

# Just-In-Time Implementation in Small and Medium Enterprises

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**Abstract**— The new uprising in the manufacturing goods and service sector has created great challenges for the industry. Now-a-days companies are highly quality focused and customer driven. Besides quality, a company has to maintain the cost of the product at a reasonable level. It has to supply products at reliable and reduced delivery time. Customers also demand more product variants that means reduced lot size and high flexibility in operations. Confronting these challenges, companies are forced to find ways to reduce costs improve quality and meet the ever-changing demands of their customers. There is no question that the elimination of waste is an essential factor for survival in today's manufacturing world. Just-in-time production system is one of these initiatives that focus on cost reduction by eliminating non-value added activities. Many manufacturers have come to realize that the traditional mass production concept has to be adapted to the new ideas of JIT manufacturing to continue moving up the ladder in a global, competitive and growing market. Just-in-time represents a philosophy of continual improvement to obtain performance excellence in the operations of an inventory system. This management philosophy is primarily applied in large-scale industries but there is no reason why similar concepts can not be applied in Small and Medium Enterprises (SMEs) as well. This research paper addresses the implementation of Just-in-Time production system in SMEs. The goal of this research is to investigate how JIT can be implemented in SMEs. Finally the conclusions and recommendations are also provided.

**Key words:** SMEs, waste elimination, cost reduction, employee empowerment

## I. INTRODUCTION

Just in time (JIT) is a production strategy that strives to improve a business return on investment by reducing in-progress inventory and associated carrying costs. The basic ideas behind the JIT production system are waste elimination, cost reduction, and employee empowerment. It is the concept of ideal production. It centers on the elimination of waste in the whole manufacturing environment, from raw materials through shipping. Just-In-Time is defined as "the production of the minimum number of different units, in the smallest possible quantities, at the latest possible time, thereby eliminating the need for inventory. Remember, JIT does not mean to produce on time, but to produce just in time.

There are certain misconceptions about JIT philosophy. Due to these misconceptions it is rarely adopted in SMEs; there appear to be problems in promoting and deploying the concept of JIT to such organizations. Some of the misconceptions about JIT are:

### A. *JIT being restricted to high technology systems.*

Being a philosophy, JIT doesn't restrict itself to high technology manufacturing environments, which make extensive use of modern technologies like FMS, CIM etc.

JIT philosophy is valid in any manufacturing environment, regardless of the level of advancement in the technology hardware.

### B. *JIT is highly cultural specific.*

Being of Japanese origin, there could be a tendency to believe that success of JIT is highly culture specific. But there are ample and conclusive evidence that culture doesn't stand in the way of JIT implementation. However, cultural differences play a role.

### C. *JIT being restricted to any specific type of industry or size of the industry.*

Organizations of different sizes, in a variety of industries, have successfully implemented JIT. Indeed some applications have shown that JIT is eminently suited to nonmanufacturing situations as well, such as in service and administrative work situations. It can be easily adopted in SMEs.

This research paper addresses the implementation of Just-in-Time production system in SMEs.

## II. LITERATURE REVIEW

There is reasonable consensus among researchers that Just in Time (JIT) is a philosophy of continuous improvement in which non-value adding activities are identified and removed in order to reduce costs, improve product quality, improve performance, improve delivery, add manufacturing flexibility and stimulate innovation in the workplace [1,2]. There are seven forms of waste were identified by Toyota engineers: Waste of overproduction, Waste of inventory, Waste of repair/defects, Waste of motion (unnecessary movement), Waste of processing, Waste of waiting, and Waste of transport [3].

JIT is a manufacturing philosophy, successfully implemented mostly in large-scale industries. Research reviews indicate it is rarely adopted in SMEs; there appear to be problems in promoting and deploying the concept of JIT to such organizations. Nevertheless, small and medium enterprises SMEs play a major role in the national economy. Musara Mazanai (2002) when studied in SMEs, JIT systems have tremendous effects on all operations of a firm, including design, accounting, finance, marketing, distribution, etc., and thus are of interest to all levels of a firm's management. However, JIT has not received serious attention from SMEs [4].

Reports on a study performed in SMEs to select and prioritize various techniques for the implementation of JIT in a seasonal order-manufacturing environment through the QFD technique. Analysis indicates that buffer stock removal and lot size reduction were the key issues to be assigned higher priority than throughput improvement. However, this prioritization has to be carried out on a case-by-case basis as each manufacturing system has different predefined goals and targets, and is set within a different context [5].

