important one. All the companies suggested to conduct weekly meetings to review progress, which could be productive. While Finding and measuring the waste, assigning specific accountabilities and timelines for each step in the change process and. Recognizing the members of the team for eliminating waste that will increase employment engagement is also recommended by all the firms. And other 2 reasons which where common are developing realistic and achievable action plans and all of above are also in demand and all 4 firm accepts this reason.

V. CONCLUSION

Thus, lean increases value to a customer and drives out waste effectively. Lean being a versatile principle can be applied in the construction industry with ease. This can only be possible if this principle is accepted by everyone in the industry. Though there are different issues involved in cost reduction internally spent by an industry through finding wastages, preventing and correcting defective work but it would result in huge savings.

After visiting various sites and interacting with the industry persons we came to know that most of them did not know about lean at all but after our interaction, they thought of implementing it in their sites. Many of them were reluctant regarding implementing this and believed that the conventional methods are better and there is no need to apply these methodologies. But after making them understand the merits of this methodologies and the profits that can be incurred they became more curious and thought about implementing lean methodologies

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