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Just in time (JIT) production system : Not just an option but an imperative - A study of an agro-machinery manufacturing company in Kerala

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ABSTRACT

Just in Time (JIT) production system offers good prospects for enhancing operational efficiency and productivity through minimization of inventory. Though, JIT is yet to pick up momentum in a significant way in Indian manufacturing companies, probably because of high level of bottlenecks in obtaining the critical inputs, some less stringent forms of JIT (sometimes called, 'Indianised JIT') are being practiced meaningfully by many companies where the inventory is maintained at substantially low levels, though not to the extent that an ideal JIT production system requires. In the above context, this paper (i) makes an overview of JIT, its major features, benefits, key pre-requisites, and also the status of JIT implementation in Indian companies; (ii) makes a detailed study of inventory management system at KAMCO – an agro-machinery manufacturing company based in Kerala; (iii) locates the need for scientific inventory management through JIT in view of the significantly lower inventory turnover ratio vis-à-vis national benchmark, and (iv) finally suggests strategies for adoption of JIT production system in a systematic and phased manner, for better operational efficiency.

Key words : Inventory Turnover ratio, Benchmarking

Concept and significance of JIT production system:

Just-in-Time (JIT) production systems were developed in Japan to minimize inventories, especially work-in-progress (WIP). In fact, WIP and other types of inventory are treated as a waste by the Japanese and accordingly these should be minimized or eliminated. Ideally, a JIT production system should produce and deliver exactly the required number of each component to the downstream operation in the manufacturing sequence just at the time when that component is needed. Thus, the JIT delivery discipline ensures that each component is delivered "just in time" and this minimizes WIP and manufacturing lead time as well as space and money invested in WIP.

JIT as an emerging cost management philosophy offers good prospects for enhanced operational efficiency of any manufacturing company. JIT is a key building block for modern approaches to manufacturing planning and control. In fact, JIT is both a philosophy and a set of techniques. It reduces the complexity of detailed material planning, the need for shop-floor tracking, work-in-process inventories, and transactions associated with shop floor and purchasing systems. These benefits in turn requires more tightly co-ordinated manufacturing processes– both

inside the company and with suppliers. Prompt supply of the input materials being a pre-requisite, efficiency at their level and adequacy of infrastructure facilities for prompt supplies are equally significant. Ideally, in a JIT set up the inventory in hand may be sufficient for a few hours production only. JIT orientation involves: (i) Reduction of set-up times and lot sizes, (ii) 'no-defects' goal in manufacturing, (iii) Focus on continual improvement, (iv) Worker involvement, (v) Cellular manufacturing. In the above context, this paper has set the following objectives:

- To make an overall review of JIT, its major features, benefits, key pre-requisites, and also the status of its adoption in the Indian scenario;
- To make a detailed study of inventory management system at KAMCO – an agro-machinery manufacturing company based in Kerala, including benchmarking KAMCO with the industry leader (*viz.*, VST) and the best among the manufacturing companies in JIT adoption (*viz.*, SBL);
- To make a reality check as to the extent and nature of applicability of scientific inventory management at KAMCO through JIT system for its enhanced performance and competitiveness;
- To suggest strategies for adoption of JIT

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production system at KAMCO, in a systematic and phased manner, for better operational efficiency and competitiveness of the company. .

Jit production system in the Indian scenario-An overview:

JIT implementation in India: Two empirical studies:

Regarding the status of JIT adoption in India, there have not been many studies. Two empirical studies on JIT implementation in India *viz.*, Mahadevan (1997) and Chandra (1998) have both pointed out that the progress of JIT implementation in India is not satisfactory. The details of these studies in brief along with summary of their findings are given below:

Readiness of Indian companies for JIT adoption: Study by Mahadevan (1997):

Mahadevan (1997) has pointed out that though in India there have been attempts to implement quality circles in 1980s, and also JIT in the more recent past, the progress in JIT implementation has not been satisfactory. TQM has been observed to be one of the most important factors for JIT implementation. Experiences of JIT implementers as per by his study are given in Exhibit I

- Of the 22 companies which had undertaken JIT efforts at the time of the study, 13 companies reported adhoc JIT efforts like experimental and adhoc modification of systems whereas 9 companies reported major JIT efforts.

