JIT IN INDIAN CONTEXT: LITERATURE REVIEW AND DIRECTIONS FOR FUTURE RESEARCH

Dr A.K. Gupta

Associate Professor, Mechanical Engineering Department, DCR University of Science & Technology, Murthal (Sonepat)

ABSTRACT

With the development of faster means of communication, better quality computers and rapid transportation systems, manufacturing is no longer restricted at local level, but has become global in character. As Indian 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 means 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. Confronting these challenges, Indian companies are forced to find ways to reduce costs, improve quality, and meet the ever-changing needs of their customers. One successful solution has been the adoption of Just-in-time (JIT) manufacturing strategy in which many functional areas of a company such as manufacturing, engineering, marketing, and purchasing etc. are involved. This paper reviews literature on JIT in Indian context, study the implemenation aspects and identify some research directions for future work

***Key words**: JIT, cost, quality*

INTRODUCTION

The basic idea of JIT was originally developed in Toyota Company of Japan. Now days, JIT concepts are being applied in a variety of industries across the globe. Survey and case studies of industries of United States, the United Kingdom, Germany, Italy, Korea, Hong Kong and India (Billesbach, 1991, Crawford et. al. 1988, Kolay, 1993, Korgaonker, 1992, Prem Vrat et al., 1993) have shown growing acceptance of JIT.

JIT may be described as an extension of the original concept of managing the material flow in a factory to reduce the inventory levels. In fact, there is much more involved in a manufacturing organization than reducing inventories to control costs. Manufacturing has to deal with other issues, such as process control, level of automation, flexible manufacturing, machine set up times, direct labor productivity, overhead, supplier management, engineering support, and the quality of product delivered to customers. A modern manufacturing organization has to deal efficiently with these issues in order to operate a smooth, productive, and quality minded department. JIT approach has demonstrated its usefulness in dealing with all such issues.

JIT SYSTEM

The basic idea of JIT was originally developed in Toyota Company of Japan. In the 1960s, Toyota worked hard on developing a whole range of new approaches to manage manufacturing . 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 adopt these approaches. At this stage and for some time later, 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. Since early 1980's, the approach has become widely known. As the approach has been adapted by Western companies, it has been given many shapes including 'Zero Inventory', 'World Class Manufacturing', and 'Continuous Flow Manufacturing'. However, the term that has now become most wide to describe this approach to manufacturing is 'Just-in-Time system'. The Just-in-Time system is not one technique or even a set of techniques for manufacturing, but is an overall approach or philosophy, which embraces both old and new techniques. Now days, JIT concepts are being applied in a variety of industries across the globe.

LITERATURE REVIEW

(Goonatilake, 1984) and (Ebrahimpour and Schonbrger, 1984) 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 [Ebrahimpour and Schonbrger, 1984, Goonatilake, 1984, Prem Vrat et al., 1993) 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, 1984) have also suggested JIT and TQC (total quality control) to solve such problems of developing countries.

(Singhvi, 1992) has described Eicher experience in implementing JIT. Significant improvements were observed in throughput time reduction, reduction in space, WIP inventory reduction, material handling, and quality levels. Large investments were not found to be essential, but it is impossible to implement JIT without employee involvement, mutual trust, and unrelenting focus on quality. Supplier is found to be an essential part of the business and there is nothing so difficult about Japanese approach, which can not be applied in India.

(Garg et al., 1995) have found 'work culture' a critical element if a company wants to implement JIT. Adopting JIT culture in India is not an impossible task. According to them, dimensions of work culture in JIT include multifunctional workers, long term employment, motivation and trust, top management attitude and commitment, support from union leaders, effective communication, poka yoke inspection method, and incentive scheme. It is felt that JIT could be a great opportunity for India in the context of recent reforms in economy and trade towards opening of economy and globalization. Some benefits attained in quantified form were also presented when some elements (quality circles, suggestion schemes, kaizan etc.) were applied in an Indian automobile company.

