

A Review on JIT Manufacturing Key Elements, Inventory, Production and Implementation

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Abstract - Just-in-time manufacturing has been receiving increased attention from industries as they recognize the benefits of lower inventories, reduced set-up-time, smaller job lots, better quality products and lower production cost. Conceptually, JIT is a manufacturing philosophy acknowledges the desire to eliminate all forms of waste in the manufacturing environment. JIT is a approach to achieving excellence in a manufacturing company based on continuing elimination of waste and consistent improvement of productivity. Operationally, JIT manufacturing emphasizes producing and delivering the exact quantity of the product at the exact time when it is needed in every process in as well as outside the factory. JIT embodies a philosophy of excellence to establish demand pulled inventory practices that produce to design specifications at a rapid but smooth delivery at with zero idle inventories, zero unnecessary lead times and increased employee involvement in the process.[2]

Key Words: *JIT, Inventory, Production, Implementation*

1. INTRODUCTION

The objective of JIT is the production or provision of defect-free goods in the required amount at the right time. The JIT philosophy evolved from a number of principles such as the elimination of waste, reduction of production cost, total quality control and recognition of employees' abilities.

In order to understand the JIT method of manufacturing properly, it is necessary to know the factors that - contribute to its emergence. JIT manufacturing evolved in Japan in the early 1970s as a method of increasing productivity despite limited resources. Japan is a nation consisting of a collection of islands with a land mass about the size of California. Although short in natural resources, Japan has an abundance of well-educated people. To successfully compete in the world markets firms in Japan had to use their resources in the most efficient manner. To do this, Japanese businesses and factories had to make the most efficient use of their equipment, strive to attain a quality standard surpassed by none of their competitors and reduce waste to the minimum.

A prerequisite to raising efficiency and eliminating waste is to improve quality. To do this, the Japanese embarked on a diversity of aggressive and sweeping programs of quality improvement. To facilitate these programs small groups of workers began forming quality improvement circles within plants. From the suggestions of these workers the JIT manufacturing method evolved

Toyota Motor Company considers cost reduction as the primary goal of the JIT philosophy. To achieve this goal

Toyota Motor Company proposed the following three sub goals:

- i. Quality control that includes kanban, smooth production flow, reduced set-up and production lead-time, U-cells, and standardized operations;
- ii. Quality assurance considers a 100% self-inspection, statistical quality control, establishing quality circles, eliminating outside inspection, fool-proofing and automation; and
- iii. Respect for humanity involves giving workers valuable jobs, training and development of multifunctional workforce, open communication, seeking employee suggestions for continuous improvements, and allowing production workers to stop the line.[5]

2. KEY ELEMENTS OF A JIT SYSTEM:

1. Waste Elimination

JIT manufacturing maintains that all wasted time and material only increases cost and lowers quality. Ideally, JIT aims at complete elimination of waste through the persistent efforts by both management and workers to look for continuous improvement in all areas of the production system. In practice, experience seems to suggest that improvement efforts directed to such activities as heightening quality, shortening lead times and reducing lot sizes will result in the biggest payoff in the pursuit of waste elimination.

2. Workplace Organization

Workplace organization means problems are made visible wherever they may exist. Organization of the workplace to achieve this objective of problem visibility involves five steps: (a) clearing and simplifying, (b) locating, (c) cleaning, (d) discipline, and (e) participation (Hall, 1987). As a result of workplace organization, the factory will be increasingly taking the shape of a product layout operating in a demand-pull environment.

3. Total Employee Involvement

Total employee involvement is crucial to the success of JIT manufacturing. All members in the factory, from upper management down to the shop-floor workers, must work as a team. Teamwork requires a long-term commitment from both senior management and the rank-and file Workers, and necessitates a real change in the corporate culture. In order for teamwork to be successful, it is vital to create an environment that fosters and supports the involvement of employees at all levels of the organization.

