

IMPLEMENTING JUST-IN-TIME PRODUCTION AND PROCUREMENT STRATEGIES

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ABSTRACT

Just-in-time (JIT) philosophy is increasingly occupying a significant place in the operations strategy of companies. Although there is less controversy about the choice of selecting JIT, as a mode to adapt to the changing business environment, there is a lot of confusion as to how to organize an effective JIT system. Even in companies that have started JIT implementation, the short term visible benefits of lot-size reduction, down-loading of inventory etc., have wrongly lead to the belief that an effective JIT strategy is in place. In reality, the JIT strategy is not a one-shot effort, but an ongoing long term process. During the course of the JIT implementation and control, constant fine tuning at various levels in the organization is required to put in place the desired setting for a more effective operations strategy. This paper attempts to identify the key strategies for successful implementation of JIT production and procurement and emphasize the need for top management commitment with a dynamic organization structure in order to incorporate the necessary changes that need to take place in an organization so that JIT implementation can take place in an effective manner.

INTRODUCTION

An overall business strategy, or indeed any strategy has two distinct components : 1) strategy formulation and 2) strategy implementation and control. Likewise, Just-InTime (JIT) operations and procurement strategy must have these two components: (1) formulation, and (2) implementation and control. Traditionally, the strategy formulation involves the top management, while the implementation and control elements are delegated down the line. In a recent survey involving the identification of critical elements of JIT implementation, Mehra and Inman [1992] reported that top management commitment and involvement were not linked directly to JIT implementation which most cases resulted in failure [10]. This finding reinforces the doctrine that the top management cannot afford to stay away and neglect the implementation aspect of the JIT strategy. Moreover, the control or implementation aspect pervades through employees at all levels. Hinterhuber and Pope [1992] postulate that with a systematic procedure of employee involvement, a company can become a confederation of entrepreneurs so that the employees understand both the strategic objectives and implementation aspects of the strategy [6] .and a JIT education strategy

KEY ELEMENTS FOR JIT IMPLEMENTATION STRATEGY

Thus, the most important elements for successful implementation of the JIT production strategy are: (1) top management commitment, (2) development of a JIT policy manual and (3) development of a JIT procedure manual, (4) develop and implement a continuous JIT training program for employees at all level, (5) develop and maintain a JIT circle involving key employee group representatives, (6) redesign the organization to make it flexible and dynamic for allowing JIT permeate through the system, and (7) develop and maintaining an effective communication and

control system in order to provide feed backs and control at all levels of the organization and all through the procurement - production - distribution environment.

Top Management Commitment

Top management commitment is the most important element of any strategy implementation. It is important to know that the top management is seriously committed. Top management must develop and declare a series of policy statements mentioning its commitment to JIT procurement - production - distribution strategy stating which products or product lines are involved, which plants or portion of the plants must be included, how all functions must be coordinated, and who is responsible for what, what resources are available for implementation, what is the time table for implementation, what internal and external sub-contractors are involved in the implementation process

1) reduction of set-up times of equipment and operations, 2) reduction of lot sizes, 3) installation of a suitable group technology process, 4) cross-training of employees in order to obtain greater utilization of both labor and equipment, and finally 5) setting up of a preventive maintenance schedule to increase quality and utilization of plant and equipment.

Reduction of Set-up time

Sandras [1987] provides a broader definition of set-up time as a process which begins when a company allocates funds for raw materials and ends with the receipt of final payment for the product [14]. Haynes, Helms, and Boothe [1991] suggest a scheme of a cooperative system involving setting up of teams in order to reduce set-up times [5]. Ritzman, King, and Krajewski [1984] report that set up time reductions influences both the lot sizing and labor productivity. According to Ritzman et al., under a JIT atmosphere the key components and parts required for changeover are kept in the right place to allow for quick changeover [13]. Zipkin [1991] stresses the need for a JIT toolbox consisting of engineering techniques to facilitate quick changeovers [19]. Schonberger and Knod [1988] provide guidelines for quick error-free set up which range from standardizing machines and components to allowing for more set-up people for expensive equipment [15]. This myriad of literature, suggests a large number of techniques for reducing set up time which include : 1) conducting a system-wide scrutiny for avenues for reducing operation or machine time, 2) setting up of teams to fix responsibility for reduction of sub-optimal set-up time, and 3) exploring the possibility of a standardization technique of operations and location of key components and parts which can pave the way for a flexible atmosphere of JIT.

