CHAPTER 6
RESULTS AND DISCUSSION

6.1 DATA COLLECTION & ANALYSIS OF JIT FACTORS

The approach to the work is a qualitative study of a large number of companies located in Delhi-NCR like Faridabad and Noida as many industries (list of industries appears in Appendix III) are located there, and involves face-to-face interviews with the senior representatives from each company. Over a hundred industries (102 industries) are included in the present study of which about 50% are ISO certified companies. The study is based on the response received through the use of a well-structured questionnaire (appears in Appendix II) that consisted of various questions relating to JIT and its implementation. 30 industries did not respond to the questionnaire. Of the remaining 72 industries, about 20% are using JIT in totality, but the various components of JIT implementation are not being uniformly applied in all the industries, rather they varied industry wise. About 25% of respondent industries are using JIT in fraction, and remaining 55% are not using JIT. Out of those implementing JIT, most of the average Indian industries have recently started implementing JIT. Those with major JIT programmes, have started as early as 1986, and have reported the average implementation period of more than three years. The three important factors that critically contributed to JIT implementation for major JIT users included supplier relationships, employee involvement and top management’s commitment. The other factors such as proximity to suppliers, improved production system, teamwork, informal working environment, workers empowerment etc. were found to be given less weightage in JIT implementation. The main reasons that encouraged major JIT users included gain in competitive advantage in the market through reduced lead time, simplification of production planning and control that resulted in improved production atmosphere and drastic reduction in inventory level. JIT were initiated by the middle level management.
on the instructions of the top level management. The components of JIT and their implementation in respect of Indian industries are discussed below. A few case studies are provided in Appendix I. Every JIT factor is comprehensively analysed and discussed below for its applicability in context of Indian industrial environment.

6.2 SUPPLY CHAIN MANAGEMENT AND SUPPLIER RELATIONSHIPS

Supply chain management is one of the most important strategic aspects of inventory management. Whom to buy materials from, how to transport goods and services, and how to distribute them in the cost-effective, timely manner contributes to much of an organization. It ensures uninterrupted flow of materials and information in the supply chain and drastically cuts short the lead time. Suppliers are the most critical components of the supply chain, as they are responsible for supplying the raw materials and other parts and components to the manufacturer. Besides making deliveries on time and in specified quantity with right quality, the supplier should be able to react to unforeseen changes such as increase or decrease in demand, quality specifications or delivery schedules that occur very frequently in the organization. JIT requires that a company must have a few reliable suppliers so that it can work with them closely, and the suppliers are able to change their schedules and technologies quickly to meet the company’s changing needs. Choosing a wrong supplier and a trust deficit in the supplier-manufacturer relationship can result in poor-quality and late deliveries, which are detrimental in the interest of an organization.

The supplier-manufacturer relationships in case of Indian industries are not found to be trustworthy in cases over 90%. The suppliers are not reliable up to the mark and the manufacturer is always doubtful about their timely delivery of materials. The manufacturer and supplier are not acting as partners so that they can understand each other in a better manner in respect of their commitments, and can contribute accordingly in the common interest of the organization. This lack of trust in the relationship is
forcing the manufacturer to keep a large stock of inventory that obstructs the effective implementation of JIT.

6.3 MULTISOURCING IN THE SUPPLY CHAIN

Multisourcing the materials in the supply chain has merits as well as demerits. The advantage is that the manufacturer is not required to depend upon a single supplier, and that eliminates uncertainty regarding availability of materials from a single supplier. But on the other side, multisourcing prevents trusting any one supplier and being always doubtful about the quality of supply materials. Also with multisourcing there is a possibility of quality variation in the supplying materials. For JIT to work effectively, single sourcing or having a few suppliers is preferred to become more focussed about perfect quality.

Single sourcing or sourcing with a few suppliers has many hurdles in case of Indian industries. It is largely due to lack of trusting relationships between the industries and their suppliers. Their relationship is not of partnership type, and they behave as if they are rivals.

