Journal of Scientific & Industrial Research
Vol 63, August 2004, pp.655-662

# JIT practices in Indian context: A survey

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*Received 25 November 2003; accepted 15 April 2004*

This paper examines the implementation of Just-in-Time (JIT) based managerial philosophy in the Indian industries. Specifically, JIT elements, JIT benefits and reasons for slow implementation of JIT in Indian industries are investigated through a survey. The results of this survey support the notion that JIT has potential to increase the organizational performance of Indian industries. However, to achieve this potential, Indian industry must be willing to modify their procedures and operations. Much has been written regarding the positive effect of JIT on performance of production system. But, the negative impact of JIT on workers and production system are not clear. The disadvantages of JIT production system are therefore highlighted here.

**Keywords**: Just-in-Time (JIT), Implementation, Elements, Benefits.

## Introduction

Increasing international competition has forced the multinational companies to seek new ways to develop a competitive edge. Indian manufactures have also been adopting innovative manufacturing approaches, managerial philosophies, and information technologies to survive in the emerging competitive market. However, Indian industries have not yet tested the full effects of popular JIT approach on performance of production system due to its limited implementation. Considering its potential in enhancing [1]performance of organizations, investigation on the important JIT issues is essential. Research has shown that JIT philosophy has the potential for increasing organization efficiency and effectiveness. However, JIT benefits do not just happen[1]. Before an organization enjoys with the benefits of JIT, it must accept JIT as an organizational philosophy. This may require the organization to modify its operating procedures, production system and in most cases work culture. In this context, in many cases the plant layouts have to be changed, relations with suppliers, and kaizen have to be implemented[2]. Many researchers have reported that JIT has potential of reducing inventory-carrying cost. It is also instrumental in reducing lead-time, decreasing thought-put time, improving production quality, increasing productivity, and enhancing customer responsiveness. Motivated by the potential benefits of successful implementation of JIT to the organizations and lack of research addressing the implementation problems in Indian context, a survey of 34 industries was conducted. This survey has shed some light on the degree of difficulty in implementation of JIT based managerial philosophy in Indian industries. The expected JIT benefits and reasons for its slow implementation are also examined in the study. Although it is really recognized that implementation of JIT in Indian organizations is not an easy job yet number of attempts are being made in several Indian industries to implement the JIT in phased manner with belief that it would be helpful in facing the global competition.

## Past Studies in Indian Context

A few papers are available on JIT practices, which highlight the positive impact of JIT on Indian industries. Vrat *et al.*[3] have conducted a Delphi study to assess the applicability or difficulty of implementing JIT elements in Indian context. The results have shown that quality circles and good communication are not very difficult to implement having a rating of 30 and above on a 40 point scale. Top management attitude, multifunctional workers, long-term relationship with vendor and support from labor union have

high rating, which indicates that JIT implementation in India is not an impossible task. The study has also stressed on focusing more on poke-yoke, reduced set up time, kanban system, and quality of incoming material.

Chandra and Kodali [4] have developed a multi-attribute decision model using analytical hierarchy process (AHP) for justification of JIT manufacturing system in Indian industries. The selection of important JIT attributes and sub-attributes was determined. All JIT attributes and sub-attributed were then used in AHP to achieve the related benefits. The results of study have quantified the JIT benefits in descending order: increased profit margin, improved competitive position, quality improvement and reduction in inventory.

Deshmukh[5] has attempted review on the state of the art of JIT and its possible ramifications in the purchasing and manufacturing system. It has been pointed out that JIT from a systems perspective requires that suppliers and manufacturing functions must be in concert with design, planning, and control. JIT must be viewed as a binding force coupling all the activities, from incoming raw material to the finished goods.

Garg *et al.*[6] have explored the specific cultural changes required in JIT environment and also reported their presence in Indian industries. They have stated that trust, locality, responsibility, development, motivation, authority, long-term relationship, and respect for human beings mark work culture required in JIT environment. It is critical for industries to make conscious and deliberate efforts to change the work culture for successful implementation of JIT. These changes require top management commitment and worker participation in decision making, and massive education and training to the people concerned.