Reduction in In-house Lot sizes of operations

Traditionally, the problem of fixing optimum lot sizes of operations was linked to the cost of ordering and cost of holding inventory. Various other methods such as the trial and error method, Wagner-Whitin algorithm, part-period balancing method, and material requirement planning (MRP) system were used [9,11]. Although these approaches were satisfying, but they suffered the drawback of focusing only on ordering cost and holding costs. Under a JIT environment, the objective of smaller lot sizes can be achieved through smaller transfer batches of operations. This reduction in batch or lot size would facilitate quicker response time to quality problems, engineering changes, and on-time delivery.

The intermediate desirable step of small transfer batches should ultimately lead to the next desirable step of a requirement driven Kanban system. Karmakar (1989) reports that under

the requirement driven Kanban system, reduction of lot sizes of operation is facilitated through a dynamic information system of MRP which triggers the process of reducing lot sizes with the help of Kanban control. The MRP system predicts the changes in requirements which helps the Kanban control system to implement the running of the new lot sizes for equipment [7] .

Implementation of Group technology process

Meredith [1992] defines group technology as a concept to simplify the engineering and production process by identifying families of parts that tend to require the same procedures for designing and production [11]. Krajewski and Ritzman [1992] report a two-step technique of implementing group technology. The first step involves grouping of parts or products with similar characteristics and assigning these parts to a group of machines. The next step involves organizing a group technology cell which is an efficient arrangement of a group of machines [9]. Walleigh [1986] suggests a technique of grouping dedicated families of dissimilar equipment that require the same manufacturing sequence. This grouping can lead to smaller batch sizes and short set-up times [18]. It is obvious from the above literature that problems of implementing group technology can take place in a company that has an equipment layout geared towards large batch sizes. Such a company would need to go over the painful exercise of identifying similar operations steps and re-grouping of equipment. Nevertheless it appears that for such a company, an immediate change now can save a lot of time, money and effort in the future. The ideal alternative is to incorporate the process of group technology in the designing stage of the equipment layout decision.

Scheme of Cross-training of employees

Meredith [1992] stresses on a flexible work force that looks for and solves production problems wherever they appear. Under this approach, the workers do their own quality inspections and maintain their own equipment [11]. On the same vein, Krajewski and Ritzman [1992] report the importance of variable skill levels of workers who can perform more than one job. This method also involves some kind of job rotation in order to relieve boredom and improve the efficiency of the worker [9]. In contrast, Billesbach and Schniederjans [1989] recommend standardization of activities in order to reduce the time and cost of cross-training workers. They claim that the standardization of activities can improve operational effectiveness and efficiency [2]. The contrasting views are suggestive of a trade-off option between standardization and flexibility. Standardization of activities have the benefits of lower training costs, quicker training and an incremental approach towards upgrading of worker skills. However, standardization suffers from the limitation of low employee morale, especially when the process is a long and monotonous. In some cases, the requirement of human judgment in solving quality problems can negate standardization of activities.

Flexibility has the benefits of a problem-solving approach, rapid learning curve type of augmenting skills, and improved job design. The pitfalls of flexibility are the higher training costs, workers resistance to quick change, and in some cases unionization of workers can prove to be a formidable hurdle towards implementation of flexibility. It appears that a JIT atmosphere is suggestive of a flexible approach towards cross-training of employees. The initial higher costs of training will level off and reflect in higher levels of productivity of employees in the future.

Preventive maintenance scheduling

Schonberger and Knod [1988] give a broad definition of preventive maintenance in terms of an approach that is operator centered. Under this approach the responsibility for eliminating breakdowns is divided between the operator and the maintenance department. The operator is responsible for routine inspection and maintaining the equipment. The maintenance department is responsible for more technical machine diagnoses, overhauls and audits [15]. Meredith [1992] warns of the dangers of equipment breakdown in a JIT system. Because there are minimal buffers between the elements of the system, high reliability and good maintainability are key factors in a preventive maintenance scheduling system [11].

Walleigh [1986] stresses the need for an environment of continuous improvement which involves the production line workers in providing key information in improving the operations [18]. Under the JIT system, preventive maintenance scheduling is not a top-management prerogative. The skill levels of employees will include scheduling and implementing an optimum preventive maintenance schedule on the basis of personal inputs and group efforts of teams of production line workers. This problem-solving approach has the advantages of constant improvement, employee involvement, constant upgrading of technical skills of employees and better adaptation to newer technologies.

KEY ELEMENTS FOR JIT VENDOR STRATEGY

JIT vendor strategy was identified as the next critical issue in the process of JIT implementation in the study conducted by Mehra and Inman [1992]. This study suggested the analysis of the following key issues for the implementation of an effective JIT vendor strategy :1) reduction of vendor lot sizes, 2) reduction of vendor lead times, 3) sole sourcing, 4) quality certification of suppliers [10].

