

JIT System: Concepts, Benefits and Motivation in Indian Industries

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Abstract

Just-in-Time system has been defined and identified worldwide by many researchers and practitioners for world class manufacturing. This system has been accepted as a systematic approach to achieve competitiveness and excellence in manufacturing by many researchers and practitioners in many countries in last three decades. This system has potential to compete in the present scenario of rapid development and growth of industrialization. This paper presents the spread of JIT movement, concepts, objectives, elements, benefits, implementation and motivation of JIT system.

Keywords

JIT, Elements, Benefits, Motivation.

I. Introduction

The new technologies have far reaching implications for the competitive advantages of countries in the international competition of global markets. Developing countries cannot remain just silent spectators while this new industrial revolution sweeps the industrialized world. The most fortunate thing about the new industrial revolution is that skilled people and not much by heavy machinery largely dominate it. Modern technology is more oriented towards system configuration than the development of hard and robust machines. With the development of fast communication, rapid transportation and super computers, manufacturing is no longer restricted today at local level, but has become global in character. A manufacturing company has to become competitive for its survival; it has to supply products of consistent high quality at reliable and reduced delivery time. Market also demands more product variants that mean reduced lot size and high flexibility in operations. Manpower cost has also risen. All these factors tend to increase the product cost. But the industry has to maintain the cost at a reasonable level. The JIT system is based on a philosophy of eliminating waste and utilizing the full capability of each worker to gain maximum benefit traditionally, purchasing departments have been given the task of negotiating for the lowest prices possible in an effort to reduce costs and increase company profits. These conventional relationships with suppliers were adversarial. Today's competitive marketplace calls for an updated strategy for the function. JIT (Just-in-Time) is one such approach to become a world-class competitor for world-class manufacturing. During the last two decades, the purchasing environment has become one of the most crucial elements in establishing the value added contents for the products and services and hence has become the vital organization in the dynamic international market [1]. Shortages of raw material, shorter lead time, high quality, increasing the variety of products with smaller runs, inflation, productivity and introduction of a JIT purchasing system etc. has prompted the realization of the importance of purchasing. The traditional approach to purchasing is at the root of many of the problems, business faces today. High inventory levels, soaring costs, adverse relationships with suppliers and quality issues which either stop production or results in poor products are just a few of the

problems with the current way of purchasing [2]. JIT purchasing functions often conflict with traditional practices of purchasing, which is characterized by competitive buyer-supplier relations with minimum communication and infrequent deliveries. The buyer carries large inventory [27, 58] to compensate for long lead-times and poor quality of incoming parts. In contrast a fundamental element of JIT purchasing is cooperative and long-term [47] buyer-supplier relationship. In addition to price the supplier selection is based on quality, technical expertise, and effective buyer-supplier communication, which result in frequent and reliable deliveries, high quality of incoming parts, small shipment size and parts delivered in exact quantity. As a result JIT purchasing helps to reduce inventory and increased productivity, benefiting both the buyer and supplier [36, 38, 40, 53, 54, 59].