Garg *et al.*[7] have conducted a survey of 31 Indian industries to analyze the importance of the attributes pertaining to JIT purchasing and supplier evaluation criteria. The surveyed companies have given great importance to some attributes such as, high quality, mutual trust, cooperated relationship, on time deliveries supplier evaluation, stable production schedule, reliable network of suppliers, reduced delivery time, long-term contract, and continuous improvement. The study has also indicated the scope of JIT as 70 on scale (0-100), which is predicted better compared to earlier studies.

Garg *et al.*[8] have conducted a case study in JIT implementation of an Indian tractor assembly industry. Records of company have indicated that significant benefits are achieved by improvement in quality and productivity, and reduction in inventory, material movement, space, manpower, work-in-process, and lead-time. The key steps in JIT implementation were extensive training of employees on pull concepts; identification of key performance parameters; new layout based on U-shaped cells; standardization of operations; a maintenance plan for each machine, housekeeping, visual control, and multi-skill training.

Kaujalgi and Lingara[9] have provided an overview of changes implemented in a spring manufacturing department. These changes were made as part of a continuing implementation of a JIT manufacturing system. This study has shown how manufacturing order and control systems change in order to create a system which can react immediately according to change in customer's needs.

Mahadvan[10] has conducted survey of 43 Indian industries. The findings of this study have suggested that TQM and vendor development efforts must precede the launch of major JIT programs. It has been found that automobile industry in India has made significant improvements in areas such as, multi-skilling of work force, total preventive maintenance (TPM) and JIT purchasing. These factors constitute the basic requirements for successful JIT implementation in any firm. Supplier development, Employee involvement, and Top management commitment are prominently listed as critical success factors. Training, task force formation, re-layout, and pilot study are indicated as among the first five steps taken in JIT implementation.

Singhvi[11] has presented the experience of implementing the JIT in an Indian automobile company. The study has found the 'employee involvement' as a critical element for implementing the JIT, while large investments are not found essential. At last, it is concluded that implementation of JIT is not so difficult in India. Its implementation could be a great opportunity for Indian industries due to its wide range of benefits.

## Survey on JIT Practices

JIT imposes a different set of requirements on the typical work culture. Work culture reflects the way of life of people, their norms and values regarding work in an organizational setting where technology and social cultural forces jointly, determine managerial style and practices. In other words, work culture plays

a significant role in successful implementation of JIT. Peoples and managers of different countries think differently, according to their social and cultural principles. Therefore the implementation of Just-in-Time (JIT) in India may be different from its implementation in western countries. Such dissimilarity causes different types of implementation problems that would not be found in other society. This paper, therefore, attempts to analyze some important JIT issues in Indian context by conducting a survey of 34 industries. The main objectives of this survey were:

(i) To identify those JIT elements, which are highly difficult to implement in Indian industry.
(ii) To search out most accountable reasons for its slow implementation in India.
(iii) To highlight the most expected JIT benefits.

## Methodology

This study includes four phases: (a) Questionnaire preparation, (b) Data collection; (c) Data Analysis, and (d) Final conclusions. First phase of this study was to review the literature related to JIT from several books, journal articles, and relevant websites. Based on this review, various dimensions and related elements of this concept were identified. At last, a questionnaire was prepared. The questions were on the company's profile, JIT benefits, JIT implementation and related problems. The questionnaire was mailed to 115 manufacturing firms located around Delhi, Faridabad and Gurgoan because of logistic constraints. Initially, response was poor. To get more response, reminders were sent to managers by telephonic calls while some mangers were personally interviewed. In all, 37 responses were completed. Out of 37 responses, 3 were excluded from study due to incomplete and unreliable responses. At last, 34 responses were found suitable for study, making response rate 29 per cent. The general profile of participated companies is given in Table 1.

