

“A scientific Approach of zero inventories by using Just in Time approach”

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Abstract- In the early 1980's, a number of US firms followed the pioneering efforts of Shigeo Shingo and Taichi Ohno and adopted Just-In-Time (JIT) manufacturing in an attempt to reshape their manufacturing environments. JIT requires that a company have a few reliable suppliers and is believed to enhance productivity and build a leaner manufacturing system which minimizes inventories and reduces which reduces risk and helps minimize the cost of manufacturing. Just-In-Time (JIT) has been a very popular operations strategy partly because of its success in the Japanese industry. Various benefits, for example, inventory reduction, improved in operations efficiency, and faster response, have been studied widely in previous research. Therefore, successful implementation of JIT is vital to many companies.

Keyword: jit, lean production etc

I. Introduction-

Just-in-Time inventory system focus is having “the right material, at the right time, at the right place, and in the exact amount”-Ryan Grabosky

Just-In-time (JIT) is also defined in the APICS (American Production and Inventory Control Society) dictionary as “a philosophy of manufacturing based on planned elimination of all waste and on continuous improvement of productivity”. It also has been described as an approach with the objective of producing the right part in the right place at the right time (in other words, “just in time”). Waste results from any activity that adds cost without adding value, such as the unnecessary moving of materials, the accumulation of excess inventory, or the use of faulty production methods that create products requiring subsequent rework. JIT (also known as **lean production** or **stockless** production) should improve profits and return

on investment by reducing inventory levels (increasing the inventory turnover rate), reducing variability, Improving product quality, reducing production and delivery lead times, and reducing other costs.

A simple definition of JIT is to produce and deliver finished goods just in time to be sold, subassemblies just in time to be assembled into finished goods, fabricate parts just in time to go into subassemblies, and purchase parts just in time to be transferred in to fabricated parts. In a nutshell, JIT is a system that produces the required items at the time and in the quantities needed. It is an approach that combines apparently conflicting objectives of low cost, high quality, manufacturing flexibility and delivery dependability. JIT is viewed as a level of perfection achieved by continuous elimination of the wasteful use of resources. The long term objectives of eliminating wastes in a manufacturing process that is so

streamlined, cost efficient, quality oriented and responsive to the customer needs that JIT becomes a strategic weapon for productivity improvement.

II. History and Background of JIT

JIT is a manufacturing philosophy, which seeks to eliminate the ultimate source of waste; Variability, in all of its forms throughout the producing processes, from purchasing through distribution. By eliminating waste, JIT targets production with the minimum lead-time and at the lowest total cost. The JIT philosophy has its roots after World War II when the Japanese were striving to compete with the U.S. manufacturing system (also known as Mass Production). Taichi Ohno was the founder of this philosophy in the 1940s when he began developing a system that would enable Toyota to compete with U.S. automakers. Note that the environment dominating U.S. manufacturing over the last five decades has been based on the Material Requirements Planning (MRP) formalized by Joseph Orlicky, Oliver Wight, and George Plossl. In an MRP environment, planning is performed based on the independent (customers') demand, in an almost JIT basis. However, shop floor control is performed based on a push philosophy in which manufacturing orders are introduced in the system and pushed through production. This is the fundamental difference between JIT and MRP.

JIT manufacturing can be traced back to the late 1700's (Just In Time, Toyota). Eli Whitney contributed his concept of interchangeable parts to the idea of JIT manufacturing in 1799. This concept was developed when Whitney took a

contract from the United States Army to manufacture 10,000 muskets at the low price of \$13.40 each. Over the next several years manufactures overall focused on the development of individual technologies. Through these years few people were concerned with the processes that each product went through during production. Early industrial engineers in 1890 began to be concerned with individual work methods, applying science to management, and all work elements. Frederick Taylor contributed the idea of standardized work (Just In Time, Toyota). Frank Gilbert conducted a motion study, which led to the development of process charting and organized labor tasks.

In 1914 Henry Ford introduced the idea of the moving assembly line to the world while producing his Model-T Ford, thus revolutionized manufacturing. By 1916, Ford began to implement the idea of JIT manufacturing (Wren, 1999). This reduced the inventory needed from \$60 million to \$20 million dollars to produce the same number of vehicles (Wren, 1999).

The present idea of JIT manufacturing can be traced to Toyota motor company in Japan. However, to begin use of JIT manufacturing in Japan, they first researched American production methods focusing on Ford's practices (Just In Time, Toyota). In Japan JIT manufacturing is referred to as the Toyota Production System. The realization for the new system came after World War II when the Japanese automotive manufactures knew they were far behind the American motor companies. The president of Toyota made a comment about the gap, "Catch up with America in three years, otherwise the automobile industry of Japan will not survive." JIT manufacturing is a result of limited demand, space, and resources in Japan compared to America. By assessing and solving these problems Toyota was able to increase efficiency and keep up with American auto manufacturing. Ten years after the first introduction of the new production system Toyota successfully implemented this technique across the company. This began started to be implemented into the western world during the late 1970's to early 1980's.

