JIT BASED QUALITY MANAGEMENT IN AGRICULTURAL AND IMPLEMENT INDUSTRY

Nishant Pahwa *

ABSTRACT

The existence of manufacturing companies in a competitive market depends upon its ability to produce high quality product at reasonable cost and with a shortest possible time. It is not difficult to build the high quality product, but it is difficult to maintain that quality. Just-in-Time (JIT) system is capable of achieving this goal. This approach combines the objectives of high quality, manufacturing flexibility, reducing inventory, reasonable cost and delivery dependability. It stimulates new directions of planning and performing activities in a manufacturing. JIT Based Quality Management is one of JIT elements having high potential in achieving many benefits such as improving company competitiveness, cost saving, quality improvement etc. This approach in Indian context is be helpful for those industries, which are struggling with problems of unreliable and long lead-time, quality of product , low productivity, high rate of scrap and defects, shortage of raw material, and least utilization of workers and equipments.

Keywords: *Benefits, Just In Time, In Agriculture And Implements Industry.*

* Lecturer, Department of Mechanical Engineering, N.C.C.E., Israna, Panipat, INDIA .

1. INTRODUCTION

The term JIT comes from quality management theory and the goal is to produce high quality products in the most efficient and economical way. Businesses of all sizes can use Just **In Time** to improve production rate. The main objective is to reduce delivery lead times, reduce inventory, reduce the amount of defects, improve staff productivity and make sure products are delivered on time. It's based on the idea that holding too much stock or too many finished goods is a waste of money, and that a manufacturing business can work more efficiently by ordering only the materials it needs to complete an order. Just-in-time (JIT) is a production strategy that strives to improve a business' return on investment by reducing in-process inventory and associated carrying costs. JIT focuses on continuous improvement and can improve a manufacturing organization's productivity, profitability, quality, and efficiency. JIT Based Quality Management has a significant effect on inventory control, quality control, purchasing, and suppliers.. JIT Based Quality Management cannot be implemented successfully with a high rate of defective items; its success requires detailed attention to quality both in purchasing and production. Therefore, there is an obvious need to identify the importance and applicability of those quality techniques/methods, which play a significant role in improvement of product quality. For this, sixty-eight quality techniques has been identified for survey; and grouped into four categories on the basis of their utility.. The ideal goal of JIT Based Quality Management philosophy is to operate entire production system without interruption and without non-value added activities. This approach put stress on long-term benefits resulting from waste elimination, and continuous improvement in system, people, and products.

2. METHODOLOGY

This study includes four phases a) questionnaire preparation b) data collection c) analysis d) final conclusions. First phase includes the preparation of questionnaire. The questions in questionnaire were based on the benefits of the implementation of JIT based quality management. The Questionnaire given to 10 companies of KARNAL of “Agricultural and implementation industry”. An experiment was conducted 20 expected benefits JIT based quality management & data generated. The Out of 10 companies only 5 companies responded with suitable data. The Questionnaire is given to 15 respondents by taking in to account 2o expected benefits of JIT

The data collected from various companies is analyzed. Than new data is generated through various attributes taken on a five point LIKET scale measuring the degree of expected benefits is subjected to statistical analysis to draw scientific and logical conclusion. Each was given to 15

respondents. The distribution of response was recorded on LIKET scale. The score of 3 was taken as neutral or average & above that measuring a degree of satisfaction. However a below 3 response for any attribute was tending towards low satisfaction. The underline null hypothesis was $\mathbf{H_0}$ **$\mu = 3$ against** H_1 alternate $\mu > 3$.

Since the product is likely to accepted by the masses if it is scoring average more than 3. To be satisfactorily true 95% confidence limit per each attribute score were generated which indicates that an attribute is having a probability of 95. The mean score is calculated for attributes from the data that is filled by each respondent taken degree of expected benefits as $X_1, X_2 \_\_\_ X_5$ and data filled by the respondents is as $F_1, F_2 \_\_\_ F_5$