Among 34 companies surveyed, eight were automobiles, six heavy machines, fivecleaners, oil filters, steering gears, air filter housing, gear and axle assembly for cars, electric motors, refrigerators, fans, etc. Inability to meet the daily schedule was the common problem of participating industries. Time losses due to machine failure and power failure, work stoppage due to bad quality were major reasons for missing schedule. Most of respondents were aware about JIT.

Table 1— General profile of companies

| | |
|---|---|
| Type of company | Automobile: 7; Heavy machines: 9; Electronics: 6; Others: 12 |
| Annual turnover (in crores) | Maximum (3150); Minimum (4.5); Average (417) |
| Number of employees | Maximum (7100); Minimum (30); Average (1855) |
| Percentage of scrap | Maximum (6.5); Minimum (0.5); Average (2.7) |
| Percentage of rework | Maximum (14.0); Minimum (1.5); Average (5.3) |
| Type of layout | Production: 8; Product: 07; Mixed: 16; Cellular: 3 |
| Ability to meet daily production schedule | Very Good :5; Good: 16, Fair: 9; Poor: 3; No response:1 |
| Scope of JIT | Very Good: 7; Good: 13, Fair: 10; Little: 4 |
| Awareness about JIT | Yes: 29; No: 3; No response: 2 |

Thirteen of the 34 respondents mentioned good scope of JIT in India.

## Analysis

The t-test is conducted at 5 per cent level of significance to analyze JIT issues such as difficulty in implementing the JIT elements, expected benefits of JIT implementation, and reasons for slow implementation of JIT in Indian industries. The following hypotheses were formulated for t-test.

(i) $H_0$: No element of JIT is difficult to implement in Indian industry. (The null hypothesis ($H_0$) will be rejected if JIT element subjected under test is not difficult to implement).
(ii) $H_0$: All JIT benefits listed in Table 2 could not be achieved through JIT implementation. (The null hypothesis ($H_0$) will be rejected if surveyed companies have achieved any expected JIT benefits listed in Table2).
(iii) $H_0$: All causes listed in Table 3, are not responsible for slow implementation of JIT in Indian industries. (The null hypothesis ($H_0$) will be rejected if surveyed companies face the similar problem as listed in Table 3).

The results of t-test are given in Tables 2 - 4. The study indicates the JIT index as 3.18 on scale 0-5, implying that perfect implementation of JIT is slightly difficult in Indian industries. It has been found that JIT elements such as, Buffer stock removal, Error pre-

