STUDY AND IMPLEMENTATION OF JUST-IN-TIME PHILOSOPHY IN INDIAN CONSTRUCTION INDUSTRY

T. Stephen Devaraj
M.Tech, Department of Construction Engineering and management, Dr.M.G.R Educational and Research Institute, Chennai.
Email id: stephentamilselvan@gmail.com

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 helped to increase the productivity of the company and has also increased the quality of its products. In recent years, numerous studies in developed countries have endeavoured to introduce JIT in the construction industry to reap similar benefits. This study focused on applying JIT to the Indian construction industry with the goal of improving its performance and thus its competitiveness. This project works is to discuss the current state of the Indian construction industry; presents the potential impediments to implementing JIT; and proposes a framework for JIT implementation in the areas of design, procurement, construction and inspection. The results of this study suggest that government and educational institutions should play a key role in spearheading the application of JIT in the construction industry in India. Companies must strive to create high quality, and low-cost products that can get to the customers in the shortest time possible. Just-in-time philosophy system is one of these initiatives that focus on cost reduction by eliminating non-value-added activities for the construction industries. This works also Deals with Implementing Just in Time Inventory Control Approach on commercial Construction. JIT has Tremendous Effect on material delivery operation. During Implementation of JIT Organization is required, to put desired efforts on all levels of the construction work.

Keywords: JIT, Contractors, SPSS, Data Collection, ANOVA

1. INTRODUCTION

1.1 GENERAL
Due to the project-based nature of the construction industry, it has earned a reputation for being inefficient and low in production. It is also known for having difficulty keeping to timetables due to delays that occur during the construction phase. For construction management, the introduction of The Just-in-Time (JIT) concept can be beneficial, particularly when it comes to managing the logistics of building supplies and labour on construction sites. When the JIT mindset was first established, it was for the manufacturing industry, where it is a means of forwarding material or work from one process to another at the precise moment that it is required by the succeeding process. In this way, inventory of
work in progress is reduced, as is the length of production cycle times, since less time is spent queuing before being processed, and flow variance is reduced, all of which contribute to constant and ongoing improvements.

When comparing the construction business to the manufacturing industry, there is a considerable variation in how JIT is implemented. This is due to the fact that building is a different form of production, one that is more directly related to product creation than it is to traditional manufacturing. If one does not take into consideration the industry of 'assembly line housing.' In general, the construction industry is significantly more complex and uncertain than the rest of the economy. It is a concept derived from the lean philosophy, and the purpose of the JIT idea is to decrease or eliminate variability and waste to the greatest extent possible. When it comes to the construction sector, this waste is sitting around waiting to be used for inventory storage and material transportation.

1.2 CONCEPT OF JIT
"Just in Time" manufacturing refers to the practise of producing only what is required at the time it is required (or "JIT" for short). The JIT idea, put another way, asserts that "the company only produces what it requires at the time and amount that it requires." The firm simply manufactures what the customer orders, rather than what it anticipates selling in the future. Instead, JIT can be defined as the process of producing the necessary units in the appropriate numbers at the last feasible moment while retaining the required level of quality and efficiency. As a result of this ability, they have complete control over their own resources and can allocate them with relative ease. Various Steps in Implementation of JIT. Identification of the source: "Just in Time" refers to the production of the appropriate quantity of material at the appropriate time. Neither before nor after the work is permitted. While large corporations have their own sources, the little construction business is experiencing difficulties with material management. Vendor analysis: A vendor is a business that provides a firm with materials to use in its operations. Depending on the company, the vendor may be a single person or a group of people.