TABLE

SCORE (X)	FREQUENCY(F)	FX
X_1	F_1	$F_1 X_1$
X_2	F_2	$F_2 X_2$
X_3	F_3	$F_3 X_3$
X_4	F_4	$F_4 X_4$
X_5	F_5	$F_5 X_5$

$$\overline{X} = \frac{\sum FX}{\sum F} \qquad (1)$$

Let $X1, X_2 \_\_\_ X_5$ be the average mean of the k variables under study taken for measuring the satisfactory level of the respondents. To measure the impact of these variables a index known as satisfaction index. In this satisfaction factor or index (I) is calculated on the base of the mean score by using

$$I = \frac{\overline{X}}{\overline{\overline{X}}} * 100 \qquad (2)$$

Where

$\overline{X}$ = mean score

$\overline{\overline{X}}$ = average mean score

$$\overline{\overline{X}} = \frac{\overline{X_1} + \overline{X_2} + \overline{X_3} ..... + \overline{X_n}}{15} \qquad (3)$$

15 is number of respondents

As per objective of study 20 expected benefits of the JIT based quality management were subjected to further analysis. . For this purpose an index is generated to measure the degree of

difficulty based on five LIKET scale mean score. As per logic If Index (I) taken as 100 indicates a normal level of satisfaction contribution of the expected benefits. If index is less than 100 give an idea that particular attribute is low intensity in its implementation. Comes out to be more than 100 or equal to be 100 than the attributes statistifcatory (I>=100) good or excellent and if the I<100 than work has to be done on that area

Formula used

$$t = \frac{\overline{X} - \mu}{S/\sqrt{n}} \qquad (4)$$

Where X = Mean of each attribute

μ = null hypothesis

S = Standard deviation

n = No of attributes

t = T test

$$S = \sqrt{\frac{\sum FX^2}{\sum F} - \left(\frac{\sum FX}{\sum F}\right)^2} \qquad (4.1)$$

TABLE 1 CALCULATION OF MEAN AND AVERAGE SCORE FOR ATTRIBUTES

Sr. no	Mean score $\overline{X}$	Average mean score $\overline{\overline{X}}$
1	3.47	2.76
2	3.4	2.76
3	3.93	2.76
4	3.2	2.76
5	3.07	2.76
6	3.93	2.76
7	3.8	2.76
8	4.2	2.76
9	3.46	2.76
10	3.33	2.76
11	4.2	2.76
12	3.67	2.76
13	4.07	2.76
14	3.33	2.76
15	3.67	2.76
16	3.8	2.76
17	2.8	2.76
18	3	2.76
19	3.6	2.76
20	4	2.76

After calculating the mean score and average mean score of the attributes .The next is to calculate the satisfaction index by using the formula given in eq.1.

TABLE 2 CALCULATION OF SATISFACTION INDEX (I) >100 FOR ATTRIBUTES

The satisfaction index of 20 expected benefits is calculated. The index having more than 100 is tabulated in one table and index having less than 100 is tabulated in another table. The satisfaction index which less than 100 need to be worked out. Table 2 shows the satisfaction index more than 100

RANK	ATTRIBUTES	INDEX
1	Increased Productivity	151.80
2	Increased Team Work	151.80
3	Reduced Work in Process	146.98
4	Reduced Inventories	144.57
5	Increased Inventory Turn	142.16
6	Improved Quality Control	142.16
7	Increased Flexibility	137.34
8	Reduced Purchase Lot Size	137.34
9	Low Scarp Rate	132.53
10	Reduced Production Lead	132.53
11	Reduced Frequency of Stoppage	130.12
12	Improved Competitive Position	125.30
13	Increased Profit Margin	125.30
14	Increased Equipment Utilization	122.89
15	Increased Product Reliability	120.48
16	Reduced Product Cost	120.48
17	Improved Worker Efficiency	115.66
18	Improved Worker Motivation	110.84
19	Reduced Supervision	108.43
20	Reduced Space Requirement	101.20

From the above table we conclude that the satisfaction index is more than 100 the level of satisfaction is good.

3. RESULTS

Expected benefits	Degree of expected benefits: High ← low 5	4	3	2	1	Mean score	$T_{calulated}$	Let H_0 =3
Improved competitive position	2	7	3	2	1	3.46	3.5	H_o = accepted
Improved equipment utilization	4	4	3	2	2	3.4	3.4	H_o = accepted
Improved quality control	7	3	3	1	1	3.9	3.9	H_o = accepted
Improved worker efficiency	3	2	6	3	1	3.2	3.3	H_o = accepted
Improved Worker motivation	3	2	5	3	2	3.0	2.6	H_o = rejected
Increased Inventory turn	6	4	3	2	0	3.9	3.9	H_o = accepted
Increased flexibility	6	4	2	2	1	3.8	2.8	H_o = accepted
Increased productivity	7	5	2	1	0	4.2	3.8	H_o = accepted
Increased profit margin	4	3	5	2	1	3.4	4.2	H_o = accepted
Improved competitive position	6	14	8	4	1	3.5	2.6	H_o = rejected
Improved quality control	9	9	8	5	1	3.4	1.7	H_o = rejected
Improved quality control	16	7	6	3	1	3.9	4.2	H_o = accepted
Improved worker efficiency	8	7	12	4	1	3.3	1.4	H_o = rejected