6.4 CONSISTENTLY HIGH QUALITY

Quality has to be improved at every step of production. A JIT system works on quality at the source, with workers acting as their own quality inspectors. Quality of products and services is very important for JIT to work effectively. Defective products result in more wastes and scraps and involve their replacements, and they obstruct the smooth flow of materials. Japanese manufacturers were immensely benefitted by the quality revolution started by the two American consultants such as W. Edwards Deming and Joseph M. Juran, and it gave them competitive leverage.
About 58% of industries, on an average, are found to be unmindful of the product quality. This is probably because of lack of good partnership between supplier and manufacturer. They consider quality as a cost increasing parameter for the product, which can affect their market share. This appears to be true as Indian markets are highly price-sensitive, and an average Indian customer is more interested in getting the products at lower costs rather than paying more for getting a good quality product. Hence the industries are reluctant about increasing their products’ quality. On the other hand, most of the Japanese industries that are pioneering JIT implementation are focusing on quality and do not allow any defect in the products. The Toyota Motor Corporation that evolved JIT puts more emphasis on quality than any other parameter.

6.5 DESIGN OF THE WORKPLACE

Order and neatness are critical elements of the working environment. All material locations must be clearly marked. Only the necessary tools, fixtures, gauges, and other resources should be present at the workplace.

Facility layout refers to the arrangement of plant facilities at the workplace. A good design of the layout facilitates smooth flow of materials, and ensures free movement of workers within the plant. Well-organized facilities render positive impact on workers by providing pleasant atmosphere, and working in such atmosphere is less stressful.

Baring a few big industries (about 22%), majority of the average Indian industries did not score well on this point. Tools, machines and equipment are not arranged according to the rules of work study in order to optimize the motion. Awareness about keeping tools and other equipment right within the reach of the workers looked missing. This probably explains the reason why workers are not giving
their best outputs and it also explains about their low productivity.

6.6 PRODUCTION CAPACITY AND PRODUCTION SCHEDULES

Production capacity of manufacturing workstations reduces the manufacturing lead times. The two ways to increase production capacities include increasing the production rates and reducing the setup times at workstations. The effective utilization of resources and the ease of implementation of capacity expansion are important issues in increasing production rates. One effective way to increase the production rate is to eliminate all the wastes from every activity. Multiskilling or cross-training of workers tremendously helps in increasing production rates as it tends to balance workstations. Multiskilling not only solves the problems of providing each workstation with the required skills, but also increases the flexibility of the workstations. A JIT system works best if workstations are relatively uniformly loaded. Capacity planning and line balancing are used to achieve this purpose.

JIT requires strict adherence to production schedules, as a level schedule and balanced operations allow even flow to prevent inventory between workstations. For example, at Toyota, there are both stable and level production schedules. Workstations must be balanced to ensure that machines and workers are effectively utilized, and there is no scope of their underutilization or overutilization.

Workers and machines in Indian industries, to a large extent (in cases over 90%), are found underutilized. Workers in the industries are reluctant and disinterested in learning new and innovative things, which proves to be a major obstacle in production capacity enhancement. It has been found that a very few (about just 9%) were interested in gaining new knowledge about the methods they were using, and were willing to change them for the sake of betterment that too under pressures from the top
management. Production schedules are not strictly adhered to because of uncertainties prevailing in the supply chain, the major being because of the non-committal attitude of suppliers to the extent of more than 60%.

6.7 PARALLEL PROCESSING

In order to reduce the manufacturing lead time, JIT manufacturing requires exploiting parallel processing of operations as far as possible. Many operations which are of independent nature can be performed simultaneously, that is, in parallel to reduce significantly the manufacturing lead time. For example, product design and process design can be carried out simultaneously to bring new products to market in a shorter time. It will facilitate new product development (NPD) in a great way.

The concept of parallel processing, often called concurrent engineering or simultaneous engineering, does not find much importance in Indian industries because of workers’ and people’s inability to come out of the conventional methods of doing works. It requires motivation which average workers and people in the organization lack. This is one of the main reasons behind the failure of Indian industries to implement JIT.

6.8 STANDARDIZED COMPONENTS AND WORK METHODS

The standardization of components and work methods increase repeatability, which in turn, increases productivity of workers. It is because of the fact that with increased repetition, workers learn to do the task more efficiently, and they can produce more components in less time. It helps in low-inventory objectives of a JIT system through drastic reduction in lead time.
Indian industries, being less competitive, are reluctant to use standardized components and work methods. It is also because of the hard fact that majority of the average Indian industries are facing financial problems in their efforts to introduce something new. It is one of the prominent reasons behind the lack of enthusiasm in JIT implementation by Indian industries.