1.3 JIT IN CONSTRUCTION
Material storage, labour time, and transportation are all wastes that can be reduced through the use of just-in-time manufacturing. Because it has previously been discovered that a third of a worker's time is spent procuring materials that he requires, which accounts for 10% of the total construction cost, doing so will produce significant benefits. Because of the massive quantity of waste that JIT removes, the supply costs associated with this ideal technique are only marginally raised compared to other approaches. The problem of waste in the construction sector has been acknowledged to some extent, and the implementation of just-in-time delivery can be justified. However, the use of just-in-time (JIT) in the construction sector differs significantly from that in the manufacturing business, owing to the distinct types of production in the two industries, as well as the greater complexity and uncertainty in the construction industry. The best way to think about construction is as a product development process. The construction industry is made up of building projects that are driven by a timeline of completion. If the timetable is adhered to, it is possible to achieve a smooth work flow and high levels of work performance. However, this is not always the
case, particularly in the case of large-scale initiatives. Design adjustments, delivery slippages, and unforeseen issues, and so on are all very likely to occur along the process. By maintaining an inventory, it is possible to protect the work flow from some of these flow changes. At the Toyota factory, Ohno was effective in reducing stocks across processes, as a result of which he was also successful in reducing the safety stock, which permits a process downstream to continue in the event of a delivery variation.

1.4 BENEFITS OF JIT IN CONSTRUCTION
In addition to the previous discussed benefits of utilizing JIT,
1. Increase the competitive advantage of enterprises by constantly and continually addressing the needs of their customers, for example.
2. Improving the quality of the materials and components used in the construction process
3. Productivity gains will be realised.
4. Lower costs as a result of fewer inventory items.
5. A more positive relationship with the provider
6. Work completed ahead of schedule
7. Increasing the overall cleanliness of the building site
8. The elimination of site congestion as well as a reduction in the inconvenience encountered by nearby residents.
9. However, these potential benefits will not be realised until substantial initial expenditures are made. For example, if the goal is to reduce the amount of time spent setting up, more advanced equipment and more competent staff are required.

1.5 STRATEGY FOR JIT IMPLEMENTATION IN CONSTRUCTION
With JIT, physical buffers such as inventory and time are removed in favour of a one-piece flow throughout processes. A manufacturing line can do this because to the high stability of flow achieved by scheduling the production. To put it another way, it would be dangerous to remove all physical buffers, if the cause of variation and uncertainty could not be addressed by construction schedule. Using buffers as a management tool, Ballard and Howell presented the following methodologies for the advancement and deployment of JIT in construction. Better location and sizing of schedule buffers: For project risk assessment and measuring the relationship between a buffer and the level of risk it is designed to mitigate, we require more precise methodologies than are now available.

Figure 1: Strategy for JIT Implementation in Construction
2. LITERATURE REVIEW

Ben Naylor et al., comparing and contrasting lean manufacturing with agile manufacturing, highlighting the similarities and differences. The lean and agile paradigms must be carefully blended in order to demonstrate the removal of waste throughout the supply chain, and this can only be accomplished by taking a holistic view of the supply chain.

Sullivan et al., Depreciation is a key component of the huge fixed costs of production in high-volume activities, which is due to the significant capital investments required in these operations. As a result, these fixed expenditures are spread out over a large number of production batches in order to lower the overall cost of owning and operating the manufacturing equipment.

Rubio et al., A production management model can be used to remanufacture end-of-life products in a lean manufacturing environment, and reverse logistics can be employed to do this. According to Browning and colleagues, reducing manufacturing costs can be accomplished through the application of lean ideas and techniques.

Rong et al., This method can be used to remanufacture old items in a lean manufacturing environment, and it does so by implementing a management model for the remanufacturing process. Browning et al. assert that lean principles and practises can be employed to minimise production costs in order to accomplish this.

Pattanaik et al., A scientific, objective procedure that reduces the amount of time spent on non-value-adding activities, such as waiting in line, moving through the process quickly, and handling administrative duties can significantly reduce delays throughout a process when applied methodology is used in conjunction with it.

JIT System: Concepts, Benefits and Motivation in Indian Industries” by Dr. Sultan Singh, Dr. Dixit Garg. This research paper provides an overview of the just-in-time (JIT) approach, including its origins, goals, advantages, and methods for implementing it. It also discusses how the JIT method can be implemented. During this section, they also discussed how the just-in-time movement has spread to various industries, and they concluded that it is not a technique or a set of techniques, but rather a philosophy or an overall approach that focuses on both traditional and cutting-edge methods of inventory control in the supply chain.