II. The Spread Of Jit Movement

JIT is simply an English phrase and is not a Japanese original word. In the beginning JIT came into wide use in the Japanese ship building industry. The ship builders were getting their steel "just-in-time". Then JIT spread to various other original equipment manufacturing (OEM) companies who began demanding just-in-time deliveries from their suppliers. The basic idea of JIT was originally developed and brought to high level of sophistication by the Toyota Motor Company in Japan. This idea was formalized into a management system, when Toyota sought to meet the precise demands of customers. Toyota originally pioneered JIT system. The Toyota Production System (TPS) was invented and promoted by Taiichi Ohno, emphasizing the elimination of all kinds of unnecessary functions in the factories. In the 1960s, Toyota worked hard on developing a whole range of new approaches to manage manufacturing [5]. The development of these approaches was hastened by the 'oil shock' of the 1960s. By 1972, these new approaches had begun to attract wide attention in Japan and in the mid 1970s other Japanese companies began to experiment with, and adopted these approaches. At this stage this was not known as JIT; it was called 'Toyota Manufacturing System'. By the end of 1970s, the Toyota Manufacturing System had begun to attract attention in the West. One of the many elements of this system was a pull scheduling technique using 'Kanbans'. The system first became known in the West as 'Kanban System'. However, this was rather misleading, as Kanban was only a small part of the total system. A pull system has a simple rule to move the materials in the production line only when needed. This means move the materials by demand only. Since early 1980s, the approach has become widely known. As Western companies have adopted the approach, it has been known by many names like Zero Inventory Production, Stockless Production, World Class Manufacturing, Small Batch Production, and Continuous Flow Manufacturing. However, the term, which is most widely used to describe this approach to manufacturing, is 'Just-in-Time management', which is not a technique or even a set of techniques of manufacturing, but is an overall approach or philosophy, which embraces both old and new techniques. Now a days JIT concepts are being applied in many activities

in industries of a number of developed and some of developing countries. Many researchers [4,5,6, 7, 13, 16, 17, 18, 25, 26, 31, 34, 37,47, 48, 51, 52, 57, 61, 62] have shown the growing acceptance in their survey/case studies of various types of industries of the Japan, United States, United Kingdom, Italy, India, Germany, Korea and Hong Kong.

III. Concept of JIT

'Sell One- Make One' (SOMO) is the philosophy of Nissan and Toyota, which stress on lean production. Similar is the philosophy of General Motors and such like other automobiles companies. Like Crosby, several other experts have commented on JIT. Genichi Taguchi, while speaking on excellence said, "In India and western countries, emphasis is on the sophisticated machines and high grade materials, which are expensive, yet quality is not up to the mark. In Japan emphasis is on developing men and technology to utilize available resources; quality is high but cost is commensurate". "Technology is never really the problem. The problem is how to use technology effectively". All these statements made by experts and Chief Executive Officers (CEOs) of different companies highlight and support the concept of JIT. JIT leads to significantly higher quality and productivity and provides visibility for results so that worker's responsibility and commitment are improved. JIT may be described as an extension of the original concept of managing the material flow in industries to reduce the inventory levels at each stage. It is a demand driven approach, which encourages flow type production. It is also described as a drive to simplify the manufacturing system in order to quickly detect the problems and force immediate solutions. It is now well recognized that JIT is not just an assortment of techniques but really a philosophy. The central idea behind the JIT philosophy is to expose the hidden problems and involve all employees, to remove them, so that the necessity of higher stocks does not arise. The techniques and systems used by various companies under waste elimination techniques of JIT are as follows:

- Batch size reduction.
- Group technology layout.
- Scientific machine and factory design.
- Mixed model of production.
- Kanban applications.
- Balanced scheduling.
- Set-up time reduction.
- Flexible and multi-functional workforce.
- Vendors orientation to JIT manufacturing.

In the past different authors have tended to view JIT in different ways but today they are converging to a common perception of JIT. The various definitions and statements of JIT, defined and updated by many authors/ researchers have been given below:

Ansari [2]: "JIT is not just a series of techniques rather it is a manufacturing philosophy which requires the support commitment and participation of human resources at all levels of organization."

Garg et al. [19]: "JIT is a philosophy that defines the way the work should be done. It is concerned with creating the right environment for effective operation. They further stated that JIT is best defined as an approach to achieve excellence in a manufacturing company."

Baker [5]: "Just in time system is an approach for providing smoother production flows and making continuous improvements in processes and products."

Billesbach [8]: "JIT can be defined as an organizational

philosophy, which utilizes employees to identify and resolve problems and inefficiencies in the workplace."

Hall [26]: "JIT is not confined to a set of techniques for improving production defined in the narrowest way as material conversion. It is a way to visualize the physical operations of the company from raw material to customer delivery."

Gilbert [22]: "JIT is a shop floor control technique that allows the scheduling the shop floor with the use of a kanban which is a material tracking device".