- Most of the firms with adhoc JIT efforts started the same only recently (*viz.* around mid-1990s) while those with major JIT programmes started the same as early as in 1986.

- Firms with major JIT programmes had an implementation lead time of over three years.

- Supplier development, Employee involvement, and Top management commitment were prominently listed as critical success factors.

- Training, task force formation, re-layout, and pilot study were indicated as among the first four steps taken in JIT implementation.

- Three most important reasons for embarking upon a JIT implementation programme were gaining competitive advantage in the market place, simplifying the production planning and control, and curbing rising inventory levels.

- Proximity of suppliers, stable production plan, or high volume repetitive manufacturing, or high volume repetitive manufacturing were never mentioned among the main reasons for JIT implementation.

Firms reporting major JIT efforts have done so after carefully evaluating its strategic nature. On the contrary,

firms reporting some adhoc modification and experimental efforts did not do any strategic planning exercise. JIT efforts were initiated by middle management because the top management asked them to do so.

Exhibit I : Experiences of JIT implementers—A summary.

[Source: Adapted from, Mahadevan (1997), p. 89.]
[See FN 1]

Mahadevan (1997) has further observed that there have been differences in the nature of JIT efforts pursued according to the type of organizations *viz.*, (i) Major – organizations that reported major JIT programmes, (ii) Some – organizations that report adhoc modification, experimental JIT efforts, and (iii) None – No JIT programmes. These variations persisted in the nature of efforts as well as in the quantum of benefits realized. Accordingly, companies that have initiated major JIT programmes have very different concerns from those who merely “think” about JIT. Only in respect of two factors *viz.* (i) Employee involvement and (ii) Standard containers, the three broad categories of organizations as above have some degree of agreement among themselves. The factors of concern experienced by the various categories of organizations as observed by him are given in Table 1.

Concluding his study, Mahadevan (1997) gives some guidelines for successful JIT implementation. Firstly, firms have to inevitably go for certain system level changes, like introduction of *Kanban*, Cellular manufacturing, and Set-up time reduction. Secondly, the nature of efforts to be employed differs from case to case, as it depends on complexity of manufacturing, the sector and the ownership. Thirdly, major JIT efforts will be successful only when it is a part of a strategic planning exercise, which in turn ensures top management’s active role and commitment. Lastly, clarity and priority is utmost important, the lack of which may lead to confusion and wasteful expenditure.

Justification for JIT for Indian industries: Study by Chandra (1998):

Chandra (1998) has pointed out that JIT manufacturing systems have attracted industries all over the world and so do those in India. The author has attempted to examine the benefits of JIT and elements for its feasibility in Indian industries. It has been noted that despite for the profound interest of prospective managers and researchers, the extent of JIT implementation in Indian industries so far is not satisfactory. The real challenge before Indian managers is to establish priorities among potential JIT techniques to achieve best possible advantage of JIT implementation. In the above context, the author has attempted to evaluate the relative

Table 1 : Concern factors on JIT implementation for various categories of organizations

Sr. No.	Major classification	Sub-classification	Concern factors
1.	Nature of JIT efforts	Major	JIT Purchasing, TPM, Kanban, Small Lot Size
		Some	JIT Purchasing, TPM, TQM, Vendor Development
2.	Sector of industry	Automobiles and Ancillaries	JIT Purchasing, TPM, TQM
		Electrical and Electronics	JIT Purchasing, TPM, TQM, Kanban, Stable Production Schedules
		Machine Tools and Capital goods	JIT Purchasing, TPM, TQM, Stand and Containers, Stable Production Schedules
		Process Industry	JIT Purchasing, TPM, TQM, Stable Production Schedules, Small Lot size.
3.	Ownership pattern	Private	JIT Purchasing, TPM, TQM, Set-up time reduction
		Multi-nationals	JIT Purchasing, TPM, TQM, Kanban, Multi-skilled work force.