Table 2— Degree of difficulty in implementing JIT attributes by the respondents

| Sl No. | JIT elements | High 5 | Degree of difficulty 4 | 3 | 2 | Low 1 | No response | Mean score | $t_{calculated}$ | Results Let $H_0$ =3.00 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Buffer stock removal | 9 | 13 | 10 | 1 | 0 | 1 | 3.794 | 1.887 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 2 | Continual quality improvement | 7 | 6 | 11 | 8 | 1 | 1 | 3.206 | 1.524 | $H_0$ accepted |
| 3 | Effective communication | 0 | 2 | 15 | 12 | 4 | 1 | 2.382 | -4.934 | $H_0$ accepted |
| 4 | Employee empowerment | 2 | 1 | 13 | 17 | 0 | 1 | 2.559 | -3.530 | $H_0$ accepted |
| 5 | Error prevention (poke-yoke) | 9 | 11 | 8 | 3 | 1 | 2 | 3.529 | 0.202 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 6 | Frequent and reliable delivery | 7 | 12 | 11 | 2 | 1 | 1 | 3.559 | 0.400 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 7 | Group incentive scheme | 0 | 6 | 8 | 15 | 2 | 3 | 2.353 | -5.162 | $H_0$ accepted |
| 8 | High QC visibility | 3 | 9 | 12 | 5 | 2 | 3 | 2.912 | -0.687 | $H_0$ accepted |
| 9 | Job enlargement | 5 | 7 | 11 | 3 | 3 | 5 | 2.794 | -1.625 | $H_0$ accepted |
| 10 | Kanban system | 16 | 11 | 3 | 1 | 2 | 1 | 4.029 | 0.175 | $H_0$ rejected, $H_a$ =4.00 accepted |
| 11 | Line stop strategy | 7 | 8 | 10 | 3 | 4 | 2 | 3.147 | 1.101 | $H_0$ accepted |
| 12 | Long-term employment | 7 | 5 | 10 | 6 | 3 | 3 | 2.941 | -0.456 | $H_0$ accepted |
| 13 | Long-term QC commitment | 2 | 6 | 17 | 7 | 2 | 0 | 2.971 | -0.227 | $H_0$ accepted |
| 14 | Multifunctional worker | 4 | 9 | 16 | 4 | 0 | 1 | 3.294 | -1.495 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 15 | Total preventive maintenance | 10 | 11 | 7 | 3 | 1 | 2 | 3.588 | 0.596 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 16 | QC authority to worker | 4 | 8 | 14 | 6 | 1 | 1 | 3.147 | 1.101 | $H_0$ accepted |
| 17 | QC training to supplier | 3 | 9 | 7 | 7 | 5 | 3 | 2.676 | -2.577 | $H_0$ accepted |
| 18 | Quality certification of supplier | 3 | 1 | 11 | 8 | 6 | 5 | 2.176 | -6.479 | $H_0$ accepted |
| 19 | Quality circles | 7 | 10 | 9 | 3 | 3 | 2 | 3.265 | 1.934 | $H_0$ accepted |
| 20 | Regular quality auditing | 2 | 8 | 13 | 7 | 1 | 3 | 2.824 | -1.388 | $H_0$ accepted |
| 21 | Self –correction of defects | 6 | 7 | 7 | 8 | 3 | 3 | 2.882 | -0.919 | $H_0$ accepted |
| 22 | Set up time reduction | 10 | 13 | 6 | 3 | 0 | 2 | 3.706 | 1.347 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 23 | Short lead time | 9 | 8 | 11 | 3 | 2 | 1 | 3.471 | -0.205 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 24 | Small lot size | 12 | 7 | 5 | 4 | 4 | 2 | 3.382 | -0.837 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 25 | Standard containers | 0 | 5 | 9 | 12 | 6 | 2 | 2.265 | -5.833 | $H_0$ accepted |
| 26 | Standardization | 4 | 9 | 11 | 7 | 1 | 2 | 3.059 | 0.448 | $H_0$ accepted |
| 27 | Process control | 8 | 7 | 13 | 1 | 2 | 3 | 3.265 | 1.934 | $H_0$ accepted |
| 28 | Statistical quality control | 6 | 7 | 9 | 6 | 3 | 3 | 2.941 | -0.456 | $H_0$ accepted |
| 29 | Strong buyer-supplier relationship | 5 | 8 | 6 | 7 | 3 | 5 | 2.706 | -2.338 | $H_0$ accepted |
| 30 | Team work | 1 | 3 | 9 | 12 | 3 | 6 | 2.088 | -7.097 | $H_0$ accepted |
| 31 | Total quality control | 9 | 8 | 8 | 4 | 2 | 3 | 3.265 | 1.934 | $H_0$ accepted |
| 32 | U-cells/Layout improvement | 11 | 14 | 5 | 1 | 0 | 3 | 3.765 | 1.703 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 33 | Vendor rating | 1 | 3 | 8 | 15 | 3 | 4 | 2.176 | -6.479 | $H_0$ accepted |
| 34 | Scheduling flexibility | 5 | 9 | 13 | 5 | 0 | 2 | 3.235 | 1.730 | $H_0$ accepted |
| 35 | Zero defect | 16 | 7 | 3 | 3 | 0 | 5 | 3.618 | 0.788 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 36 | Zero deviation schedule | 17 | 12 | 3 | 1 | 0 | 1 | 4.235 | 1.322 | $H_0$ rejected, $H_a$ =4.00 accepted |
| 37 | 100 per cent quality inspection | 6 | 9 | 8 | 4 | 5 | 2 | 3.029 | 0.225 | $H_0$ accepted |
| | | | | | | | | | | Grand Mean score: 3.18 |