A study on different inventory management techniques in construction” by Kanani M A, Sharma N D, Kashiyani B K.: According to the writers, inventory refers to the products or resources that a firm employs for both manufacturing and selling purposes. Objects are the most commonly used supporting materials for manufacturing when it comes to supporting materials. In a business, inventory accounts for more than 60% of the total money available for expenditure. Inventory is one of the most significant current assets a company may have because it enables for a smooth manufacturing and selling process for the organisation. Inventory management encompasses two parts of current asset management that are focused on inventory management: maintaining stock and implementing an effective control system to keep inventory costs down. Funding in the form of stock accounts for a major amount of a company's operational capital, and it accounts for a significant portion of the company's overall assets in many cases.
3. METHODOLOGY

- Detailed Literature review
- Identification of problem and preparation of research plan
- Validation of Questionnaire
- Questionnaire Distribution
- Reminders, Phone Calls & Interviews
- Collection of data
- Analysis in SPSS
- Result & Discussion
- Conclusion
4. JIT APPLICATIONS AND IMPLEMENTATION 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.

4.1 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.

4.2 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.

4.3 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 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 stages 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.

5. ABOUT SOFTWARE

5.1 SPSS

SPSS Statistics is a software package used for interactive, or batched, statistical analysis. Long produced by SPSS Inc., it was acquired by IBM in 2009. The current versions (2015) are named IBM SPSS Statistics. The software name originally stood for Statistical Package for the Social Sciences (SPSS), reflecting the original market, although the software is now popular in other fields as well, including the health sciences and marketing.

5.2 WHAT IS SPSS

SPSS is short for Statistical Package for the Social Sciences, and it’s used by various kinds of researchers for complex statistical data analysis. The SPSS software package was created for the management and statistical analysis of social science data. It was originally launched in 1968 by SPSS Inc., and was later acquired by IBM in 2009. Officially dubbed IBM SPSS Statistics, most users still refer to it as SPSS. As the world standard for social science data analysis, SPSS is widely coveted due it’s straightforward and English-like command language and impressively thorough user manual.

5.3 DATA COLLECTION AND ORGANIZATION

SPSS is often used as a data collection tool by researchers. The data entry screen in SPSS looks much like any other spread sheet software. You can enter variables and quantitative data and save the file as a data file. Furthermore, you can organize your data in SPSS by assigning properties to different variables. For example, you can designate a variable as a nominal variable, and that information is stored in SPSS. The next time you access the data file, which could be weeks, months or even years, you'll be able to see exactly how your data is organized.

5.4 DATA OUTPUT

Once data is collected and entered into the data sheet in SPSS, you can create an output file from the data. For example, you can create frequency distributions of your data to determine whether your data set is normally distributed. The frequency distribution is
displayed in an output file. You can export items from the output file and place them into a research article you're writing. Therefore, instead of recreating a table or graph, you can take the table or graph directly from the data output file from SPSS.

5.5 STATISTICAL TESTS

The most obvious use for SPSS is to use the software to run statistical tests. SPSS has all of the most widely used statistical tests built-in to the software. Therefore, you won't have to do any mathematical equations by hand. Once you run a statistical test, all associated outputs are displayed in the data output file. You can also transform your data by performing advanced statistical transformations. This is especially useful for data that is not normally distributed.

5.6 IMPORTANCE AND BENEFITS OF SPSS

SPSS statistics is a software package used for logical batched and non-batched statistical analysis. This software is one of the most popular statistical packages which can perform highly complex data manipulation and analysis with simple instructions. SPSS can take data from almost any type of file and use them to generate tabulated reports, charts and plots of distributions and trends, descriptive statistics and conduct complex statistical analyses. This package of program is available for both personal and mainframe computers.