[Source: Adapted from, Mahadevan (1997). Are Indian Companies Ready for Just-in_time?, *Management Review*, July–Sept., p.90.]

[Notes: “Major” denotes major JIT programmes reported; “Some” denotes Adhoc modification / Experimental JIT efforts; and “None” denotes no JIT programmes.]

importance of decision attributes, based on a multi-attribute decision model using an analytical hierarchy process (AHP). Thus, the justification for JIT in the Indian context has been studied. The study has concluded that the benefits of JIT manufacturing system are manifold. The major benefits of such a system in the descending order of significance are as follows:

- Increased productivity
- Increased profit margin
- Improved competitive position
- Quality improvement
- Reduction in inventory

JIT in the Indian context: The case of “Indianised form of JIT”:

In India, there are quite less number of instances of companies practising JIT or lean manufacturing. In fact, they are maintaining adequate inventory to meet instances of delay in supplies which in turn results in lower operational efficiency and profitability. In spite of relative disadvantages for Indian companies, a few progressive Indian companies like Sundaram Brake Linings Ltd (SBL) have outperformed even Japanese counterparts. SBL has put in place n ‘Indianised form of JIT’, by modifying JIT to suit Indian conditions.

As already noted, in the Indian context there are quite less number of instances of companies practising JIT or lean manufacturing. In fact, they are maintaining adequate inventory to meet instances of delay in supplies. But this practice of inventory management has got its cost implications which in turn results in lower operational efficiency and profitability. This situation is quite different in countries like Japan where even a day’s disruption of

supplies would lead to a complete chaos. In the Indian scenario, Sundaram Brake Linings Ltd. (SBL) has an impeccable track record of excellent productivity and operational efficiency. It has meaningfully implemented JIT system, in spite of the handicaps faced by Indian industries in this regard, particularly in the form of infrastructural bottlenecks. In the Indian scenario, though JIT in the strict sense may not be feasible because of systemic inadequacies, at least an “Indianised form of JIT” could be very meaningfully adopted by SBL. A brief account of the operational efficiency of SBL is given in the following paragraphs.

JIT in the Indian context: the case of “Indianised form of JIT” of SBL:

In spite of relative disadvantage for Indian companies, SBL is one of the best among the very few progressive companies that have adopted JIT system. In fact, SBL could even outperform even Japanese counterparts, in spite of its handicaps in India. SBL could better even its Japanese counterparts in handling supply shocks, through an ‘Indianised form of JIT’. SBL has adopted JIT by modifying it to suit Indian conditions. Unlike in Japan where things run to perfection, Indian entrepreneurs have to reckon with several layers of risk while adopting JIT which can be in the form of infrastructure, labour, politics etc.

In India, there are very few instances of companies dropping their inventory levels to a few hours of production. Only where the source of supply is in close proximity have the Indian companies resorted to hourly supplies. They, instead, seem to be comfortable with a stock of a day’s production where the suppliers are located not too far off or have their warehouses at a reasonable distances. The

'milk run' by these suppliers feed the supplies for every day's production. In instances where the suppliers are located at a distance say 500 km or more, some corporates have resorted to holding safety stocks. This safety stock is defined and determined by a matrix of values which includes the type of the input, its criticality to the production, the lead time for transporting it from the supplier to the factory, its value and even threat perception of the supply disruption. But then this Indianised form of JIT is not most efficient. Especially when corporates here have to compete in the global market with the best in the world.

In mature economies, better infrastructure and considerably less supply shocks mean that enterprises there could manage by working on very low inventories. They thus have a competitive advantage. In an era of low interest rates, Indian companies may have preferred to absorb this cost but if and when the cost of funds move, it would start pinching their profitability significantly. On the delivery side too, corporates have been maintaining warehouses at locations close to the buyers both in India and abroad so that the bottlenecks do not upset their delivery schedules and hence their credibility. This also costs money. Indian companies have successfully hit a formula with regards to inventory control. One that obviates the need to carry huge inventory while at the same time takes care of the risks inherent in India.