vention (poke-yoke), Frequent and reliable delivery, Kanban system, Multifunctional worker, Total preventive maintenance, Set up time reduction, Short Lead time, Small lot size, U-cells/layout improvement, Zero defect, and Zero deviation schedule are difficult to implement while other elements such as, Continual quality improvement, Effective communication, Employee empowerment, Group incentive scheme, High QC visibility, Job enlargement, Line stop strategy, Long-term contracts/employment, Long-term QC commitment, QC authority to worker,QC training to workers supplier, Quality certification of supplier, Quality circles, Regular quality auditing, Self–correction of defects, Standard containers,

Table 3 — Expected benefits of JIT implementation as perceived by respondents

| Sl No. | Expected JIT benefits | Degree of expected benefits High ← Low 5 | 4 | 3 | 2 | 1 | No Response | Mean Score | $t_{calculated}$ | Results Let $H_0$=3.00 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Improved competitive position | 6 | 14 | 8 | 4 | 1 | 1 | 3.500 | 0.000 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 2 | Improved equipment utilization | 9 | 9 | 8 | 5 | 1 | 2 | 3.412 | -0.623 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 3 | Improved quality control | 16 | 7 | 6 | 3 | 1 | 1 | 3.912 | -0.545 | $H_0$ rejected, $H_a$ =4.00 accepted |
| 4 | Improved worker efficiency | 8 | 7 | 12 | 4 | 1 | 2 | 3.324 | -1.273 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 5 | Improved worker motivation | 5 | 4 | 11 | 7 | 3 | 4 | 2.676 | -2.577 | $H_0$ accepted |
| 6 | Increased inventory turn | 14 | 10 | 6 | 3 | 0 | 1 | 3.941 | -0.360 | $H_0$ rejected, $H_a$ =4.00 accepted |
| 7 | Increased administrative efficiency | 3 | 7 | 12 | 9 | 1 | 2 | 2.882 | -0.919 | $H_0$ accepted |
| 8 | Increased flexibility | 13 | 10 | 6 | 3 | 2 | 0 | 3.853 | -0.923 | $H_0$ rejected, $H_a$ =4.00 accepted |
| 9 | Increased productivity | 17 | 11 | 4 | 1 | 0 | 1 | 4.206 | 1.166 | $H_0$ rejected, $H_a$ =4.00 accepted |
| 10 | Increased profit margin | 9 | 8 | 10 | 5 | 1 | 1 | 3.471 | -0.205 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 11 | Increased product reliability | 7 | 6 | 7 | 8 | 2 | 4 | 2.882 | -0.919 | $H_0$ accepted |
| 12 | Increased team work | 14 | 11 | 7 | 1 | 0 | 1 | 4.029 | 0.175 | $H_0$ rejected, $H_a$=4.00 accepted |
| 13 | Low scrap rate | 10 | 12 | 4 | 5 | 1 | 2 | 3.559 | 0.400 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 14 | Lower over heads | 8 | 7 | 9 | 3 | 4 | 3 | 3.088 | 0.668 | $H_0$ accepted |
| 15 | Reduced inventories | 17 | 8 | 5 | 2 | 0 | 2 | 4.000 | 0.000 | $H_0$ rejected, $H_a$ =4.00 accepted |
| 16 | Reduced labor requirement | 3 | 8 | 5 | 9 | 4 | 5 | 2.471 | -4.238 | $H_0$ accepted |
| 17 | Reduced paper work | 2 | 5 | 8 | 12 | 3 | 4 | 2.382 | -4.934 | $H_0$ accepted |
| 18 | Reduced product cost | 7 | 9 | 9 | 7 | 1 | 1 | 3.324 | -1.273 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 19 | Reduced production lead time | 6 | 13 | 8 | 3 | 3 | 1 | 3.382 | -0.837 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 20 | Reduced purchase lot size | 12 | 7 | 9 | 4 | 1 | 1 | 3.647 | 0.978 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 21 | Reduced raw material/parts | 8 | 8 | 5 | 6 | 4 | 3 | 3.029 | 0.225 | $H_0$ accepted |
| 22 | Reduced space requirement | 2 | 7 | 12 | 10 | 2 | 1 | 2.824 | -1.388 | $H_0$ accepted |
| 23 | Reduced supervision | 3 | 10 | 9 | 8 | 2 | 2 | 2.941 | -0.456 | $H_0$ accepted |
| 24 | Reduced the frequency of stoppage | 9 | 12 | 8 | 3 | 1 | 1 | 3.647 | 0.978 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 25 | Reduced work in process | 14 | 10 | 5 | 3 | 1 | 1 | 3.882 | -0.732 | $H_0$ rejected, $H_a$ =4.00 accepted |