Improved Worker motivation	5	4	11	7	3	2.6	-1.3	H_o = rejected
Increased Inventory turn	14	10	6	3	0	3.9	4.	H_o = accepted
Increased administrative efficiency	3	7	12	9	1	2.8	-0.59	H_o = rejected
Increased flexibility	13	10	6	3	2	3.8	4.3	H_o = accepted
Increased productivity	17	11	4	1	0	4.2	6.8	H_o = accepted
Increased profit margin	9	8	10	5	1	3.4	2.2	H_o = rejected
Increased product reliability	4	3	3	4	1	3.3	1.3	H_o = rejected
Increased team work	7	5	2	1	0	4.2	6.7	H_o = accepted
Low scrap rate	4	6	2	2	1	3.6	2.8	H_o = rejected
Reduced inventories	7	3	4	1	0	4.06	5.4	H_o = accepted
Reduced product cost	3	4	4	3	1	3.3	1.4	H_o = rejected
Reduced production lead time	3	6	4	2	1	3.6	3.6	H_o = accepted
Reduced purchase lot size	6	3	3	3	0	3.8	3.4	H_o = accepted
Reduced space requirement	1	3	5	4	2	2.8	-0.92	H_o = rejected
Reduced supervision	1	5	4	3	2	3	0	H_o = rejected
Reduced frequency of stoppage	4	5	3	2	1	3.6	2.5	H_o = rejected
Reduced work in	7	4	2	1	1	4	4.2	H_o =

process								accepted

The value of $H_o = 3$ if the value comes out to be more than 3 it is accepted otherwise it is rejected.

4. DISCUSSION

The conducted survey has revealed that after implementing the JIT in Agricultural and Implements industry. This is favorable sign in ease the implementation of JIT Based Quality Management. However, industries have need to cautious planning and full teamwork for effective implementation quality programs. Some techniques such a total preventive maintenance, quality circle etc requires more attention since their successful implementation may be helpful to determine the ways and means to improve present position of our industries in area of quality, cost and flexibility.

4.1 Benefits

1 Over Production Ceases - components are typically made to order not stock

2. Labour Costs Are rationalized - The Company saves because it is not paying workers to produce items that have no immediate use. Staff is focused only on the material at hand.
3. Relationships With Suppliers become strategic - Suppliers have to have a positive and inter-dependent relationship with the manufacturer, rather than the historic relationship where the customer had the power and the supplier was not an equal.
4. Motivated Workforce - Staff are motivated by specific goals and targets related to the manufacturing targets.
5. Improvement in scheduling and forecasting - JIT requires adequate focus in scheduling and forecasting (getting these wrong means that you'll have problems in getting the correct inventory at the right time).
6. Material Flow improves - JIT typically includes some rationalization of lot sizes - this facilitates better management of inventory and reduced delays in completing lots for distribution.

4.2 Problems in Implementation

The various problems being faced by the companies. The managers were asked to identify the problems faced during implementation of JIT Based Quality Management. Poor and inadequate maintenance of machines is cited by seventeen managers. Four managers mentioned that multifunctional workers are often not available. Some companies indicated that biggest problem is use of traditional quality control techniques. One company has

indicated that negative attitude traits, and beliefs of Indian workforce are most accountable reason for slow implementation of JIT Based Quality Management. The group of fourteen companies indicates the high cost of implementation as a major problem. The survey results indicates that informal and casual quality auditing, lack of support from suppliers, lack of training and lack of' understanding about JIT concepts, are some another reasons for slow implementation of JIT Based Quality Management. In addition, participated industries have also indicated they do not have full support from top management, and research and development (R&D) department.