Reduction of vendor lot sizes

Walleigh [1986] recommends that companies work with vendors in implementing JIT in the vendor's factory once the company is able to master the JIT system in-house. This step is also linked to the desirable step of sole sourcing of each key component [18]. Bose corporation carries out an innovative technique called JIT II which involves the vendor in a partnership relationship to practice concurrent engineering and joint design of facilities. The hallmark of this implementation is the process of sharing information that links vendor to the buyer [16].

Stamm and Golhar [1991] report of the unique advantage of small firms over large firms in reducing vendor lot sizes in a process of participatory decision making. The introduction of Electronic Data Interchange (EDI) technology can improve interchange of key planning variables between vendor and buyer. This is particularly important because of the erratic pattern of demand which necessitates quick response systems [16].

Reduction of vendor lead times

Ritzman, King, and Krajewski [1984] warn of the inventory and customer linkages due to poor vendor performances of variability of lead times and quality of vendor shipments [13]. Turnbull, Oliver, and Wilkinson [1992] report that vendors in the auto industry of Japan report monthly schedule variations of +/- 20 percent from the original schedule. In contrast, vendors in U.K. auto industry report monthly schedule variations of 200% from the original schedule [17]. A recent study conducted by Billesbach, Harrison, and Morgan [1991] of U.K. and U.S.

companies that have implemented JIT system, reported that delivery reliability and quality conformance were rated as much higher priority measures than price [2]. Just as in the case of reducing vendor lot sizes, technology appears to be the key in decreasing uncertainty in vendor performance and implementing the desired objectives of reducing vendor lead times and vendor lot sizes. A system of common access to inventory records between vendor and buyer should be explored for possible implementation. The next step of sole sourcing is a necessary element for this common access system to occur. The obvious limitation of sharing proprietary knowledge and secrecy leads to the necessity of establishing trust and a long term relationship between vendor and buyer.

Sole Sourcing

Under a JIT system the advantages of an arrangement of sole sourcing are : 1) close coordination of schedules, 2) vendor involvement in planning and designing of parts to be supplied, and 3) availability of quantity discounts [11]. The drawback of this method is the risk of being totally dependent on one supplier. Haynes, Helms, and Boothe [1991] emphasize the fact that the exact number of vendors could vary by company and product, but a good majority of successful JIT companies have a limited number of sources [5]. This smallness of vendors also facilitates information-sharing between vendor and buyer. Kowalski [1991] reports that even in hospitals, programs called stockless inventory, which involves obtaining virtually all supplies from a single source or at most two suppliers have grown in popularity. Although this program would have expected to yield a low service level, it is interesting to note that in one hospital service levels of nearly 97-98 percent were achieved [8]. Billesbach, Harrison, and Morgan [1991] surveyed U.S. and U.K. companies that had implemented JIT systems and found that 11 percent of all U.S. respondents reduced the number of suppliers by more than 50% in the last 5 years. Similarly 10% of U.K. companies that were surveyed reported more than 50% reduction in number of suppliers in the last 5 years [2]. Traditionally, the decision of selection of suppliers were the prerogative of the procuring department. One of the major drawbacks of this approach is the tendency of procuring employees to base vendor rating on economic variables, rather than on the objectives of monitoring quality. It is not uncommon to find procurement employees who are not competent to tackle vendor quality problems. The JIT system focusses on the bridging relationship between vendor and buyer. The quality problems of the vendor is also a source of concern for the buyer. An interactive problem solving approach is desirable to maintain a long term durable relationship with vendors. Buyer involvement in vendor goes beyond financial and economic relationships. In a process that involves information-sharing, access to technological advances and constant feedback, the destiny of vendor is merged to that of the buyer.

Quality Certification of Suppliers

Garvin [1983] reported that careful selection and monitoring of vendors was the first step towards ensuring reliable and defect-free production [4]. Black [1993] reports that Caterpillar Inc. had inaugurated a supplier certification program in 1979 for its more than 5000 suppliers. By 1989, more than 83% of the company's revenue came from certified suppliers [1]. Schonberger and Knod [1988] elaborate on the mechanism of quality certification of suppliers as a formal study of supplier's quality program. The desired objective is to evaluate suppliers on the basis of quality of design, training, capability of delivery on-time, and defect rates. This stage ensures the optimum incoming quality level on the basis of past audit of vendor performance on quality. The

steps of sole sourcing and quality certification of suppliers are closely linked. Both steps stress on the long term relationship, sharing of key information, and a problem-solving approach [15].

NEED FOR ORGANIZATION FLEXIBILITY

Several changes must take place in an organization for an effective implementation of JIT strategies. They are categorically listed in exhibit 1. Broadly, these changes can be divided into two groups: 1) changes in employees attitude, and 2) continuous support and commitment of top management for JIT implementation. These two changes are inter-linked, simultaneous, and tend to reinforce each other.