Operational highlights of SBL: Hallmark of excellence in productivity and profitability:

The financial highlights of SBL (FY 2003 to FY 2007)

are given in Table 2 below. From the Table it may be noted that the inventory turnover is quite high (about 20) and moreover it is showing an increasing trend over the years. As of FY 2007, this ratio is 20.7 which means that nearly two times a month it turns over, or in other words the holding period is just above 15 days ($\frac{1}{2}$ month), as an inventory turn over of 24 corresponds to 15 days ($\frac{1}{2}$ month). Almost all major financial parameters (EPS, PAT, RONW etc.) are quite good and are showing an increasing trend.

Analysis of inventory management at KAMCO and benchmarking with SBL and Insustry Leader (VST)

Present Inventory Management System at KAMCO: ABC analysis:

KAMCO follows the conventional ABC method of inventory management. The criterion used for classification uses Delivery Ratio (DR) showing promptness in delivery and Quality Ratio (QR) showing the level of quality, both being given equal weightage (50%). Assessment made is reviewed at quarterly intervals as per the above criterion and accordingly the ABC classification already made is changed, in case of variations observed in the total value of individual items (Table 3).

Inventory turn over ratios of KAMCO (FY 2002-2007):

For the purpose of assessing the effectiveness of inventory management at KAMCO inventory turn over

Table 2 : Operational highlights of SBL (FY 2003 to FY 2007)					
(Rs. in Laacs)					
Particulars	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Sales and other income	10,195	12,075	13,367	14,560	18,983
Export sales	5,339	5,251	5,878	5,482	5,490
Profit before tax (PBT)	1,020	1,335	1,536	1,634	2,166
Profit after tax (PAT)	734	909	1,015	1,039	1,377
Net worth (NW)	3,572	4,188	4,814	5,518	6,491
Return on net worth (RONW)	20.50%	21.70%	21.10%	18.80%	21.20%
Earnings per share (EPS) (Rs)	27.03	33.50	37.41	38.30	50.76
Sundry debtors (in Days)	86	76	84	88	85
Inventory turnover (Times)	16.30	19.50	21.30	19.10	20.70

[Source: Computed from published financial statements of SBL for the respective financial years]

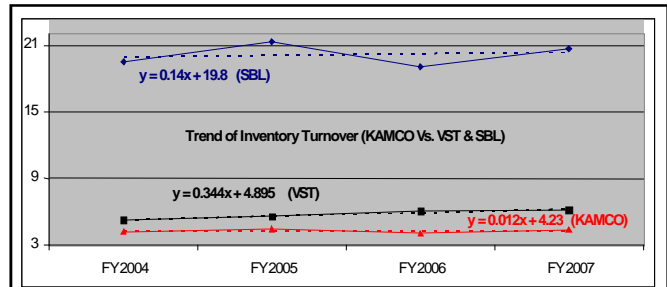
Table 3 (a) : ABC Classification of inventory at KAMCO – Methodology			
Classes	% of number of items	% of value of items	Criterion for classification (DR = Delivery Ratio and QR = Quality Ratio)
A	10	70	$[(DR*0.5) + (QR*0.5)] = 0.9$ or more.
B	20	20	$[(DR*0.5) + (QR*0.5)] =$ between 0.7–0.9
C	70	10	$[(DR*0.5) + (QR*0.5)] =$ less than 0.7

(Source: Compiled from, Purchase Department Records, KAMCO)

Table 3 (b) : Inventory turnover ratios of KAMCO (FY 2002 – 2007) (Rs. in Lacs)

