# Study And Implementation of The Just - In - Time Philosophy In The Indian Construction Industry

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***Abstract-*** *The Just-in-Time (JIT) philosophy originated from the Toyota Production System (TPS) and has been used in the manufacturing industry for many decades. It has boosted the company's productivity and improved the quality of its goods. According to a number of recent studies, the introduction of JIT in the construction industry has been a goal for many developed countries in recent years. To improve the Indian construction industry's performance and thus its competitiveness, this study focused on applying JIT to the industry. It is the goal of this project to examine the current state of the Indian construction industry, to identify any obstacles that may stand in the way of implementing JIT, and to develop a framework for doing so in the fields of design, procurement, construction, and inspection. Government and educational institutions should play an important role in promoting the use of JIT in India's construction industry, according to this study. Product quality and delivery time must be prioritized by companies in order to compete in today's fast-paced business environment. One of these initiatives is the Just-in-Time philosophy system, which aims to reduce construction costs by eliminating non-value-added activities. This work also focuses on implementing a Just in Time Inventory Control Approach in commercial construction. JIT has a major impact on the delivery of materials. A coordinated effort at all levels of the construction process must be made when implementing a JIT organization.*

***Keywords***- AMOS (Analysis of Moment Structures), JIT (Just-In-Time), SSPS (Statistical Package for the Social Sciences), FACO (Final Assembly and Checkout)

## I. INTRODUCTION

Construction is primarily a project-based industry, and it is well-known for its low productivity and its inability to meet deadlines due to delays that occur during the construction process. Just-in-time (JIT) management of building materials and workers on construction sites is a useful tool for project management in the construction industry. Originally developed for the manufacturing industry, JIT is a method of moving material or work from one process to the next at the exact moment that it is needed in the next process. Because less time is spent queuing before being processed, and flow variation is reduced, it is possible to reduce the amount of work-in-process inventory while also improving the production cycle time. In contrast to the manufacturing sector, the construction industry uses JIT in a very different way. This is due to the fact that construction is a distinct type of production from manufacturing, with more in common with product development. If the 'assembly line housing' industry is not taken into account. Construction projects are notoriously difficult and fraught with risk. In the context of lean manufacturing, the JIT concept aims to reduce or eliminate waste and variation. This waste is waiting, storing inventory, and moving materials in the construction industry.

Just in Time (JIT) production is a manufacturing philosophy which increases speed of production. Just-in-time manufacturing refers to the idea that a company only produces what they need when they need it. If the customer orders something, the company only makes it, and not based on the company's forecast. It is also possible to define JIT as producing the necessary units, with the required quality, in the required quantities, and at the last safe opportunity. It means that the company is able to manage and allocate its own resources very easily.

A contractor can implement JIT in the effort to overcome the problem of constantly dealing with unique projects instead of standard design projects. Training workshops and seminars for the development of better communication skills. If engineers know more about the client's needs and expectations, rework can be avoided. Improving the build-ability of designs, by incorporating buildable principle. Implementing new integrated approaches for procurement such as D&B, instead of the traditional procurement processes, together with the establishment of supporting in-house design teams.

## II. LITERATURE REVIEW

1. LITERATURE STUDY

**1.1 Ben Naylor et al..,** has compared the lean and agile manufacturing paradigms, highlighting the similarities and their differences. Total supply chain perspective is essential and companies should be striving for legality, which is attained by carefully combining both lean and agile paradigms which shows the elimination of waste. Another author John.

**1.2 Sullivan et al..,** describes the large fixed costs of production are depreciation intensive because of huge capital investments made in high-volume operations. These fixed costs are spread over large production batch sizes in an effort to minimize the total unit costs of owning and operating the manufacturing system.

**1.3 Rubio et al..,** analyses a production-management model that considers the possibility of implementing a reverse-logistics system for remanufacturing end- oflife products in a lean production environment. Browning et al .., [9] shows the implementation of lean principles and practices will reduce production costs.

**1.4Pattanaik et al..,** exercise an applied methodology for scientific, objective techniques that cause work tasks in a process to be performed with a minimum of non-value adding activities resulting in greatly reduced wait time, queue time, move time, administrative time, and other delays.

2.LITERATURE SUMMARY

From the literature study, I can say that the contributions of JIT implementation initiatives for accruing strategic benefits for meeting the challenges posed by global competition. Of all the strategies employed by an organization, JIT has emerged as the front runner to compete in the global business arena. An effective JIT implementation program can focus on addressing the organization's problems, with a view to optimize purchasing, production, utilization of workers and delivery of finished goods. JIT has become a new management practice in all types of organizations. In recent years, many organizations have showed significant improvements in business through JIT implementation. JIT strategies and philosophy can be effectively employed to realize fundamental improvements of manufacturing performance in the organization, thereby leading the organization to compete with others successfully in this highly competitive environment. JIT can prove to be an effective global strategy by which firms can enhance their performance and achieve competencies. Thus, in this highly competitive scenario, by using JIT the organizations could scale new levels of achievements. The implementation of JIT really makes the difference between success and failure of the organizations. This paper reveals the relevance of strategic JIT initiatives in the manufacturing/service sector and the strategies adopted by organization for implementation of JIT to realize its objectives successfully.