Handerson [27]: "JIT is described as hottest and most controversial subject facing manufacturers and distributors."

Hong [29]: "JIT is described as a production of the smallest possible quantity at the earliest possible time using a minimum of resources, and elimination of waste in the manufacturing process."

Miltenberg [40]: "JIT is an approach where waste in the production process is systematically identified and removed to reduce cost and lead times and improve quality."

Mazany [39]: "JIT is a philosophy that extends throughout the entire organization, and one, which emphasizes a proactive approach to the management of operations."

Moore [42]: "JIT is a production system to produce the kind of units needed and the time needed and the quantities needed."

Prem Vrat et al [49]: "JIT is indeed a complex highly integrated system of methods techniques and philosophies which must be understood in a holistic sense."

Voss [60]: "JIT is an approach which ensures that the right quantities are purchased and made at the right time and quality and that there is no waste"

Voss and Robinson [61]: "JIT is a production methodology which aims to improve overall productivity through the elimination of waste and which leads to improve quality."

Schonberger [55]: "JIT is a system to produce and deliver finished goods just in time to be sold, purchased materials just in time to be transformed into fabricated parts and sub-assemblies just in time assembled into finished goods."

JIT can be summarized as a system to eliminate waste and achieve excellence in an entire organization. The sole purpose of JIT is to eliminate waste. Anything that does not add any value to the product is known as waste.

IV. Objectives of JIT

The objectives of JIT are achieved through several physical systems or projects. Some of JIT objectives are as follows:

- To reduce the set-up times and lot sizes.
- To achieve 'zero defects' goal in manufacturing.
- To focus on continuous improvement.
- To concentrate on involving workers and using their knowledge to a greater extent.
- Layout of equipments in such a way so as to minimize both travel distances and inventories between the machines.
- To reduce inventories and thus economize on inventory carrying costs.
- To eliminate waste (such as long set-up times, zig-zag material flow, scrap, machine breakdown, higher stocks, rework, inspection etc.).
- To identify any problem related to waste and solve that through total employees involvement.
- To eliminate all non-value adding activities by systematically identifying these.
- To cross-train the workers in multi-functions to maintain and enable them to run several machines at a time.

JIT companies tend to group their machinery and equipments into manufacturing cells. These cells are typically U-shaped to increase workers interactions and to reduce material handling; workers are cross-trained to handle multiple machines. Changing business environment is forcing the companies to adopt the JIT system. Almost all the excellent companies in the world are using the JIT system today. A study of the suppliers of raw materials, parts and components to the Mother Auto Industries in the US has revealed that over 70 percent of the companies have implemented JIT systems. JIT is also considered to be one of the major factors contributing to the grand success of Japanese industrial performance. In India, companies like Maruti Udyog Limited (MUL), Eicher, Escorts, Telco, Tisco, TVS, etc. have adopted JIT based systems and improved their product quality.

V. Elements of JIT System

The following are the main elements of a JIT system stated by many researchers:

- Master schedule [22]
- Automation and autonomation [34]
- Buffer stock removal [11, 17,25]
- Cellular manufacturing [17,25, 34, 46, 47, 48, 50, 51]
- Computer-integrated manufacturing [17]
- Continuous improvement [17,25,46,47]
- Effective communication [21, 34]
- Focused factories [34,48, 51]
- Flexible workforce [4, 17, 25, 28, 34, 47, 48, 51]
- JIT purchasing [23, 25, 34, 39, 46, 47, 48, 51]
- High quality [4, 25, 34, 46]
- Jidoka [44,46]
- Kanban system [14, 17, 25, 28, 33, 34, 44, 47, 48, 51]
- Layout improvement [4, 17, 25, 34, 47, 48]
- Process flexibility [14, 28]
- Product and process simplification [4, 25, 47]
- Pull-controlled flow [4, 12]
- Quality circles [34, 35, 51]
- Robots [12,17]
- Setup time reduction [4,14,17,25,28,34,46,47,48,51]
- Small lot size [4, 9, 14, 22, 25, 28, 44, 47]
- Standard containers [25, 34, 47]
- Standardization [14, 17, 28]
- Statistical process control [47]
- Statistical quality control [34]
- Streamlined process design [14, 28]
- Total productive maintenance [51]
- Total quality control [51]
- Under capacity scheduling [17, 34]
- Worker-centered quality control [17]
- Work-in-process reduction [47]
- Zero defect [47]
- Zero deviation schedule [17]
- Multi functional workers [34]