Table 4 — Reasons for slow implementation of JIT methods in Indian industries

| Sl No. | Reasons for slow implementation of JIT in Indian industry | High ← | | | | Low | No Response | Mean score | $t_{calculated}$ | Results Let $H_0$ =3.00 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 4 | 3 | 2 | 1 | 0 | | | |
| 1 | High cost of implementation | 14 | 7 | 4 | 4 | 2 | 3 | 3.529 | 0.202 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 2 | Informal and casual quality auditing | 7 | 6 | 16 | 3 | 1 | 1 | 3.353 | -1.053 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 3 | Lack of communication on QC with in company | 5 | 9 | 11 | 4 | 2 | 3 | 3.059 | 0.448 | $H_0$ accepted |
| 4 | Lack of customer awareness about product quality | 8 | 6 | 7 | 7 | 2 | 4 | 2.971 | -0.227 | $H_0$ accepted |
| 5 | Lack of employee mathematical skill | 2 | 6 | 13 | 12 | 0 | 1 | 2.853 | -1.153 | $H_0$ accepted |
| 6 | Lack of production technology and managerial skill | 3 | 7 | 7 | 11 | 5 | 1 | 2.676 | -2.577 | $H_0$ accepted |
| 7 | Lack of support from workers | 7 | 9 | 6 | 8 | 3 | 1 | 3.176 | 1.314 | $H_0$ accepted |
| 8 | Lack of support from supervisors | 8 | 7 | 7 | 8 | 2 | 2 | 3.147 | 1.101 | $H_0$ accepted |
| 9 | Lack of support from suppliers | 7 | 16 | 8 | 2 | 0 | 1 | 3.735 | 1.527 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 10 | Lack of support from design engineering | 0 | 3 | 11 | 13 | 3 | 4 | 2.176 | -6.479 | $H_0$ accepted |
| 11 | Lack of support from HRD department | 5 | 8 | 10 | 6 | 4 | 1 | 3.029 | 0.225 | $H_0$ accepted |
| 12 | Lack of support from R & D department | 14 | 9 | 8 | 3 | 0 | 0 | 4.000 | 0.00 | $H_0$ rejected, $H_a$ =4.00 accepted |
| 13 | Lack of team work | 5 | 8 | 9 | 6 | 3 | 3 | 2.912 | -0.687 | $H_0$ accepted |
| 14 | Lack of top management participation in QC programs | 10 | 8 | 4 | 6 | 3 | 3 | 3.206 | 1.524 | $H_0$ accepted |
| 15 | Lack of training | 4 | 13 | 10 | 5 | 2 | 0 | 3.353 | -1.053 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 16 | Lack of understanding about JIT techniques | 9 | 15 | 5 | 4 | 0 | 1 | 3.765 | 1.703 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 17 | Negative attitude, traits & beliefs of Indian work force | 1 | 7 | 8 | 10 | 4 | 4 | 2.382 | -4.934 | $H_0$ accepted |
| 18 | Poor and inadequate maintenance | 17 | 6 | 8 | 2 | 0 | 1 | 4.029 | 0.175 | $H_0$ rejected, $H_a$ =4.00 accepted |
| 19 | Shortage of multifunctional workers | 8 | 9 | 12 | 5 | 0 | 0 | 3.588 | 0.596 | $H_0$ rejected, $H_a$ =3.50 accepted |
| 20 | Traditional methods of quality control | 11 | 8 | 7 | 6 | 0 | 2 | 3.529 | 0.202 | $H_0$ rejected, $H_a$ =3.50 accepted |