6.9 WASTES IN MANUFACTURING

Waste can be defined as those activities that consume resources but do not add any value to the product or service. To identify and eliminate waste, workers and managers must be continually assessing processes, methods and materials for their value contributions to the firm’s products and services. JIT requires continuous improvement of production processes and methods in order to minimize waste.

Indian industries involve a lot of wastes for which they incur huge costs that increase the price of the products. One of the serious problems these industries are facing is that the current methods of production are not as efficient and effective so as to produce cost-effective products. Chinese industries are far ahead of Indian industries in this respect. There are a lot of unnecessary human motions involved while performing on works because of poor design of the work environment that adversely affects the efficiency of workers and reduces their productivity as well. Industries believe more in inspection than making defect-free products in one go, and it involves costs of inspection. Many quality control tools exist, but either the industries are ignorant about this or are unwilling to use them. Equally important is their inability to reduce high holding and setup costs of inventory.
6.10 AUTOMATED PRODUCTION

The ability to provide product or service variety depends on the degree of flexibility designed into the production system. Automation tends to provide greater flexibility in production, and has a big role in JIT systems to obtain low-cost production. It involves elimination of human efforts in job through the use of robots, but incurs very high cost. It results in greater accuracy of works with consistently high quality of products.

Most of the average industries (in cases over 95%) are facing financial constraints, and it prevents them to use automation in production on a large scale. This is also one of the reasons of their lagging in manufacturing competitiveness.

6.11 PREVENTIVE MAINTAINANCE

In the traditional approach to manufacturing, corrective maintenance is more acceptable, which relates to repairing a machine when it breaks down. It is because of the fact that there are queues of materials sitting in front of the machines to be worked upon so that production can continue undisturbed, at least until the queues are finished. JIT manufacturing, on the other side, requires smooth flow of materials and little buffer inventory between workstations, and hence unplanned machine downtime can prove to be disruptive. If a machine in a JIT system breaks down, it will eventually stop all the following downstream equipment for lack of work. Work stoppages and product defects are often the result of poor equipment maintenance. Therefore all the machines and equipment require regular maintenance to prevent their sudden breakdowns, and this maintenance is called preventive maintenance. Preventive maintenance, on one side, can reduce the frequency and duration of machine downtime, whereas on the other side, also helps to identify the defective machines that can be replaced suitably during maintenance schedule more easily and quickly than dealing with machine failures during
Indian industries are not sincere enough towards preventive maintenance. Their approach is causal and irregular. The machines and equipment are often not taken care of regularly. The workers unknowingly wait for machines to breakdown. The malfunctioning of machines and equipment occurs more frequently that result in product shortages and late deliveries. It adversely affects the speed of JIT implementation.

6.12 PROCUREMENT AND LOT SIZING

Procurement of materials is planned in a systematic manner to ensure continuity in the production system and to avoid shortage at any point of time. The success of JIT greatly depends on procurement strategy adopted by an organization in order to obtain quality materials and services at the right cost. JIT purchasing is important as delays in the receipt of materials or receiving the wrong materials affect the implementation of JIT. The strong manufacturer-supplier relationship makes a production system more dependable and eliminates any uncertainty regarding manufacturing schedule, and hence makes procurement easy for JIT. In case of late deliveries from the supplier, a company will be forced to keep large, costly inventories to meet the requirements of customers. Easy procurement and smooth flow of materials is directly linked to effective supply chain management.

Lot sizing is always better whether it is traditional approach of manufacturing or JIT manufacturing. Conventional production systems use larger lot sizes for economical purpose, but involve very high inventory holding cost. Small lot sizes are useful in the implementation of JIT, as they tend to fulfil quick customer requirements without holding the inventories for long time. Easy and fast consumption of items in small lot size accelerate the pace of JIT and further procurement becomes more frequent.
For JIT the ideal lot size is unity, but it is not practical to use.

The approach of Indian industries towards procurement is badly affected because of chaotic situations prevailing on the ground level. Many factors are responsible for this. First, the supplier-manufacturer relationships are not as strong to ensure a predictable lead time. Secondly, they are not using the right-size containers to obtain the economy in procurement. The number of containers and the number of units to be held by each container flowing back and forth between two workstations directly affects the quantities of work-in-process inventory and safety stock, as the containers spend some time in production, in a line waiting, in a storage or in transit. As a result, the industries do not get the benefits of cost-effective price. Because of instability in the market, demand is also not easy to forecast. At the same time, the industries are also not strictly using lot sizing principles to make their procurement more economical. These factors adversely affect the implementation of JIT in Indian industries.