Financial year	Net sales	Average inventory	Inventory turnover ratio
FY 2002	6745.14	1299.71	5.19
FY 2003	7342.89	1426.42	5.13
FY 2004	6815.40	1617.31	4.21
FY 2005	7934.39	1789.42	4.43
FY 2006	8003.69	1994.85	4.01
FY 2007	9121.74	2078.32	4.39

(Source-Annual Report 2001-2002 to 2006-2007)



(Source: as in Table 3 and 4 above)

Fig. 1 : Trend of inventory turnover ratios (KAMCO Vs. SBL and VST) (FY 2004 – 2007)

Table 4 : Inventory turnover of KAMCO: Benchmarking with SBL and VST (FY 2004 – 2007)

Inventory turnover (Times)	FY 2004	FY 2005	FY 2006	FY 2007	Average
KAMCO	4.21	4.43	4.01	4.39	4.26
VST (Industry Leader)	5.19	5.59	6.06	6.18	5.76
SBL (taken as Benchmark)	19.5	21.3	19.1	20.7	20.15

(Source: Computed from Annual Reports of FY 2004 to FY 2007)

ratio has been computed. This ratio denotes the speed at which the inventory is converted into sales, thereby contributing to the profits of the firm. Other factors remaining constant, higher the ratio, better the inventory management. This ratio reveals the number of times finished stock is turned over during a given accounting period. Actually it can be found out as follows:

$$\text{Inventory Turnover Ratio} = (\text{Net Sales} / \text{Average Inventory})$$

where, average inventory = (Opening stock + Closing stock) / 2

Comparing the inventory management performance of KAMCO with SBL (taken as a Benchmark, in view of its excellent performance in inventory management and business profitability) and VST (industry leader, with constantly growing market share and profitability), it is observed that KAMCO is lagging behind VST and much more behind SBL. Its trend is also the least impressive. (Table 4, Fig. 1).

JIT adoption at KAMCO - The future plan of action

JIT Adoption at KAMCO: A reality check:

Based on the experiences of progressive Indian companies like SBL and also in the light of evidences from earlier studies, an attempt is made in this section to study as to what should be the strategy of KAMCO in this regard. In fact, KAMCO has just started adopting JIT in a small way in FY 2007 and right now 09 components are under JIT system. As inventory turnover ratios (times) of KAMCO are decreasing over the years which is not

advisable, KAMCO should adopt JIT in an elaborately. However, initially a phased approach is advisable, till its infrastructure becomes adequately developed to support JIT. Table 4 shows feasibility of KAMCO for adoption of JIT production system.

Present JIT system in KAMCO and Roadmap for adoption of JIT in a phased manner:

As already noted, inventory management system at KAMCO is least impressive and it needs to catch up substantially to attain the status of VST – the leader of its own industry (agro-machinery) in terms of market share, profitability etc. Furthermore, to attain the status of SBL – the best company among the manufacturing firms in India in respect of inventory management, profitability etc.

JIT system has been in vogue in KAMCO since FY 2007, though in a small way. The company’s current policy is to consider only ‘A’ category items (as per ABC Analysis) alone for JIT adoption. These ‘A’ category items are further analysed as to their ranking based on such criteria as (i) Capacity of the suppliers, (ii) Distance to the suppliers, (iii) Quality of the items supplied, (iv) Promptness in supplies etc. Only such items that rank sufficiently high as per the above ranking are considered for JIT. Accordingly, right now 09 ‘A’ category items (out of the total 83 ‘A’ items) have been brought under this system. These items along with values are as follows: (1) Cylinder Frame (Rs.3500); (2) Main Handle (Rs.625); (3) Front Frame (Rs.1200); (4) Wheel Rim (Rs.600); (5) Fly Wheel (Rs.2000) (6) Wheel Cover (Rs.250); (7) Fuel Tank (Rs.500) (8) Belt Cover Assembly (Rs.400); (9)