The inventory-productivity relationship has been described in many studies but never examined statistically in SMEs. There is a correlation between labour productivity and Just in Time (JIT) minimizing inventory. We approach this model in two different ways. The results of the first approach indicate that a higher inventory or Work in Process (WIP) inventory, each tested separately, has a positive effect on labour productivity, which was not expected. A higher WIP/sales ratio, however, has a negative effect on labour productivity, as expected. The results of the modified model demonstrate that a higher capital investment per employee and a higher WIP/sales ratio have a negative impact on labour productivity [6].

Self-administered questionnaires were distributed to a sample of manufacturing sector SMEs in the food, wood and furniture, metals, non-metals and other industries. The study revealed that the majority of SMEs in the manufacturing sector were not applying the JIT inventory management principles. It was furthermore revealed that there are challenges impeding the implementation of JIT principles in the manufacturing sector SMEs. These challenges include lack of reliable supplier networks, lack of capital and lack of knowledge of immediate financial gains among others. Furthermore, statistically significant positive correlations between the application of JIT inventory management principles and cost efficiency, quality and flexibility were found. It is therefore deduced that manufacturing sector SMEs can benefit significantly in terms of improved quality of products, increased operational cost cuts and increased flexibility by applying the JIT inventory management principles [7].

### III. BARRIERS IN IMPLEMENTING JIT IN SMES

There are barriers which potentially impede successful implementation of JIT production. The absence of senior management commitment and support was the most frequently reported reason for JIT failure. Supplier education is an often neglected part of JIT implementation, and companies seeking to implement JIT fully would benefit greatly by addressing this issue [8]. Other barriers include lack of formal training/education for management and workers, and lack of cooperation with suppliers, obstacles to employee participation [9], schedules may be more complex because changeovers are frequent [10], and lack of accurate forecasting system [11].

Goonatilake [12] and Ebrahimpour and Schonbrger [13] have exposed the problems of developing countries on the basis of their studies of manufacturing firms, in developing countries. The problems include underutilization of capacity, low productivity; unreliable and long lead times, shortage of raw materials and parts, inferior quality, lack of technology transfer and management etc. Some other problems identified by researchers in context of developing countries (including India) include inferior quality, little workers' motivation, exact quantity on exact time, and unreliable transportation system etc. Since most manufacturers enjoy a certain degree of monopoly status, they are more concerned about maintaining efficiency rather than reducing cost (two main inventory control objectives), which is just reverse the case of developed countries, where maintaining efficiency is automatically achieved due to better infrastructure and practices. Ebrahimpour and

Schonberger [13] have also suggested JIT and TQC (total quality control) to solve such problems of developing countries.

### IV. RESEARCH OBJECTIVE

Various organizational modifications and management initiatives are required for the successful JIT implementation in SMEs. There are many factors which impede the application of JIT inventory management approach. The level of difficulty faced in implementation of various JIT subsets differs from industry to industry and place to place. The objective of the thesis is to justify the implementation of just-in-time production system for SMEs. Other things will include analysis of JIT system from its conception to its success today, basic components and tools of JIT, and specific requirements for implementing JIT systems for the industries in focus.

### V. THE SPECIFIC OBJECTIVES ARE

The paper attempted to achieve the following objectives:

- (1) To investigate the application of JIT inventory management among SMEs in the manufacturing sector.
- (2) To investigate the factors which impede the application of the JIT inventory management approach among SMEs in the manufacturing sector.

### VI. STUDY

Can JIT be applied to small and medium enterprises? To get this answer, JIT is applied to Keshav Polymer Limited which is a small manufacturing company making plastic products like plastic toys. A descriptive analysis of the company, its departments and its potential for the application of JIT inventory system is done. Some structural changes are done in the plant layout.

The study is done in two parts. In the first part, various elements of JIT which are necessary for its implementation are studied. The feasibility of these parts is checked whether they can be incorporated in the company or not. In the second part, most common/frequent problem faced in the implementation of JIT elements is studied and their level of difficulties- easy, moderate or hard is determined.