6.13 WORKERS EMPOWERMENT

The success of JIT greatly depends upon the empowerment of workers in a plant. Workers should be given authority to take initiative in solving production problems. They are not required to wait for any guidance from their superiors in dealing with day-to-day activities relating to quality problems, machine malfunctions or safety concerns. Japanese workers are encouraged to work together to find the solution of problems.

Workers in most of the Indian industries (about 95%) are not relied upon about their ability to solve problems, and hence are not authorized to take any corrective measure in case something goes wrong. There is a clear dividing line between workers and people above them, and there is a sense of superiority among people above workers.
that prevents their free mixing. This is one of the major reasons why workers do not look enthusiastic about JIT and its implementation.

6.14 ORGANIZATIONAL SET-UP

The success of a business largely depends upon its people, the organization and the environment in which they are working. A good organizational environment has positive impact on the productivity of people. It increases productivity of both workers and organization. If people are competent and motivated, they can provide a distinct competitive edge by their skills and the ideas they create. A committed workforce can transform a business to a great height. Managers and workers must see each other as co-workers committed to the company’s success. An open and trusting organizational culture and teamwork are two important tools that help rapid growth of organization. This helps in a better way to understand JIT.

The relationships between management and workers in Indian industries are not cooperative and friendly, and a dictatorial way of doing work prevails, which prevents free mixing between them. The mixing of the people from the two sides will help to eliminate many misgivings and will provide clarity on the task being performed, but sorry to say it does not exist in the industries. On the other hand, openness and total employee involvement are important to the Japanese industries. With staff acting as coaches, all employees help solve production problems. Shop floor decisions are benefited by inputs from employee relations, finance and engineering personnel, all interacting with management and line workers.
6.15 COMPETITIVE ENVIRONMENT

A competitive manufacturing environment encourages workers and people in the organization to think about something new and innovative. It propels workers and people to work faster and excel others, and helps in JIT implementation. JIT works most effectively if workers are awarded suitably for their extra efforts in their tasks.

Unfortunately, competitive environment does not prevail in Indian Industries that prevents these industries to use new and innovative methods, which otherwise could have improved their manufacturing efficiency. More than two-third (about 70%) of average Indian industries have not even heard of JIT. It raises doubt about their intention to use and implement JIT.

6.16 GOVERNMENT’S ROLE

The government’s encouragement and right direction for industries make a big difference by providing them right atmosphere and various types of incentives like tax relief and reduction in duties to start a business. It helps in speedy implementation of JIT.

The Indian industries lack encouraging supports from the government. Japanese industries, on the other hand, have strong patronage from the government. The Ministry of International Trade and Industry (MITI) of Japan provides direction concerning which industries will flourish and which will decline and be phased out. It has helped Japan in its goal of world class manufacturing.
6.17 GRAPHICAL REPRESENTATION OF DATA AND INTERPRETATION

Fig. 6.1 shows the implementation of JIT in Indian industries. About 55% of Indian industries are not using JIT, 20% of them are using JIT in totality and the remaining 25% are using JIT partially. The major reason behind not using JIT or using JIT partially is because of their unawareness about JIT and their approach to implement it without giving due consideration to factors that are critical in JIT implementation. Hence, it necessitates the requirements of regular workshops, seminars, etc. so as to increase their awareness about JIT. This measure will help the industries in better understanding of JIT.

![Fig. 6.1: Implementation of JIT in Indian industries.](image)

Fig. 6.2 shows the approximate percentage importance that major JIT users assigned to various elements of JIT during its implementation at their plants. It clearly shows the greater role of three major factors such as supplier relationships (30%), employee involvement (30%) and top management commitment (20%) in JIT implementation. Proximity to suppliers just contributed to 10%. Other factors (10%) that contributed lesser in JIT implementation included improved production system, teamwork, workers empowerment and informal working environment.
Fig. 6.3 shows the objectives that prompted JIT users for its implementation. Reducing the inventory level was given the highest priority (60%). Lead time reduction (15%) was emphasized next to it. Other prompting factors (5%) included reducing production costs, reducing wastes in manufacturing etc. besides simplifying production system and gaining competitive advantage each contributing 10%.
Fig. 6.4 shows the comparison of supplier relationships for JIT users and JIT nonusers. Figure shows that 80% of JIT users have close supplier relationships as compared to 20% in case of JIT nonusers. A major element of JIT seems to be verified.