4. Implementation Issues

There are two goals when implementing a JIT manufacturing system. The short-term goal is to reduce manufacturing cost by lowering inventory and heightening productivity, while the long-term goal is to enhance

competitiveness by reducing lead times, improving flexibility and raising quality. The process of implementing a JIT system involves three phases, namely (1) justifying JIT adoption, (2) organizing for JIT manufacturing and (3) establishing an operational plan for JIT implementation (Hay 1989). It is important to realize that JIT implementation is not a process of progressing through these three phases in a discrete and sequential manner. Since there is a high degree of overlap between the activities involved in the three phases, an integrated approach to JIT implementation works better.[2]

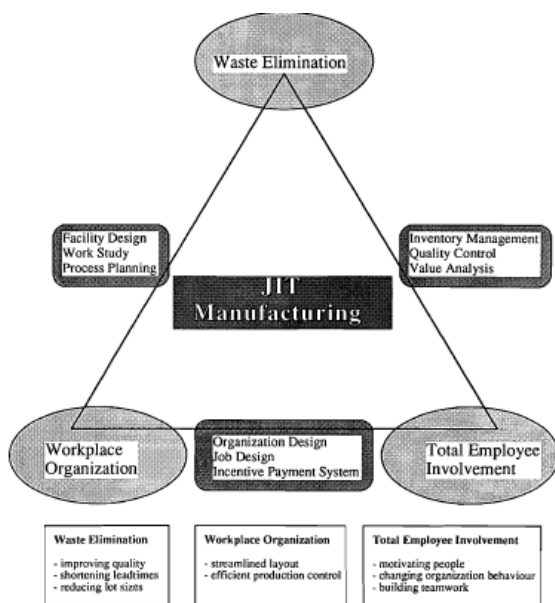


Fig- 1: The building blocks of JIT manufacturing

JIT Inventory:

According to the simulation and mathematical studies on inventory system comparisons, the manufacturing environment is most crucial in reducing inventory. In particular, leveled production, reduced set-up time and lot sizes are most effective in reducing inventory and improving customer-service levels [5]

With kanban, the JIT philosophy focuses on simplifying the production process and finding ways to reduce set-up times and lot sizes. When compared to MRP and OPT, kanban provides an appropriate manufacturing environment for effectively controlling inventory. Another critical factor in successful implementation of an inventory system is human involvement. Since workers are responsible for making the kanban system work, researchers find it advantageous because it is relatively simple and easy to implement. MRP, on the other hand, has more human involvement problems because employees are more excluded from decision-making and fail to see how their work contributes to reduction in inventory. OPT requires managers to make procedural and work method changes prior to its implementation. These changes increase employee involvement. As a result, OPT has fewer employee problems in controlling inventory than MRP

A JIT approach has as its main goal the reduction of the levels of inventory and its associated carrying costs—or to reduce waste altogether. The less time a product is in process, the less inventory there is to finance, store, and manage.

The objective is to push to zero the amount of time the product is waiting to be worked on, in transit, and/or being inspected.

JIT is a production system which by its very nature eliminates waste in the production process; thereby reducing costs, improving quality, and shortening manufacturing cycle time.

Two basic assumptions underlie JIT:

- Making incremental improvements to the production process always lowers costs and improves quality.
- Tasks that are done repetitively, on a continuous basis, can be improved to the furthest extent possible. Simplicity and repetition bring competence.

The mechanism, by which JIT eliminates waste, is as follows. Small quantities of inventory are systematically removed from the production process, which results in the occurrence of small problems. After careful study solutions are found and quickly implemented. The result is that waste in the production process is eliminated, causing costs to fall and quality to improve. This routine of removing inventory, identifying problems, finding solutions and making incremental improvements to remove the wastes which caused the problems, is repeated again and again, until the production process produces products without any waste—that is, with perfect quality, in the right quantities at the right time, and at the lowest possible cost. [3]

JIT Production:

Just-in-Time is a production strategy with the requirement to stand by or produce materials at the right time, with the right quality and quantity on the right place. The more the conditions are met, the better the JIT production can be realized. In fig. 1 the conditions for the JIT production are presented.