#### A. Various Factors Affecting Jit Implementation Reliable Supplier Networks

The customer-supplier relationship is a primary area of focus in a JIT program. JIT system is based primarily on their missions and ability to predict and provide for material requirements when they are needed. Traditionally, suppliers were thought of and treated as adversaries and so there was always a need of safety stock levels against poor performance by suppliers. JIT requires that users strive to develop trusting and shared partnerships with their suppliers. Vendors must become part of the team and share in the goal for total quality control, delivering zero defect parts, frequently and on time to eliminate wasteful in-house safety stock. Suppliers must be flexible and have the capability to make and deliver parts as necessary. Part of the supplier selection process involves establishing a dual

sourcing network. Suppliers must be innovative and have the technology and expertise to assist in problem solving.

### B. Equipment Layout

Cellular manufacturing is used in JIT system. Cellular manufacturing is one of the cornerstones when one wants to become JIT. Cellular manufacturing is a concept that increases the mix of products with the minimum waste possible. A cell consists of equipment and workstations that are arranged in an order that maintains a smooth flow of materials and components through the process. It also has assigned operators who are qualified and trained to work at the cell.

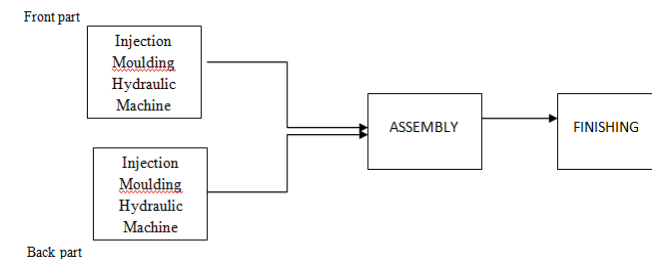


Fig. 1: Plant Layout

### C. Small lot size

The major premise behind JIT is that inventory levels will be as low as practical to meet the production schedule. The objective is to eliminate waste in both time and materials through the reduction of inventories. The traditional purchasing and procurement of materials system relies on the "just-in-case there is a disruption in supply" concept of large batch quantities that often results in lower quality of goods and greater cost. Large lot purchases rather than small quantities are also used because shipping and handling costs are considered constant, regardless of lot size. Part of the justification for these large quantity purchases is the perceived cost savings associated with lower shipping and handling costs discounted for size. JIT purchasing practices, however, emphasize the purchase of minimum lot sizes allowing for tighter control over inventory and eliminating large stockpiles of parts. Under the JIT system, the improved product quality, decrease in holding costs, and increase in customer responsiveness and sales far outweigh the cost savings associated with large quantity discount rates.

### D. Setup Reduction

Setup time is time spent in preparation to do a job. In manufacturing, set-up time is the elapsed time between when the last unit of one lot is produced and when the first good unit of the next lot is produced. Set up or changeover reduction has been an important element of lean thinking for a number of years. However, changeover and set up time are actually different things. Changeover is the time between good product and good product at the right speed. Set-up time refers to the time taken to physically make the change to the line in order to run the new product, run-up time is the time taken to make adjustments to the line in order to produce products of the specified quality at the specified production speed. Set-up reduction may bring the following impacts to the shop floor: lot-size can be reduced, help to reduce inventory, reduce the cost of setup labor, increase the capacity on bottleneck equipment, help to eliminate the set

up scrap, and reduce the potential quality problems and obsolescence. There are a number of potential advantages to reducing the time taken to changeover a production line, these include: increased efficiency, reduced stock requirement, increased capacity, reduced work in process, increased flexibility.

### E. Design simplicity

A simple design tends to be more aesthetically pleasing. Simplicity is more accessible. It helps us get things done faster, more easily and more efficiently. It leads to less need for instruction and support. Design simplicity can be achieved by removing the features which are unnecessary, by placing things into logical groups which makes them easier to find or by moving the features and options to another location.

### F. Quality

Another vital element of JIT is the assurance of quality in every part. Total quality control requires that all incoming parts be defect-free. Suppliers should inspect at the source in keeping with defect free delivery. This eliminates the necessity for inspections upon delivery which are costly, redundant, increase lead times, cause accumulation of inventory in delivery areas of the plant, and add no value. The emphasis is to shift from a store-room operation to a front-line operation. The goal of defect-free parts requires building quality into the process and ultimately into the final product. Improving product quality also eliminates the need for incoming inspection which increases turn-around and delivery times as well as manpower efforts and associated costs.