SPSS is beneficial for both qualitative and quantitative data equal importance is been given for both data sets, about 85% of the research scholars carry quantitative data for their further analysis, so the layman thinks that the SPSS software is more beneficial in quantitative data than qualitative one but no SPSS gives equal weight age for both data sets. Even if there are several software’s available in market to analyze quantitative data SPSS is more preferable than other software’s. Since SPSS is user friendly software & ease to use for the beginners and also helps in analysis even when the data set goes larger.

6. QUESTIONNAIRE

The preliminary structure of this questionnaire is consists of around 50 questions and its categorized in 4 types such as general, Waste causes in construction, Waste generation, 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).
PERSONAL DETAILS:
1. Name : 
2. Age : 
3. Designation : 
4. Type of projects : 
5. Company Turnover :
   • Strongly Agree

I.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

WASTE CAUSES IN CONSTRUCTION
11. Complexity of detailing in the drawings
   • Strongly disagree
   • Disagree
   • Neutral
   • 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

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?
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

Table 1: Scale - JIT implementation in your organization

<table>
<thead>
<tr>
<th>S.N</th>
<th>Lean practice</th>
<th>Very poor</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very good</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preventive maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>JIT/continuous flow production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cycle time reduction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Zero defects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Scrap reduction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Setup time reduction/quick changeover techniques</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Inventory management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Supply chain management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Human resource management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Decrease in construction cost/ unit cost of construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Increase in growth rate in unit sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12. Increase in sales per employee
13. Decrease in delivery speed/delivery lead time
14. Decrease in construction cycle time
15. Decrease in defect rate/rejection rate/% rejection
16. Increase in labor productivity
17. Increase in employee satisfaction
18. Increase in customer satisfaction

7. SPSS RESULTS
7.1 FREQUENCY ANALYSIS
Table 2: JIT manufacturing industry Technique is increase productivity compared to conventional

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIT manufacturing industry Technique is increase productivity compared to conventional</td>
<td>4</td>
<td>16.0</td>
<td>16.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>5</td>
<td>20.0</td>
<td>20.0</td>
<td>36.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>20.0</td>
<td>20.0</td>
<td>36.0</td>
</tr>
<tr>
<td>Neutral</td>
<td>6</td>
<td>24.0</td>
<td>24.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Agree</td>
<td>5</td>
<td>20.0</td>
<td>20.0</td>
<td>80.0</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>5</td>
<td>20.0</td>
<td>20.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Fig 2 pie chart shows the comparison results
### Table 3 SPSS Results for sustainability of conventional system

<table>
<thead>
<tr>
<th>Conventional system of manufacturing industry is it sustainable</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>4</td>
<td>16.0</td>
<td>16.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>4</td>
<td>16.0</td>
<td>16.0</td>
<td>32.0</td>
</tr>
<tr>
<td>Neutral</td>
<td>4</td>
<td>16.0</td>
<td>16.0</td>
<td>48.0</td>
</tr>
<tr>
<td>Agree</td>
<td>7</td>
<td>28.0</td>
<td>28.0</td>
<td>76.0</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>6</td>
<td>24.0</td>
<td>24.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

### Table 4 SPSS Results for Major problem in manufacturing industry

<table>
<thead>
<tr>
<th>Which is the Major problem faced by manufacturing industry industry</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global economic climate</td>
<td>6</td>
<td>24.0</td>
<td>24.0</td>
<td>24.0</td>
</tr>
<tr>
<td>Environmental hazards</td>
<td>6</td>
<td>24.0</td>
<td>24.0</td>
<td>48.0</td>
</tr>
<tr>
<td>Labor delayed projects</td>
<td>4</td>
<td>16.0</td>
<td>16.0</td>
<td>64.0</td>
</tr>
<tr>
<td>Zero margin contract bids</td>
<td>3</td>
<td>12.0</td>
<td>12.0</td>
<td>76.0</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
<td>24.0</td>
<td>24.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5 ANOVA Results