III LITERATURE REVIEW

Many researchers have carried out significant work in the area of JIT:

Ebrahimpour and Withers (1993) identified two manufacturing philosophies namely Static optimization which means that the emphasis is on management of the workforce, functional autonomy, cost minimization and maintaining stability. Second philosophy is Dynamic evolution which means the philosophy of continual improvement. They conducted a survey of 221, US based firms with the help of questionnaire based on five point Likert scale. They analyze the data using ANOVA and tested at the 0.05 significance. Responses from non-JIT firms were indicative static optimization philosophy.

Whereas JIT firms responses indicates that they are using dynamic evolution philosophy.

Su (1994) had shown the benefits of implementing JIT such as reduced space requirement, reduced inventory investment, reduced manufacturing lead time and increased equipment utilization etc. They also raised some issues for the managers to be aware of before implementing JIT such as cooperation between management and the workforce, adhere to daily schedules, changes in layout, revision of purchase agreements, small containers use etc. He conducted his study in a heavy industry of Korea and identified the important activities which the company has followed for implementing JIT.

Mahesh Mathur (1994) presented the design and operation of a computer simulation model developed on a SLAM SYSTEM to compare the buildup of set up costs and inventory carrying costs with varying lot sizes. While reduction of lot sizes is a necessary step towards implementation of 'Just-In-Time' (JIT) in a job shop environment, a careful cost study is required to determine the optimum lot size under the present set up conditions.

Banerjee and Kim (1995) have presented an integrated JIT inventory model with a single buyer and supplier showing that a point optimal integrated inventory replenishment policy, as opposed to independently derived policies for one buyer and supplier, results in significant economic benefits for both parties.

Nassimberri (1995) has analyzed nature of the relationship between principal operational JIT practices, i.e. the practices that create the link between buyer's and supplier's operation chains. The study was carried out on the basis of a survey of 457 respondents in different areas from 50 Italian plants. The study has demonstrated that the practices considered show 3 main underlying factors: delivery synchronization, design and interaction on quality. Each of these factors is partly independent from others and can be interpreted as a distinct type of buyer supplier interaction.

Zhiwei Zhu and Paul H. Meredith (1995) defined the critical elements in JIT implementation. The objective of their research was to fill the gap by organizing an overall picture of a JIT implementation process from the views of both practitioners and academicians and by comparing findings based on studies employing different research methods.

McLachlin (1997) suggested that there should be an active supplier audit and certification programme and they should be involved in new product development. He also suggested use of mistake proof devices and the items should be inspected at the immediate workstation to minimize the number of rejections.

IV OBJECTIVES OF JIT

The objective of JIT manufacturing system is to:

- Eliminate waste that is, minimize the amount of equipment, materials, parts, space, and worker's time, which adds a great value to the product
- Increase productivity

JIT means making what the market demands when it is in need. It is the most popular systems that incorporate the generic elements of lean systems. Lean production supplies customers with exactly what the customer wants, when the customer wants, without waste, through continuous improvement.

V PRINCIPLE OF JIT

The first basic principle involved in JIT production approach is the elimination of waste. In a JIT system, waste is defined as anything associated with the production process that does not add value to the product. Thus, waste includes quality defects, inventories of all kinds, time spent to move material and time spent in setting up the machines. If the implications of managing the reduction in waste for the categories mentioned above are analyzed, it becomes obvious why JIT is involved in all aspects of the management of production Process. The second principle of JIT involves the management of people. JIT philosophy assumes that people are capable and willing to take on more responsibility. If defective parts are being produced, an individual can stop the production line. Once stopped, everyone working on the line has the responsibility to solve the problem.

The production worker is also given the responsibility for the maintenance of his equipment. Frequently, a production worker goes through a check list before starting to operate the equipment similar to that done by a pilot before flying an aircraft. Along with the new job responsibility for workers comes the responsibility for management to provide the training, time, tools and, most important, the authority necessary to accomplish the job. Inventory is seen as incurring costs, or waste, instead of adding and storing value, contrary to traditional accounting. This does not mean to say JIT is implemented without awareness that removing inventory exposes pre-existing manufacturing issues. This way of working encourages businesses to eliminate inventory that does not compensate for manufacturing process issues, and to constantly improve those processes to require less inventory.

VI Factors which influences the successful implementation of JIT:

1. **Top Management Support:** Top Management Support has been recognized as the most important factor in the implementation of JIT because JIT is an innovative

approach, which requires changes throughout the organization as well as the commitment of all people within the organization.