Attitude-adjustment of employees involve: 1) an awareness of JIT; 2) adaptability to change; 3) commitment to constant improvement or to total quality; 4) capability of working in teams; and 5) willingness to learn new skills.

JIT means different things to different people. There is great difference in the way companies define the concept of JIT and disseminate its intended meaning to the employees. JIT awareness seminars conducted within the company can serve to guide the employees on the company's intended direction and goals. The other four factors are inherent adjustments of employees. With the present state of the U.S. economy and under-currents of what lies ahead, employees are likely to lose their jobs if they do not respond to change positively. A working knowledge of the many facets of total quality as applicable to the context of the company is a required feature. A capacity to work in teams is a definite advantage to the employee. In the near future, it appears that a good number of companies will motivate and direct formation of teams in solving of problems. The last factor is critical but it is easily misunderstood and assumed as a 'given'. No change can take place unless the employees are motivated to learn new skills. The introduction of JIT awareness seminar, commitment to new technology, and working in teams can all become useless, unless the employees choose to upgrade their skills.

The continuous support and commitment of top management is important in the key areas of : 1) technology, including management information systems (MIS); 2) vision, goals and objectives of the company; and 3) creating strategic alliances and partnerships. In terms of technology, the bare elements of a JIT system would require : 1) flexible manufacturing system (FMS) which may include Kanban control and group technology; and 2) Electronic Data Interchange (EDI) which may include the information system components of MRP, and MIS. Technology commitment must not be confused with mere provision of large sums of capital. With the present proliferation of software technology and compact FMS technology, the cost of technology may be within the reach of a company. However, the concept of bench marking dictates that technology be geared not only towards improving the productivity and performance of the company, but also towards attaining a competitive edge in world's marketplace.

JIT implementation does not operate in a void, but is intimately related to the overall goals, vision, and objectives of the company. Therefore, JIT should be thought of as a means to achieve a desirable objective. To this extent, the involvement of top management is crucial. With the extensive delegation of what used to be top-management concerns (for example, preventive maintenance) to the employees, the top management is involved in long-term strategic consequences of JIT implementation that affects the future of the company.

Creating strategic alliances and partnership appear to be a critical component of the long term JIT strategy. However this area is not without controversy. The overall business strategy can conflict with the operations strategy in terms of links and alliances of the company. Under a

overall business perspective, alliances are created not only with the operations strategy in mind, but also because of factors of access to technology, resources, and market reach. Under the JIT system, the concept of sole sourcing and quality certification of suppliers may work in conflict of the selection of alliances under the overall business strategy. One possible solution would be to inculcate JIT discipline into the alliance company.

CONCLUSION

Mere commitment of resources will not do the trick. The attitudinal adjustments and top management commitment should work in tandem to achieve the benefits of JIT. The success of JIT implementation lies heavily in the hands of employees. Although the top management does not play an operational role in JIT, certain long term decisions are necessary from time-to-time. In the long run, the success of JIT implementation hinges heavily on the cycle from top management commitment to employee involvement and back to top management commitment. The U.S. companies need to internalize the JIT concept and implementation amongst its workers in order to meet the competitive challenge in the world's marketplace.

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EXHIBIT 1
NECESSARY CHANGES FOR EFFECTIVE
IMPLEMENTATION OF JIT

Desired Effect

Necessary Changes

1. Reducing set-up time of equipment operations and location of components	<ul style="list-style-type: none">* System-wide scrutiny for reducing operation/machine time* Exploring possibility of standardization of* Setting up teams to fix responsibility for reducing set-up time
2. Reducing In-house lot sizes	<ul style="list-style-type: none">* MRP information system* Kanban control
3. Group technology	<ul style="list-style-type: none">* Identification of similar manufacturing steps* Grouping of equipment
4. Cross-training of Employees	<ul style="list-style-type: none">* Job rotation* Augmenting skill levels of workers* Delegation of quality inspection and equipment maintenance
5. Preventive Maintenance Scheduling implementing	<ul style="list-style-type: none">* Employee participation in constant improvement* Delegation of scheduling and preventive maintenance scheduling
6. Reducing vendor lot sizes	<ul style="list-style-type: none">* Introduction of EDI for planning* Adjusting to varying demand
7. Reducing vendor lead times	<ul style="list-style-type: none">* Common access to inventory records* Use of EDI to decrease lead times
8. Sole sourcing of	<ul style="list-style-type: none">* Quality should enter evaluation equation suppliers* Interactive problem-solving approach* Co-destiny of vendor and buyer
9. Quality Certification of Suppliers	<ul style="list-style-type: none">* Ensuring optimum incoming quality* Sharing of information* Long-term relationship