Table 5 : JIT Adoption at KAMCO: a Reality Check		
JIT – Requirements	Position in respect of KAMCO	Remarks
Prompt supplies	(i) Good rapport with most suppliers (ii) Bulk procurement on annual basis (iii) Not-so-good inventory management	KAMCO should preferably go for JIT adoption in a bigger way to better manage its inventory costs.
Worker Involvement	(i) Trained and skilled manpower (ii) Satisfactory industrial relations, HRM (iii) Public sector company	Generally satisfactory situation for embracing JIT. Though a PSU, it has reasonably good HR systems.
No defects production / continual improvement / modern techniques like cellular manufacturing (CM)	(i) Current production system conforms to high quality standards and as such “no defects” production is almost in place. (ii) Philosophies like ‘continual improvement’ is also within reach.	KAMCO’s production system can reasonably support JIT system in spite of the PSU legacy of the company.
Conformity of the present JIT system in KAMCO with ideal JIT requirements – Ease of installing full JIT	Already JIT is being employed in a small way and 09 components are within JIT. The requisite infrastructure (like, computerized inventory management) are in place. Thus, adoption of FIT in full-swing is easier.	To the present group of 9, another 5 may join within the next Quarter. KAMCO plans to make the total number 50 by the next year-end. (See Appendix–IV, Para III & IV).

[Source: Compiled by the Author, based on known details and facts collected from KAMCO]

Table 6 : Strategy for adoption of five selected components into the JIT system (Next Quarter)				
Components (All ‘A’Type) (Value, Rs)	Location (supplier)	Distance (km)	Quality, Promptness and Other Remarks	Strategy for the next Quarter (beginning, April 2009)
Blade Shaft (1500)	Okkal	6	Good, Prompt	All these 5 items are locally available, and that too from reliable suppliers. They may be brought under JIT in the next Quarter. Then, total =9+5=14
Tyre (1200)	Kozhikode	180	Good service	
Tube (200)	Kozhikode	140	Good service	
Chain (550)	Coimbatore	130	Established, Prompt	
Rear Wheel Bracket (500)	Ernakulam	25	Very good service	

[Source: Formulated by the Author based on relevant facts and logical assumptions.]

Table 7 : Strategy for inclusion of more items into JIT system (for the Next Three Years)						
Year 1		Year 2		Year 3		JIT implementation strategy
Q1	09 Nos A	Q1	11 Nos A	Q1	14 Nos B	In Year 1, 36 items (<i>i.e.</i> 9 each in each of the four quarters) to be included so that cumulative number becomes 50 at the year-end. In Year 2, 44 items (33 A and 11 B) and in Year 3, 56 items (B).
Q2	09 Nos A	Q2	11 Nos A	Q2	14 Nos B	
Q3	09 Nos A	Q3	11 Nos A	Q3	14 Nos B	
Q4	09 Nos A	Q4	11 Nos B	Q4	14 Nos B	
Cum. Total = 50		Cum.Total=94		Cum. Total=150		Thus by third year-end=150 Items (83 A & 67 B)

[Source: Formulated by the Author based on relevant facts and logical assumptions.]

Silencer Assembly (Rs.400). In quarterly intervals, KAMCO makes a review is made to decide as to whether the components under JIT have to be increased or decreased based on their latest rankings as per the prescribed criteria.

The above strategy ensures that by the end of the quarter ending June 2009, another 5 components gets into the JIT system, thus making the total number 14 (*i.e.*, 9 plus 5). Based on the current policy of the company to bring in 50 items into the JIT fold by another one year (June 2010) 36 items (9 each in each Quarter beginning

from July 2009) may be included (Table 3). Considering the profile of the current suppliers (primarily distance factor) and also such other factors as capacity, delivery schedules, it is logical to include another 44 items (11 each in all the four Quarters) (33 of A Category and 11 of B Category) in the next (second year, ending June 2010). In the third year 56 items (14 items each in all the four Quarters, all of B Category) be included, so that by the end of third year, total reaches 150 (83 of A Category and 67 of B Category). (Remaining B category items and the entire C category items cannot be brought under JIT.)

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