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>JMP construction Technique is increase productivity compared to</td>
<td>(Combined)</td>
<td>4</td>
<td>5.910</td>
<td>5.324</td>
<td>.004</td>
</tr>
<tr>
<td>Between Groups</td>
<td>Unweighted</td>
<td>1</td>
<td>1.286</td>
<td>1.159</td>
<td>.295</td>
</tr>
<tr>
<td>Linear Term</td>
<td>Weighted</td>
<td>1</td>
<td>1.470</td>
<td>1.324</td>
<td>.263</td>
</tr>
<tr>
<td>Deviation</td>
<td></td>
<td>3</td>
<td>7.390</td>
<td>6.658</td>
<td>.003</td>
</tr>
<tr>
<td>Within Groups</td>
<td>22.200</td>
<td>20</td>
<td>1.110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>45.840</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Waste minimization enhances the productivity in manufacturing industry activity

<table>
<thead>
<tr>
<th>Waste due to Improper Planning of manufacturing industry?</th>
<th>Between Groups (Combined)</th>
<th>Linear Term</th>
<th>Weighted</th>
<th>Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unweighted</td>
<td>.302</td>
<td>.083</td>
<td>7.867</td>
</tr>
<tr>
<td></td>
<td>Weighted</td>
<td>.302</td>
<td>.083</td>
<td>3.203</td>
</tr>
<tr>
<td></td>
<td>Deviation</td>
<td>1.38203</td>
<td>.083</td>
<td>21.220</td>
</tr>
<tr>
<td>Within Groups</td>
<td>30.050</td>
<td>20</td>
<td>1.503</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>38.000</td>
<td>24</td>
<td></td>
<td></td>
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</tbody>
</table>

Total 44.000 24

7.2 DESCRIPTIVE STATISTICS

Table 6 Descriptive Statistics results in SPSS

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Analysis N</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIT construction Technique is increase productivity compared to conventional</td>
<td>3.0800</td>
<td>1.38203</td>
<td>25</td>
</tr>
<tr>
<td>Waste minimization enhances the productivity in manufacturing industry activity</td>
<td>3.0000</td>
<td>1.25831</td>
<td>25</td>
</tr>
<tr>
<td>Waste due to Improper Planning of manufacturing industry?</td>
<td>3.1200</td>
<td>1.48099</td>
<td>25</td>
</tr>
<tr>
<td>Waste due to irregular Cash Flow?</td>
<td>2.8400</td>
<td>1.49108</td>
<td>25</td>
</tr>
<tr>
<td>Waste produced due to over ordering &amp; over production?</td>
<td>3.1200</td>
<td>1.39403</td>
<td>25</td>
</tr>
<tr>
<td>Damage to materials on site during transportation</td>
<td>3.2000</td>
<td>1.35401</td>
<td>25</td>
</tr>
<tr>
<td>Overproduction/ production of a quantity greater or required than necessary</td>
<td>2.4800</td>
<td>1.58430</td>
<td>25</td>
</tr>
</tbody>
</table>
Effects of political and social conditions create impact in waste Generation?

<table>
<thead>
<tr>
<th></th>
<th>2.6800</th>
<th>1.28193</th>
<th>25</th>
</tr>
</thead>
</table>