(Garg et al., 1996] examined critically JIT purchasing in Indian context. An analysis of a questionnaire supplied to various industries is carried out with the help of statistical tests. A test of significance (t-test) was applied for the importance of JIT attributes, problems in implementing JIT attributes, and expected percentage benefits of JIT purchasing implementation. There was an indication that Indian industries were giving importance to JIT attributes, facing some problems in implementing JIT, and expecting an overall benefit on an average 59.8% if JIT purchasing is fully implemented. Tests confirmed that the scope of JIT implementation in India was fair and it was independent of the type of industries, layout, and number of employees. Small industries were more optimistic than large and medium scale industries about JIT implementation.

(Kumar and Garg, 2002] took a closer look on JIT implementation problems and benefits in Indian context. A survey of Indian industries was conducted to identify those JIT elements which are highly difficult to implement, those which are easy to implement in Indian context and to identify the most expected JIT benefits in Indian context. It was found perfect JIT implementation may not be feasible in most Indian industries due to lack of resources, lack of technology, non availability of multifunctional workers etc. However, some elements such as continuous improvement, layout improvement, quality circles, small lot size etc. are easy to implement as reported by Indian industries. Therefore maximum weightage must be given to these elements to reap maximum benefits. The elements which found to be difficult to implement included zero defects, automation and autonomation, JIT purchasing, kanban system, set up time reduction etc. Reduced work in process, reduced purchase lot size reduced production lead time, improved competitive position etc. were found some of the high ranked expected benefits as a result of JIT implementation.

(Prem Vrat et al., 1993) have identified problems in JIT implementation in Indian context. These included poor quality of incoming material, non-receipt of delivery by buyer of exact quantity on exact time, little workers' motivation, unreliable transportation system etc. The Delphi study carried out by (Prem Vart et al., 1993) indicated the JIT index to be 23.38 on a 40 point (0-40) scale, implying that though quite difficult, JIT implementation in India is possible. It may take 10-20 years for JIT to be fully implemented in Indian industries. It further stated that in order to become competitive, the Indian industry can't ignore the idea of JIT. The study also indicated that

attention must be focused on poka yoke inspection methods, reduced setup times, 100 % quality of incoming material, kanban system, delivery by the vendor of exact quantity on exact time to achieve the results. Worker motivation and literacy need to be increased.

(Kolay, 1993)] suggested an approach to assess a vendor on an overall performance index, which was certainly useful in the area of supplier management in Indian context.

(Kumar et al. 2002) reported that several Indian industries were implementing basic principles of just-in-time (JIT) in a fragmentary framework of Total Quality Management (TQM) with the belief that it would be helpful in facing global competition. The present status of JIT/TQM quality techniques in India had been analyzed through a survey of 46 Indian industries. The survey indicated that techniques such as quality circle, total preventive maintenance, cause and effect diagram, kaizen, JIT purchasing etc. require more attention since their implementation may be helpful to improve present position of Indian industries in the areas of quality, cost and flexibility.

Mahadevan [1997] through survey investigated how far the Indian companies they are ready for Just-in-Time. Findings suggest TQM and vendor development efforts precede the launch of major JIT programmes. Automobile Industry in the country has made significant improvements in areas such as multi-skilling of work force, setup time reduction and small lot sizes. TQM, TPM, and JIT purchasing constitute the basic requirements for successful JIT implementation. It has also been suggested that JIT and TQM must go together. JIT provides an organizational frame work for the exposure of waste and problems, TQM provide and organizational framework to solve these problems. The author is of the view that Indian companies are slow in exploiting the far reaching effects of JIT implementation.