5. CONCLUSION

In this survey, the degree of difficulties in implementation of JIT Based Quality Management is found 3.18 on scale (0-5) implying that implementation of JIT Based Quality Management in its totality is slightly difficult in Indian industries. Some attributes such as set up time reduction and kanban are also found difficult to implement due to lack of' investment in research and development (R&D) activities. Another significant difficulty in implementing JIT Based Quality Management is huge investment in installation of visual control, training of employees and restructuring of production process costs. It has been observed that ISO certification has increased the quality awareness in industries. Consequently, quality control and maintenance activities are now' considered as staff function. This may be the favorable sign for implementation of JIT Based Quality Management. The concept of total preventive maintenance has not deep rooted resulting in high frequency of breakdowns'. Even with these problems, Indian industries are expecting significant benefits from implementation of JIT Based Quality management. However, expected benefits do not just happen. Before an organization enjoys with the benefits of JIT Based Quality Management, it must accept principles of JIT Based Quality Management 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, and kaizen have to be implemented. This study indicated that implementation of JIT Based Quality Management in Indian organization is not an easy job yet numbers of attempts are being made in several Indian industries to implement this approach in phased manner with belief that it would be helpful in facing the global competition.

6. REFERENCES

1. Ackroyd S., Burrell G., hughes & Whitaker A (1988). "The japanization of british industrial Relation Journal. Lf .19 PP. 11-33.

2. Aggarwal A., & Sumer C. (1985) "MRP, JIT, OPT, FMS?" Harward Business review, September- Oct, pp 8-12.
3. Aggrawal S.K, Vrat P. & Karunes S. (1996), "Quality Management self asseament approach for Quality Improvement", Productivity journal, Vol. 37, pp 239-244.
4. Ansari A,& Modarress B. (1990), " JIT.", New- York; Free press.
5. Inman R & Bulfin R.L (1991), "Sequencing of JIT Mixed Model Assembly Lines ", Management Science, Vol 37, pp 901-904.
6. Inman R. & Sehra S. (1991), "JIT Implications for Service Environment." Production & Inventory Management Journal, Vol.32, pp. 16-21.
7. Barker P.J (1993), "Value –Adding Performance Measurement: A Time Based Approach." International Journal of Production &Research, Vol.13,pp33-40
8. Bondi P.J (1994) "How Do JIT System Affect Human Resource Management?" Production &inventory Management Journal, Vol. 35, pp 1-4
9. Baker R.C, Chang R.E& Chang I.C (1994), "Switching Rules for JIT Purchasing." Production &Inventory Management Journal Vol. 35, pp 13-17
10. Billesbach J.(1994), "Applying Lean Production Principles To a Process Facility". Production &inventory Management Journal, Vol. 5, pp 40-44
11. Ben-Daya M. (1999), "Integrated Production Maintenance &Quality Model for imperfect Processes." IIE Transaction, Vol. 31, pp 491-501
12. CususmanoM.A(1994), " The Limits of Lean." Sloan Management Review, summer pp.27-32
13. Chakroborti T. (1997) "TQM-A Hard Climb" The Economics Times (Supplementary), 28Mar -3 April
14. Dutton B.(1990) "Switching to Quality Excellence ", Manufacturing System Vol 8, pp 245-256.
15. Deshpande S.P & Golhar D.Y (1996), "HRM Practices of JIT Firms in Canada." Production Planning & Control Vol.7, pp79-85
16. Fisher M.(1997), "What is the Right Supply chain For Your Product ?Harvard Business, Review March – April pp.105-116
17. FreeLand J.R (1991), "A Survey of Just in time purchasing in the United States." Production &Inventory Management Journal Vol. 32, pp 43-50.
18. Garg D., Deshmukh S.G & Kaul O.N [1996] "Critical Analysis in JIT Purchasing in Purchasing in Indian Context" Productivity Journal Vol. 37, pp 13-17

19. Garg D., Deshmukh S.G & Kaul O.N [1996] "Attributes for JIT Purchsingand Supplier Evaluation: ASurvey." Productivity Journal Vol. 38, pp 322-326
20. Garg D., Deshmukh S.G (1999) "JIT Concepts and Relevance in Indian Context."Industrial Engineering Journal, VOL28 pp.14-18
21. Hall R.W (1983), "Zero Inventories" (Homewood, IL: Dow Jones-Irwin)
22. Hobbs O.K (1997), "Managing JIT towards Maturity" Production &Inventory Management Journal Vol. 38, pp 47-50.