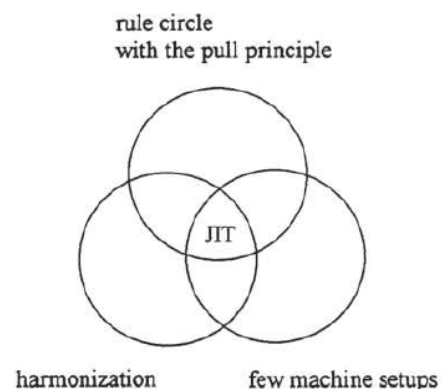


Fig- 2: JIT Production

JIT production is possible only in a stable manufacturing system. The stable manufacturing system can be reached only by low variation of all production factors: piece-work-time, machine setup time, capacities, demands, etc. And low variation can be balanced by harmonization. The harmonization means alignment of the working rhythm in the manufacturing system. The less products there are in the manufacturing, the easier the harmonization will be, for example in mass production, where there are only a few production factors to harmonize. The more different the products, the more difficult it is, for example in a special order manufacturing, because the different products lead to high

variation of the production factors. And the harmonization in a job-shop manufacturing is not easy because of the variety of the production processes. [4]

JIT Implementation:

Implementing JIT means arranging the production process (through the JIT production control system) so that this mechanism can operate to the fullest extent possible, as well as making resources available for making the improvements.[3]

The types of improvements that are made include:

- i. Reducing set-up times so that production in small lots is possible
- ii. Improving procedures, tooling, and materials, so that defective parts are not produced
- iii. Greater use of quality control techniques such as SPC, TQC, and so on
- iv. Improving process capability and careful application of automation
- v. Standardizing procedures, tooling, materials, and products
- vi. Improving product design
- vii. Multi-skilling workers to do a variety of tasks.

Implementation-in-manufacturing articles are broader in scope and examine the role of the basic tenets of the JIT philosophy in manufacturing. First, we identify critical variables from conceptual articles. These variables are then classified according to the basic tenets of the JIT philosophy. Development of these variables over time is presented next. Finally, we review the empirical, simulation and mathematical studies reported in this category.[5]

JIT implementations in various industries. The following points are to be considered

- i. Elimination of waste
- ii. Set-up time reduction;
- iii. Smooth production flow;
- iv. Employee participation in decision-making;
- v. Total quality control;
- vi. Total preventive maintenance;
- vii. Kanban; and
- viii. Suppliers.[6]

Benefits that should result from the implementation of a JIT system include:

- i. Lower inventory carrying costs;
- ii. Space and cost savings in the factory and warehouse;
- iii. Reduced risk of obsolescence; and
- iv. Reduced response time to customers' orders and delivery times. [1]

JIT implementation concluded that JIT production strategy and JIT vendor strategy were significant elements of JIT implementation. Success in JIT implementation was assessed based on downtime, inventory and workspace reductions, increased quality, labor and equipment utilization and inventory turnovers. The elements of JIT production strategy were: setup time reduction, in-house lot sizes, group technology, cross training and preventive maintenance. Employee development plays a major role in the success of the implementation process. Cross-training of the employees led to a flexible assembly line

while various employee involvement exercises maintained their interest and motivation [6]

CONCLUSION:

JIT is much more than just a manufacturing technique. It is a broad-based manufacturing philosophy, embracing a body of management principles and an array of management systems and techniques, which will, if used correctly in the right manufacturing environment, greatly increase a firm's productivity and enhance its competitiveness in the marketplace. The key to JIT manufacturing is continuous improvement in every facet of the production facility. This is achieved through persistent efforts in achieving waste elimination, introducing workplace organization and fostering total employee involvement. These three elements are the building blocks of the foundation on which a successful JIT system rests. JIT manufacturing is a philosophy towards improving efficiency through the absolute elimination of waste by continuous improvement and workers' involvement.[7]

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