2. **Employee's Participation and Bottom up Management:** Employees participation and bottom up management have been recognized as important factors for successful JIT implementation because they lead to the improvement of performance in quality, productivity and flexibility.
3. **Education and Training:** Education and training plays a vital role in a JIT environment. Both attitude change and skill development are necessary. Management and employees at all levels in the organization must understand and accept the need for JIT change. It is important that all levels of management understand JIT philosophy, how JIT operates, the expected benefits and needs for JIT implementation.
4. **Team Work:** Involvement of people at all levels of an organization paramount in JIT implementation aspects. The creation and maintenance teams are the mechanism by which this involvement occurs.
5. **Quality:** One of the basic requirements for a successful implementation of JIT is the existence of total quality management principles. JIT experts advise against the implementation of JIT unless a company has made a full commitment to quality and productivity.
6. **Commitment:** To enable suppliers to deal with customers in a confident manner, they must be backed by the level of commitment given by manufacturers. Without a partnership between the customer and supplier, there will always be hesitation instead of trust. The concept of trust and commitment in JIT is used to build partnerships and to reduce the needs for materials-production control, receiving inspection or inventory buffers that many companies have constructed.

VII INVENTORY REDUCTION BY JIT:

The cost of warehousing inventory is a non-value added activity. Upon receiving merchandise, your customer's only concern is, "Does it work and is it going to perform the function for which it was purchased?"

Just-in-time (JIT) purchasing and just-in-time production help combat these undesirable, non-value added inventory costs. These demand-pull inventory systems are applied by requiring that raw materials arrive in your warehouse exactly as they are needed for production or distribution. The goal of JIT systems is to eliminate all non-value added activities.

VIII The benefits of just-in-time inventory systems:

JIT purchasing and productions systems offer many advantages over traditional systems, such as:

- Lower investment in inventory
- Reduced space required to store inventory
- Reduced risk of defective and obsolete inventory
- Reduced manufacturing costs
- Simplification of your costing system (all goods sold / produced will flow to the cost of goods sold since inventory is sold and produced only when needed)

The primary benefit of a JIT purchasing or production system is the reduction of inventory, ideally to zero. Reducing inventory will decrease the cost of handling and storing materials. It will also free up space that can be used for more cost effective activities.

VIII ADVANTAGE OF JIT

Deploying JIT results in decrease of inventories and increases the overall efficiencies. Decreasing inventory allows reducing wastes which in turn results in saving lots of money.

There are many advantages of JIT:

- Increases the work productivity
- Reduces operating costs
- Improves performance and throughput
- Improves quality
- Improves deliveries
- Increases flexibility and innovativeness

For industrial organizations to remain competitive, cost efficiencies have become compulsory. JIT helps in this process. It is extended to the shop floor and also the inventory systems of the vendors. JIT has been extended to mean continuous improvement. These principles are being applied to the fields of Engineering, Purchasing, Accounting, and Data processing.

Just in Time aims to reduce waste and improve quality, bringing a whole range of benefits to manufacturing businesses of any size, as well as retailers with complex supply chains. These benefits include:

Standardization: It refers to the elimination of the heterogeneity in services in order to simplify, improve and standardize processes and the related performance of the employees involved.

Competitive Advantage: Lean manufacturing helps create a more flexible business that has better communication with customers and suppliers, and can react more quickly to market demands. Many businesses find greater customer loyalty is a

welcome by-product of adopting this new way of working. Implementing JIT working will help your business move towards industry best practice and keep up with competitors.

Improved Job Satisfaction: JIT demands active participation in the production process from employees. It increases their skills, gives them greater responsibility and fosters an interest in the performance of the whole company, rather than just their department or team.

Flexibility: System's flexibility i.e. response to change improves. The change may involve variations in quantity of customers, type of services, routing pattern, alternate materials, workforce availability, etc.

X CONCLUSIONS

This chapter presents some important conclusions obtained from present work. In this work, various vital issues of JIT implementation have been analyzed. The following conclusions have been drawn:

1. It has been observed from literature that JIT implies doing the job right the first time and permanently solving problems as soon as they appear. It also means efficient use of resources and removing deficiencies in the system.
2. Most important elements for JIT implementation are as follows:
 - Frequent and Reliable Service
 - Customer Awareness
 - Communication and Information Sharing
 - Team Work.
3. It has been observed that given elements are the most important and relatively less difficult to implement. These are Communication and Information Sharing, Team Work, Frequent and Reliable Service, Customer Awareness and Commitment.

XI SCOPE FOR FUTURE WORK

JIT concept is growing very fast. So, there is a lot of scope for future research in this area. Some important issues identified for future research are as follows:

1. In the face of global competition, the need of customers demands from the companies to improve the product quality and customer service. The reduction of wastage has long been used by the manufacturing sector as a means to reduce costs and improve the product quality.

2. Scope of JIT in computer integrated manufacturing system.
3. JIT can also be implemented in other service sectors like Healthcare, Education, and Transportation etc.

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