(Garg & Deshmukh, 1999] reviewed and classified the literature on JIT purchasing. The literature was reviewed and classified as conceptual articles, survey, case studies, and empirical/modeling work. The relative importance of JIT purchasing attributes had been identified. A survey of the attributes was carried out in Indian context. Attributes of high quality, mutual trust and cooperative relationship, reliable delivery, increased customer and supplier's support was among the attributes that were given a very high importance by Indian industries. This study had also predicted a better scope of JIT implementation in India compared to an earlier study [128]. The results of a case study in JIT implementation of an Indian tractor assembly were presented in this paper. Significant benefits were achieved by reductions in inventory, material movement, space, manpower, work-in-process and lead-time and an increase in productivity and quality as a result of JIT purchasing implementation. The key steps in implementation were: extensive training of employees on pull concept, identification of key performance parameters; new layouts based on U-shaped cells, standardization of operations, a maintenance plan for each machine, housekeeping, visual control and multiskill training. It has also been found that most of the identified JIT purchasing attributes were given strong emphasis.

(Gupta et al. 2003) investigated the role of JIT in service sector through case study of an educational institute. The study was focused on admission process of the students. Existing process was characterized by: long waiting time for students and their parents, long duty hours for staff, poor information system leading to unrest and confusion etc. To encounter the difficulties in the existing system, a new process was proposed in JIT context. Key JIT element of successful JIT installation in this environment involved GT type cell layout, Kanban, multiskill workforce. It will reduce significantly the number of days to complete the whole process and will make everybody satisfied with the service provided.

A survey (Gupta et al. 2004) of Indian service sector has been conducted to determine the relevance of JIT in service sector in Indian context. A questionnaire was developed and administered to 80 service industries. Responses from 43 industries (Response rate 54%) were obtained. Data is compiled and analyzed. Firstly, it is done by factor analysis on a scale (0-100) .The mean score for the importance of JIT elements taken together as perceived by the respondents was found to be 75.75 (Maximum importance=100) which can be interpreted as fairly good . The mean score for problems in implementation taken together was found to be 73 (Maximum for no problem in implementation=100) which can be interpreted as little problems in implementation. Similarly mean score for expected benefits taken together as a result of JIT implementation was found to be 75.75(Maximum benefit=100) which can be interpreted as high benefits as a result of JIT implementation. Some JIT elements, which are comparatively easy to implement, are also identified in the survey. These are quality improvement techniques, standardization, process simplification, lay out improvement, quality circles etc. Attention must be focused on these elements so that maximum benefits can be obtained

IMPLEMENTATION ASPECTS

Factors related to implementation

It is easy to understand the concepts of JIT in terms of eliminating waste and improving productivity. But, in reality, the concepts are difficult to implement because of the need for fundamental organizational changes. The factors that hinder the implementation of JIT in manufacturing environment have been grouped into four categories. These four categories are:

- Management
- Workers
- Process
- Suppliers

Management

- Lack of formal training programmes for management

- Extent of management support to JIT implementation
- Lack of communication between workers and management

Workers

- Lack of formal training programmes for workers
- Reduction in labour turnover rate
- Increase in workforce morale
- Extent of cross training workers
- Extent of workers' resistance to cross training
- Extent of the use of unionized workers
- Unionized workers as a hindering factor to JIT implementation

Process

- Reduction of rejects of finished goods
- Improvement of finished goods inventory
- Reduction in lead times
- Reduction in setup times
- Reduction in the levels of work load variability
- Cut down setup time through machine modification or replacement of existing equipment
- Cut down maintenance time through machine modification or replacement of existing equipment

Suppliers

- Lack of cooperation of suppliers in communication and information exchange
- Lack of cooperation of suppliers in correctly supplied materials
- Lack of cooperation of suppliers in timing of supplied materials
- Extent of use of sole suppliers

(Goonatilake, 1984) and (Ebrahimpour and Schonbrger, 1984) 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. These problems identified by researchers in context of developing countries including India are shown in Table 1

Table 1. Relevant Problems of Developing Countries in JIT Manufacturing context as Reported in Literature

Problems
Inferior quality [3]
Lack of technology transfer and management [3]
Little worker's motivation [16]
Low productivity [3]
Non- receipt of delivery by buyer of exact quantity on exact time [16]
Poor quality of incoming material [16]
Shortage of raw materials and parts [16, 10]
Underutilization of capacities [3, 10]
Unreliable long lead times [3, 10]
Unreliable transportation system [16]

Misconceptions about JIT philosophy

The following are certain misconceptions about JIT philosophy;

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.