Table 7 Correlation Matrix results in SPSS

<table>
<thead>
<tr>
<th>Correlation</th>
<th>JIT manufacturing industry Technique is increase productivity compared to conventional</th>
<th>Waste minimization enhances the productivity in construction activity</th>
<th>Waste due to Improper Planning of manufacturing industry?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation</td>
<td>1.000</td>
<td>.096</td>
<td>.117</td>
</tr>
<tr>
<td>Waste minimization enhances the productivity in manufacturing industry activity</td>
<td>.096</td>
<td>1.000</td>
<td>-.224</td>
</tr>
<tr>
<td>Waste due to Improper Planning of manufacturing industry?</td>
<td>.117</td>
<td>-.224</td>
<td>1.000</td>
</tr>
<tr>
<td>Waste due to irregular Cash Flow?</td>
<td>-.135</td>
<td>.222</td>
<td>-.142</td>
</tr>
<tr>
<td>Waste produced due to over ordering &amp; over production?</td>
<td>-.394</td>
<td>-.048</td>
<td>-.108</td>
</tr>
<tr>
<td>Damage to materials on site during transportation</td>
<td>-.454</td>
<td>-.098</td>
<td>.071</td>
</tr>
<tr>
<td>Overproduction/ production of a quantity greater or required than necessary</td>
<td>.229</td>
<td>-.376</td>
<td>-.345</td>
</tr>
<tr>
<td>Effects of political and social conditions create impact in waste Generation?</td>
<td>.086</td>
<td>.232</td>
<td>.065</td>
</tr>
</tbody>
</table>

Table 8 Principal component analysis

<table>
<thead>
<tr>
<th>Communalities</th>
<th>Initial</th>
<th>Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIT manufacturing industry Technique is increase productivity compared to conventional</td>
<td>1.000</td>
<td>.725</td>
</tr>
<tr>
<td>Waste minimization enhances the productivity in manufacturing industry activity</td>
<td>1.000</td>
<td>.811</td>
</tr>
<tr>
<td>Waste due to Improper Planning of manufacturing industry?</td>
<td>1.000</td>
<td>.802</td>
</tr>
<tr>
<td>Waste due to irregular Cash Flow?</td>
<td>1.000</td>
<td>.859</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>Waste produced due to over ordering &amp; over production?</td>
<td>1.000</td>
<td>.836</td>
</tr>
<tr>
<td>Damage to materials on site during transportation</td>
<td>1.000</td>
<td>.684</td>
</tr>
<tr>
<td>Overproduction/ production of a quantity greater or required than necessary</td>
<td>1.000</td>
<td>.900</td>
</tr>
<tr>
<td>Effects of political and social conditions create impact in waste Generation ?</td>
<td>1.000</td>
<td>.664</td>
</tr>
</tbody>
</table>

8. RESULTS AND DISCUSSION

Proper Training and Implementation of JIT concepts and practices can be successfully adopted in construction industry projects and has increased keen interest from many organized players in the industry. It was clearly seen that the enabling factors included commitment of top management and site management, as well as the culture and systems of the organization will be main forces for the success of JIT construction industry in India. Even though the prevalent theory of construction (or specifically, theory of construction industry) is seen as counterproductive, leading to added costs and reduced overall performance, the huge positive impact of JIT implementation on sustainable innovation within construction industry have been quantified and provided proof of sustainability outcomes in terms of reduced waste, effort and time. With JIT construction industry, there is achievement of more for less by continuous reduction of expenditures in the construction industry process.

From the above results frequency analysis respondents response for both JIT technology vs conventional are equal percentage (24%), from descriptive statistics analysis reason for waste in construction of a quantity greater or required than necessary (Std. Deviation = 1.58430, Mean = 2.4800), Waste due to irregular Cash Flow (Std. Deviation = 1.49108, Mean = 2.8400)

CONCLUSION

According to the results of the study, 70% of companies agreed that wastes are generated in the construction sector, based on the responses of various project participants. JIT ideas and concepts have been thoroughly investigated, and it was discovered that the construction industry's JIT method helps reduce waste and boost output. In the context of India, the JIT construction business is examined. In order to determine which factors have the most impact, a ranking analysis using the Statistical Package for Social Sciences is performed. The construction sector managers can discover the appropriate actions and methods to implement new approaches for decreasing waste, leading to process improvement, by establishing the incidence of non-value added operations. Building operations can be reduced to a minimum by using JIT construction methods, which in India require training and consulting in order to be accepted. This JIT construction method is necessary for green and sustainable growth.
REFERENCES

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[6]. Akintola Akintoye, Just in Time application and implementation for building material management”, Construction management and economics (1995) 13, 105-113