## III. METHODOLOGY

1. JIT APPLICATIONS IN CONSTRUCTION PROJECTS

The main goal of JIT materials management system in construction project is to optimize materials delivery timing and to minimize inventory quantities. Materials inventory or storage on site are exposed into certain deficiencies such as protecting it against theft, damage, and weather, and failing to provide space for materials. The implementation of JIT in construction requires commitment from staff and crew involved in the construction in terms that all parties from the planning and site should collaborate together and participate in the decision-making process. The successful implementation of JIT is dependent on the suppliers' flexibility, users' stability, total management and employee commitment as well as teamwork.

1.1. ELIMINATION OF WASTE

JIT aims to improve product quality and productivity, through the elimination of waste. Waste is considered as non-value adding to an activity. 'Excess inventory is regarded as waste since no value is added by accumulating inventory. Furthermore, inventory takes up space, ties down capital, incurs storage costs, as well as security and insurance costs; not to mention the risk of damage during storage as well as the risk of obsolescence'. Hence, motion is regarded as a form of waste. Wastes include over-production of components and products, delays in materials and information, material transportation, unnecessary processing, excess stocks, unnecessary human activities and defects in material and information. Thus, the JIT concept calls for zero inventory or buffer stocks. Waiting time, inspection time, and time spent at rectifying defect is believed wasteful. JIT can also be applied in demolition projects where waste materials can be shipped directly to demanders through means of transportation generated from the project. Therefore, getting things done 'first time right' is another doctrine of the JIT concept.

1.2. CONTRACTORS AND SUPPLIERS COMMUNICATION

To ensure the right materials come at the right times and the exact right amounts are not an easy task for suppliers. Of course, assessing the supplier will be based on meeting such constraints: Delivery Cost, Material Cost, Reliability time, Quality of the material, availability of material. 'The suppliers must know and monitor each stage of work-in-process'. This can be achieved with ease by contractors giving authority to their site management to communicate directly with their suppliers on site materials requirements. Agapiou defined that the relationship between suppliers and contractors falls below the need to secure the lowest price for materials. This is done without even taking into consideration the methodology of materials handling. The decisions of choosing suppliers by contractors are often based on fractional information. Suppliers should be involved in the planning stage of the contract as well as post-contract stage.

Suppliers should become fully aware of the bill of quantities along with final approved schedule of the construction project in order to prepare the required material that needed to be ordered and purchased and make sure to deliver the exact time with the precise quantities that they required on site. Radio Frequency Information (RFID) technology can be used to store material information whenever Just-in Time (JIT) method is adopted in specific project. Another point of view, a relationship should reform as "partnership" between contractors and materials suppliers and subcontractors to achieve performance improvement Construction Materials Quantities The daily requirements of materials during the construction project life-cycle need to be determined before assessing delivery methods and schedules. Underestimating or overestimating daily requirements can be counterproductive. There are two major drawbacks results from estimating at the extreme end of the spectrum: First, if there were a shortage in delivered materials that would possibly result in delaying the project. On the other hand, an excess of material on-site would count as waste since it does not add value to the final product. As a result, additional cost will be incurred to the budget for the excess delivery charges and the cost for storage, security as well as insurance. The quantityof material which is delivered on the daily or periodic basis is identified by the requirement of work-in-process. In order to ensure zero-inventory or near zero- inventory, the quantities have to be exact and accurate of construction materials and synchronized with the production plan and schedule.

### 1.3. CHALLENGES IN IMPLEMENTING JIT IN CONSTRUCTION

In reality the application of JIT on construction differs from manufacturing industry due to its characteristic. The different characteristics exist for the both industries are in context of different types of production, and because of the greater complexity and uncertainty of construction.

There are several reasons why the construction industry becomes uncertain and complex. The construction industry involves a lot of people with different of body knowledge, skills and experiences. Furthermore, the parties involved in the construction industry have their own objectives and target to be achieved in certain period of time. The situation becomes harder because a single actor's action, ideas and ego sat every stage of construction development may bring different effects to the whole project. Beside of multiple participants in construction development, the number of parts, relative lack of standardization and constraining factors easily make the construction of an automobile factory more difficult than the production of an automobile in that factory. When this complexity is joined with economic pressures to minimize time and cost that uncertainty arises in construction is not surprising.