VI. Benefits Of JIT System

The JIT system is aimed at improving profits, and return on investment through cost reductions, inventory reductions, and quality improvements. These benefits explain wide acceptance of JIT in industry. The following are some benefits of a JIT system stated by researchers:

- Close supplier/customer relations [32, 36, 45, 50]
- Fast response to engineering changes [25, 32, 41]
- Improved competitive position [6]

- Improved equipment efficiency [6, 14, 28]
- Improved worker efficiency [6, 14, 28,38]
- Improved worker motivation [6, 14, 28, 38]
- Increased administrative efficiency [25, 41]
- Increased equipment utilization [24]
- Increased flexibility [25, 46,47]
- Increased inventory turns [24]
- Increased profit margin [6]
- Increased team work [14, 28]
- Less scrap [14, 28, 41]
- Lower overheads [46,47]
- Reduced product cost [6, 25]
- Reduced production lead time [4, 6, 30]
- Reduced purchasing lot size [4, 36]
- Reduced raw materials/parts [14, 28, 46,47]
- Reduced space requirements [6, 14, 24, 28, 41, 46,47]
- Improved quality [6, 14, 24, 25, 28, 32, 41, 46,47]
- Increased productivity [4, 14, 25, 28, 41, 46,47]
- Reduced inventories [6,10, 14, 24, 28, 36, 41]
- Reduced labour requirements [6, 24]
- Reduced paper work [6]
- Reduced work-in-process reduction [14, 28, 46]

VII. JIT Implementation

The JIT system is not new to the present scenario of industrialization. This technique is not limited to any particular country but due to its large potential of benefit it has a widespread application throughout the world. Many industries have adopted it and others are going to implement it for their survival in the fast competition at each stage in each area. Implementing JIT requires organizational changes as well as physical plant changes. Cultural transition barriers such as performance measures, organization structure and pay systems, often make organizational changes a tougher and longer process than the physical changes necessary for JIT. While solution to physical problems exists, JIT implementation [20] often waits for organizational changes to catch up. Sustaining the continuous improvement philosophy of JIT is critically dependent on this organization transition. Implementing JIT requires a plan along with commitment. This plan should be an integral element in the company's total business plan.

VIII. Motivation for JIT System

JIT emphasizes on quality, which is essential for a JIT system. The defects not only produce waste but they can also grind the production process to a halt. Since there is no inventory to cover up for mistakes, perfect quality is required by a JIT system. A JIT system is designed to expose errors and get them corrected rather than covering them up with inventory. JIT can be applied to many subsystems of a manufacturing environment such as engineering design, setup time and lot size reduction, purchasing, flexibility, suppliers' management, product development, inventory reduction at every stage, marketing, lead time reduction etc. among these purchasing has the cost saving. The purchasing goods represent 50-80% of the cost of goods sold for many companies [15], and in some industries such as textile industry, it accounts for more than 80% of the total cost. Usually, the purchasing department is expected to procure the right quantity of material of right quality at the right time, from the right source, and at the right cost [3]. JIT system has been implemented in many industries of several countries such as United States, United Kingdom, Italy, Germany, and Korea etc. JIT is an approach of excellence in

the entire organization, emphasizing on quality, by eliminating wastages to improve productivity. JIT is an inventory monitoring technique at each stage of the system starting from raw material to finished product to achieve the target in time.

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