### G. Employee involvement

A successful JIT environment should have the cooperation and involvement of everyone in the organization. People are managers when they have a hand in planning their job activities and measuring the results of what they have done. The total employee involvement philosophy includes teaming, empowerment, gain sharing and training etc. Employees are given considerable power and authority. Quality circles are formed, where teams of employees are given the freedom to find solutions to problems and to come up with their own methods.

### H. Multifunction workers

For JIT, workers should be multifunctional. Employees are rotated out of their jobs and trained into a new job. They are not only trained on how to do the job, but they are also trained about the quality and maintenance issues that go along with the job. The principle here is that an employee with a well-rounded background about how the company operates will be valuable to the company in making improvements

### I. Zero Defects

Zero defects is a management tool aimed at the reduction of defects through prevention. In manufacturing, traditionally people thought that producing zero defects are not possible and not necessary. It is because of the fact that people thought that at some level of production it would be no longer possible to produce without defects and not necessary because although there were defects, the product is still reaching reach customers expectation. But with the aim of JIT, defect prevention is preferable to quality inspection and



correction at the later stage. This is also related to a part of Quality Management.

*J. Capital Investment*

JIT requires considerable capital investment to update machinery, to change plant layout to cellular layout and training (at all levels).

*K. Training to worker and supplier*

Education and training are two necessary conditions for the involvement of the firm's employees. The training program in JIT environment is a continual process, but most of the training is extensive at the beginning and the others are given on job training. Training that employees require are interpersonal skills, the ability to function within teams, problem solving, decision making, job management performance analysis and improvement, business economics and technical skills. During the creation and formation of JIT, employees are trained so that they can become effective employees for the company. In JIT, not only training of employees is required but also training of suppliers is also necessary. They are important part of JIT for supplying the raw material on time.

*L. Analysis*

After studying the factors affecting the implementation of JIT, an analysis is done to find the level of difficulty faced while implementing JIT in Keshav Polymers Limited. Self-administered questionnaires were distributed to a sample of manufacturing sector SMEs in the food, wood and furniture, metals, non-metals and other industries. The study revealed that the majority of SMEs in the manufacturing sector were not applying the JIT inventory management principles. It was furthermore revealed that there are challenges impeding the implementation of JIT principles in the manufacturing sector SMEs. These challenges include lack of reliable supplier networks, lack of capital and lack of knowledge of immediate financial gains among others. Furthermore, statistically significant positive correlations between the application of JIT inventory management principles and cost efficiency, quality and flexibility were found. It is therefore deduced that manufacturing sector SMEs can benefit significantly in terms of improved quality of products, increased operational cost cuts and increased flexibility by applying the JIT inventory management principles.

*M. Level of difficulty in implementing JIT*

S. No.	Elements of JIT	Calculated Score	Level of Difficulty
1	Capital Investment	7.6	Low
2	Reliable supplier networks	7.9	Low
3	Equipment layout	8.8	Low
4	Small lot size	6.3	Moderate
5	Setup Reduction	5.1	Moderate
6	Design simplicity	7.8	Low
7	Quality	4.2	Moderate
8	Employee involvement	3.6	High
9	Multifunction workers	2.8	High

10	Zero Defects	2.5	High
11	Training to worker and supplier	7.1	Low

Table 1: Level of difficulty in implementing JIT

A questionnaire list was given to all the employees of the Keshav Polymer Limited. In the questionnaire list all the elements of JIT were listed. They were asked to rate the level of difficulty of each element on the scale of 1-10. A factor which is easiest to implement is given 10 numbers and a factor which is most difficult to implement is given 0 number. After that, the level of difficulty of each element was calculated by taking simply mean. If the calculated score was between 1-4, then those factors are difficult to implement. If the calculated score was between 4-7, then those factors are difficult to implement. If the calculated score was between 7-10, then those factors are difficult to implement.

From the analysis, it is clear that, In Keshav Polymer Limited factors like Capital Investment, Reliable supplier networks, Equipment layout, Design simplicity and Training to worker and supplier are easy to implement. Factors like Small lot size, Setup Reduction and Quality are difficult to implement. Factors like Employee involvement, Multifunction workers and Zero Defects are difficult to implement.