## 2. PREPARATION OF QUESTIONNAIRE & DATA COLLECTION

A questionnaire (Appendix – I) is prepared for data collection and compiling the results together for a final result. THE questionnaireconsists of around 50 questions and it's categorized in 4 types such as general, Waste causes in construction, Waste generation, and Lean practice. The design of questionnaire was prepared by using Multi response. Like (1 - Strongly disagree, 2- disagree, 3- Neutral, 4 -agree, 5- Strongly agree). The prepared questionnaires were given to the various project participants from management level to labour level (Project Manager, Design Engineers, Executive Engineers, Supervisors and Labours).

## IV. DATA COLLECTION

As this topic needs vast data collection from many projects in India, I contacted many friends and colleagues for assistance in data collection. With their help, collected and compiled data based on the questionnaire in appendix I. For this research, I visited and collected data from New Delhi, Bangalore, Chennai, Kochi, Trivandrum and Thrissur. The response from various project participants from management level to labour level is compiled in a table:

**Table 1 - Analysis of the Scope of JIT in Indian construction Industry**

| Type of Participant | SCOPE OF JIT IN INDIAN CONSTRUCTION INDUSTRY | | | | |
|---|---|---|---|---|---|
| | **Strongly disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
| Project Manager | 0.00% | 0.30% | 1.10 % | 3.20 % | 95.40 % |
| Design Engineer | 0.00% | 0.00% | 0.00 % | 3.70 % | 96.30 % |
| Executive Engineer | 0.00% | 0.50% | 0.00 % | 0.50 % | 99.00 % |
| Supervisor | 0.00% | 0.00% | 0.00 % | 2.30 % | 97.70 % |
| Labour | 0.00% | 0.00% | 0.50 % | 1.50 % | 98.00 % |

## V. CONCLUSION

The research reveals that the JIT initiatives have great influence in affecting manufacturing performance improvements, improvement of culture of an organization, involvement of employees, quality, etc. In the data collection and survey, it is evident that an average of 97.28% people from construction industry consider that JIT system is applicable in the Indian construction industry and it will change the overall conventional systems of the industry too. This authenticates that JIT initiatives have extremely high potential in recognizing overall competencies of the organization. The research also acknowledged the fact that the top management can play a major role towards achievement of improvements in manufacturing performance by providing competent framework for JIT implementation, implementing an efficacious reward and recognition system in the organization and providing resources for coping upwith change in the organization. The abovementioned factors augur the usefulness of treating manufacturing performance as a multi-dimensional concept.Hence it can be concluded that even if manufacturing industries and construction firms are different kinds of production systems but a JIT technique can also be applicable to construction. Especially, in a vast sector like Indian construction industry, it will bring a lot of positive changes.

## APPENDIX 1

QUESTIONNAIRE

The questionnaire is consisting of around 50 questions and it's categorized in 4 types such as general, Waste causes in construction, Waste generation, and Lean practice. The design of questionnaire was prepared by using Multi response. Like (1 - Strongly disagree, 2- disagree, 3- Neutral, 4 -agree, 5- Strongly agree). The prepared questionnaires were given to the various project participants from management level to labour level (Project Manager, Design Engineers, Executive Engineers, Supervisors and Labours).

i. PERSONAL DETAILS:

1. Name :
2. Age :
3. Designation :
4. Type of projects :
5. Company Turnover :

ii. GENERAL

6. JIT technique in construction industry is increase productivity compared to conventional techniques?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

7. Waste minimization enhances the productivity in construction industry activity?
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

8. Conventional system of construction industry is it sustainable?
   - Yes
   - No

9. Which is the Major problem faced by construction industry?
   - Global economic climate
   - Environmental hazards
   - Labor delayed projects
   - Zero margin contract bids
   - Others

10. Unfriendly attitudes of project team and labors errors affect the construction industry productivity?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

iii. WASTE CAUSES IN CONSTRUCTION

11. Complexity of detailing in the drawings
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
12. Overlapping of design and construction industry
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
13. Selection of low-quality products also one of the reason for increasing waste?
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
14. Unfriendly attitudes of project team and labors errors
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
15. Inappropriate placement of the product
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
16. Poor technology of equipment will decrease the productivity?
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

iv. WASTE GENERATION

17. Waste due to Improper Planning of construction industry?
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
18. Waste due to irregular Cash Flow?
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
19. Waste produced due to over ordering & over production?
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
20. Waste due to re-work
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
21. Insufficient instructions about handling
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
22. Using excessive quantities of product than required?
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
23. Damage to materials on site during transportation
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
24. Overproduction/ production of a quantity greater or required than necessary
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree
25. Effects of political and social conditions create impact in waste Generation?

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly Agree

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