Standardization, Process control, Statistical quality control, Strong buyer-supplier relationship, Team work, Total quality control, Vendor rating, Scheduling flexibility, and 100 per cent quality inspection are easy to implement in Indian industries. Similarly, JIT benefits such as Improved equipment utilization, Improved quality control, Improved worker efficiency, Increased inventory turn, Increased flexibility, Increased productivity, Increased profit margin, Increased team work, Low scrap rate, Reduced inventories, Reduced product cost, Reduced production lead time, Reduced purchase lot size, Reduced the frequency of stoppage and Reduced work in process are expected benefits. The results of survey indicate that High cost of implementation, Informal and casual quality auditing, Lack of support from suppliers, Lack of training, Lack of understanding about JIT techniques, Poor and inadequate maintenance, Shortage of multifunctional workers, Traditional methods of quality control are major reasons for slow implementation of JIT in Indian industries. In addition, participated industries have also indicated that they do not have full support from top management and R&D department. Even with these problems, Indian industries are expecting significant benefits from JIT implementation. Statistical tests confirm that scope of JIT in India is good. Therefore, attention must be focused on critical elements of JIT to reap maximum benefits.

**Disadvantages of JIT Implementation**

For more than a decade, JIT has been touted as prime way to keep costs down and assembly lines running smoothly. However, some researchers criticized that JIT methods have some considerable negative implications at various levels. Indian industries should be examined these issues prior to the implementation of JIT These are:

(i) Implementation of JIT does not automatically increase profit because benefits derived from JIT adoption may be offset by its many direct and indirect costs. In addition the industries cannot expect favorable results just by implementing the JIT because it demands appropriate 'fit' between new manufacturing practices and organizational design, structure, and processes. Its success also depends critically on executive (management) commitment, employee empowerment, and an open organizational culture[12].

(ii) JIT demands the delivery of high quality parts/raw material in small lots. The small lot size production requires increase in efficiency and reliability of production system to unrealistic level because multiple sourcing becomes difficult under JIT[13].

(iii) JIT programs are not one-time efforts that can be quickly implemented. Such programs need continuous assessment to achieve a sustained improvement in quality. They also require continuous close cooperation and communication at all levels of industries[14].

(iv) The stringent demands of the JIT production system require maintaining communication between the supplier and industry at the highest levels because buffer stocks have been eliminated or reduced dramatically. The timing is just as important as quality and quantity. There is little or no margin or error[15].

(v) Extending managerial power is a salient feature of JIT But, it has negative implication for workers. Workers are in fact subject to highly visible forms of managerial power, control, and processes of constant surveillance and monitoring of output and performance. In addition, JIT entails excessive re-training costs and demand unrealistic employee commitment levels[16].

(vi) The JIT information system, kanban requires longer time to transmit any new information through the system as compared to centralized information processing system[17].

**Conclusions and Recommendations**

The results of this survey support the notion that JIT has the potential to increase the operational efficiency, quality and organizational effectiveness of Indian industries while its some basic elements are slightly difficult to implement in existing production system of industries. To gain the benefits of JIT, Indian industries must be willing to modify their procedures and operations. The training of employees in order to create an organizational culture, establishment of new procedures for dealing with suppliers, analysis of operations to identify the areas of standardization, simplification and automation and reengineering of operational processes and procedures are some important issues, which should be examined prior to the implementation of JIT. If these issues are not adequately addressed the JIT effort is bound to encounter humans and suppliers related problems. The potential benefits of JIT to Indian organizations are not in doubt. However the art of designing the 3right strategy for implementing the JIT in Indian in-

dustries is debatable. Therefore, issues related to these concerns are worthy of future research.

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