*N. Management Initiatives Required*

The predominant reason for JIT failure is lack of commitment by top management. JIT must be launched where there is absolutely no skepticism about management's long-term commitment to JIT success. Employees recall management's past track record on "flavor of the month plans" that died quietly with little or no fanfare. The first time management compromises quality in favor of quantity it will devastate the morale of the shop floor personnel. They sense that management's main emphasis is money for products shipped, not customer satisfaction, thus relegating JIT to a quiet death.

JIT must have a champion for its cause within every organization. Ideally, this advocate would be the highest ranking person who applies to your situation, i.e., the CEO at the corporate level, the division manager at the division level or the plant manager at the plant level. Typically, the consciousness of JIT penetrates the organization somewhere below this top level of management. For the greatest chance of success, JIT should be presented to the top manager as soon as possible. By initially teaming up with the top manager, he or she will perceive ownership of the JIT concept, thus he or she will have a stronger commitment to JIT. If the top management does not embrace the concept of JIT, but rather it develops at the middle management level, the chance for failure increases.

There are two key elements that are management's responsibility: motivation and education. Management must use these elements to overcome the reluctance to change by the employees and the natural fear that accompanies change. Each level of the organization has different fears about JIT so each level requires a different motivational approach. Management must understand the apprehensions of people at every level and what actions can be taken to gain their trust and commitment to join the JIT venture.

## VII. CONCLUSION

JIT is a production system that is mainly characterized by the removal of inventory from production processes. This system calls for certain changes in operations and internal culture like the restructuring of production floors, retraining of workers, new and increased worker responsibilities.

JIT has several benefits that can enhance a firm's production cycle. JIT can also generate costs or setbacks especially if ill applied. Some of the benefits of JIT include high quality and cheaper goods, reduction in waste levels and increased supplier relationship. The demerits also comprise of a possible halts in production during times of natural disasters, the risk of delayed products to consumers due to defective parts and the cost of paying salaries and wages during periods of low or no production.

Keshav Polymers Limited is a small manufacturing company making plastic products like plastic toys. In order to increase its productivity capacity, the company decides to change its manufacturing system and expand its operations. It seeks the advice of a consultant who suggests that the company can adopt JIT. The management is surprised to learn that JIT can be applied to a small company. Factors like Capital Investment, Reliable supplier networks, Equipment layout, Design simplicity and Training to worker and supplier are easy to implement. Factors like Small lot size, Setup Reduction and Quality are difficult to implement. Factors like Employee involvement, Multifunction workers and Zero Defects are difficult to implement.

## VIII. FUTURE OF JIT IN INDIA

Being a philosophy, JIT does not restrict itself to high technology manufacturing environments which make extensive use modern technologies like flexible manufacturing systems (FMS) or computer integrated manufacturing (CIM). JIT philosophy is valid in any manufacturing environments, regardless of the level of automation in the technology hardware. Similarly, the philosophy is not limited to any specific type of industry nor does the size of the organization matter. Organizations of different sizes, in a variety of industries, have successfully implemented JIT philosophy. Indeed, some applications have shown that JIT is eminently suited to non-manufacturing situations as well as, such as in service and administrative work situations. It may not be possible to shift from traditional manufacturing system to JIT system at once. To start with companies may try to implement JIT elements that are easy to implement. Some case studies and survey studies must be done in developing countries like India to expand the base of JIT applications in India. As service sector is growing very fast in developing countries like India but poorly managed. JIT can be very useful in improving the performance of service sector. This becomes another area for future research.

Indian Industries are going through tough competition and have to improve in order to become competitive globally. JIT like techniques can be very helpful in improving the performance of Indian industries and it has also been demonstrated in literature that JIT approach can be applied in Indian conditions also. Shifting from traditional system to JIT system may not be possible at once but Indian industries can start with applying some JIT elements that

may be easy to implement. Proper training can be very helpful in implementation aspects. JIT can be very effective in Small and Medium Enterprises (SMEs) also.

## IX. RECOMMENDATIONS

For JIT to be feasible in India there needs to be an upgrade of India's infrastructural assets. There needs to be more of everything; education, power lines, water pipes and roads. Infrastructure helps in generating income to grow and develop an economy. Hence, a good infrastructural base will help in implementation of JIT. The culture of maintenance also needs to be adopted, maintained and upheld by Indian industries.

Companies who hope to change into a JIT system must improve upon their internal culture of training, employee contribution, and suggestions. This does not only hold true for a JIT system since internal operations of traditionally producing companies will be heavily enhanced when this is implemented.

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