![Graph showing supplier relationships for JIT users versus JIT nonusers.](image)

**Fig. 6.4**: Supplier relationships for JIT users versus JIT nonusers.

Fig. 6.5 shows the contribution of important components in quality improvement while implementing JIT. Quality at the source (50%) has the greatest impact on JIT implementation, which manifests its importance.

![Graph showing contribution of quality improving components in JIT implementation.](image)

**Fig. 6.5**: Contribution of quality improving components in JIT implementation.
Fig. 6.6 shows the contribution of important components of production system in JIT implementation. Uniformly loaded workstations contributed largest (50%) in JIT implementation. Kanban system, setup time reduction, and adherence to production schedules each contributed to 15%. Multiskilling of workers did not contribute much (just 5%).

![Fig. 6.6: Contribution of production system components in JIT implementation.](image)

Fig. 6.7 shows the contribution of organizational components in JIT implementation. Top management commitment (60%), teamwork (15%) and workers empowerment (15%) have greatest impact on JIT implementation.

![Fig. 6.7: Contribution of organizational components in JIT implementation.](image)
Fig. 6.8 shows the level of automation. Figure shows that majority (55%) of Indian industries are not using automation. This is also one of the major reasons why they do not contribute largely in JIT implementation.

![Pie chart showing automation levels](image)

**Fig. 6.8:** Industries using automated production.

Fig. 6.9 shows the deliveries made by the suppliers. About 90% of industries reported that their suppliers make delay by a day or two in their deliveries as compared to just 10% suppliers making deliveries on time. This seems to be one of the principal reasons why Indian industries are facing difficulties in implementing JIT.

![Pie chart showing delivery status](image)

**Fig. 6.9:** Deliveries by suppliers.
Fig. 6.10 shows the cooperation of suppliers in JIT implementation. About 92% of industries answered in negative about their suppliers’ cooperation in JIT implementation compared to just 8% being supportive. This is directly linked with timely deliveries made by the suppliers to their manufacturers.

Fig. 6.11 shows the nature of supplier-manufacturer relationship in the industries. In just 12% cases, the relationship is of partnership type, whereas in most of the cases (88%) the two entities have a general type of relationship. This also indicates the lackadaisical approach in JIT implementation.
Fig. 6.12 shows the number of suppliers for manufacturer. In about 91% cases, the manufacturers have three or more than three suppliers. It may be because of the reason that manufacturers think that larger number of suppliers will help to reduce uncertainty in the deliveries of supplies.

![Fig. 6.12: No. of suppliers for manufacturer.](image)

The impact of every JIT parameter is discussed in depth in the present study. The extent to which these factors contribute is of variant nature. Manufacturing as well as organizational factors both are found to be contributing in JIT implementation. Although use of different manufacturing tools can facilitate in JIT implementation, but organizational factors need to be considered more carefully as they have the potential to change the mindset of people which can produce more effective results than the use of manufacturing tools.

The results of the present study are expected to help the Indian industries in the following way:

- It will help them understand the prevailing industrial environment.
- It will help them understand the prerequisites for JIT implementation.
• It will let them identify their shortcomings and drawbacks, and to take corrective measures accordingly.
• It will help them remove their misgivings about JIT.
• It will help them know about the impediments in the way of JIT implementation.
• It will help them know their levels of preparation about JIT implementation.
• It will help them understand JIT and its implementation in a better way.

The following suggestions/recommendations are offered based on the results of the present work:
• Seminar/workshops must be arranged to increase the awareness about JIT.
• Industries must be sensitized about the drawback of high levels of inventory.
• Regular training of workers must be arranged to make them update.
• Organizational atmosphere must be improved to increase free interaction between workers and managers.
• Level of automation must be increased to improve the production.
• All types of wastes must be eliminated.
• Production schedules must be followed at all costs.
• Customer satisfaction must be at the centre of all production activities.
• Suppliers must also be made accountable for defects in the products.
• Suppliers must be made dependable.
• Supplier-manufacturer relationships must be improved.
• Emphasis must be laid on teamwork.