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.

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

in the adaptation of JIT and in the determination of relative priorities for implementing specific components of JIT.

CONCLUDING REMARKS AND DIRECTIONS 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. Some survey and case studies must be conducted in Indian industries to expand the base of JIT applications in Indian Industries. Indian service sector is also growing very rapidly but poorly managed. JIT can also play a meaningful role in improving the performance of service sector. Some case studies on JIT applications in Indian service sector will demonstrate the usefulness of JIT in Indian service sector.

REFERENCES

1. Billesbach, T.J. (1991), "A study of the implementation of Just-in-Time in the United States", *Production and Inventory Management*, Vol. 32, No. 3, pp. 1-4.
2. Crawford, K.M., Blackstone, J.H. and Cox, J.F., "A study of JIT implementation and operating problems", *International Journal of Production Research*, Vol. 26, No. 9, 1988, pp. 1561-1568.
3. Ebrahimpur, M. and Schonberger, R.J. (1984),"The Japanese Just-in-time/Total quality control production system: Potential for developing countries", *International Journal of Production Research*, Vol. 22, No. 3, pp. 421-430.
4. Garg, Dixit. and Deshmukh, S.G. (1999),"JIT purchasing: Literature review and implications for Indian industry", *Production Planning & Control*, Vol. 10, No. 3, pp. 276-285.
5. Garg, Dixit., Deshmukh, S.G. and Banwet, D.K. (1998),"JIT purchasing in India: Problems, prospects, and directions", Productivity, Vol. 39, No. 1, pp. 119-23.
6. Garg, Dixit., Deshmukh, S.G. and Kaul, O.N. (1996), "Critical Analysis in JIT purchasing in Indian Context", *Productivity*, Vol. 37, No. 2, 1996, pp. 271-277.
7. Garg, S., Vrat, P. and Kanda, A. (1995), "Work culture in JIT environment", *Productivity*, Vol. 35, No. 3, pp. 463-466.

8. Gupta, A., Kumar, R and Garg, D.," JIT in Service Sector, "Productivity, Vol. 43, No. 4, pp. 594-602, Jan-Mar 2003.
9. Gupta, A., Kumar, R and Garg, D., "Just in Time in Service Sector, "*Productivity*, Vol. 44, No. 4, pp. 613-620, Jan-Mar 2004.
10. Goonatilake, P.C.L. (1984), "Inventory control problems in developing countries", *International Journal of Operations and Production Management*, vol. 4, No. 4, pp. 57-64.
11. Kumar, Vikas and Garg, Dixit. (2000),"JIT elements in Indian context: An analysis", *Productivity*, Vol. 41, No. 2, pp. 217-222.
12. Kumar, Vikas., Garg, Dixit. and Mehta, N.P. (2002),"JIT/TQM Quality Techniques in Indian Industries", *Productivity*, Vol. 42, No. 4, 2002, pp. 582-590.
13. Kolay, M.K. (1993), "Supplier asset base- appreciating or depreciating", *International Journal of Operations and Production Management*, Vol. 13, No.8, pp. 72-86.
14. Korgaonker, M.G. (1992), "Just In Time manufacturing", *Macmillan India Limited*.
15. Mahadevan, B (1997), "Are Indian Companies ready for Just-in-Time?" Management Review, pp. 85-92.
16. Prem Vrat, Mittal, S. and Tyagi, K. (1993), "Implementation of JIT in Indian environment: A Delphi study", *Productivity*, Vol. 34, No. 2, pp. 251-256.
17. Singhvi, S. (1992),"Employee involvement in JIT success: The Eicher experience", *Productivity*, Vol. 33, No. 2, pp. 366-369.