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An Assessment of Just-in-Time Manufacturing

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An Assessment of Just-in-Time Manufacturing

Abstract

Manufacturing of materials into useable products has changed dramatically since the Industrial Revolution. The United States dominated the manufacturing arena until the early 190s. After that period, efforts of global competitors in such areas as quality control and productivity, started to surpass the efforts made by the United States in these same areas. For the first time, U.S. manufacturers started sensing the pressure of competition. The United States is using its competitive advantage over other nations in the manufacturing segment. Part of this loss is a result of the way the U.S. manufacturers are conducting their business. A larger part is the lack understanding and willingness to utilize and adopt some of the methods available to make them more competitive at home and in the global marketplace (Moskal, 1988).

The survival of manufacturing organizations has necessitated that management focus their attention towards new methods of dealing with rising costs, poor quality, and intensified competition. It is no longer acceptable to approach manufacturing using old management philosophies (Byard, 1987). The use of modern information technologies to attain a competitive advantage is essential for organizational success. One such method is the implementation of the Just-In-Time (JIT) approach. Just-in-time is an operating philosophy which was created in Japan around 1950.

AN ASSESSMENT OF JUST-IN-TIME
MANUFACTURING

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to the Graduate Faculty
of the Department of Industrial
Technology
University of Northern Iowa

In Partial Fulfillment of the Requirement of
the Non-Thesis Master of Arts Degree

by

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INTRODUCTION

Manufacturing of materials into useable products has changed dramatically since the Industrial Revolution. The United States dominated the manufacturing arena until the early 1970s. After that period, efforts of global competitors in such areas as quality control and productivity, started to surpass the efforts made by the United States in these same areas. For the first time, U.S. manufacturers started sensing the pressure of competition. The United States is losing its competitive advantage over other nations in the manufacturing segment. Part of this loss is a result of the way the U.S. manufacturers are conducting their business. A larger part is the lack of understanding and willingness to utilize and adopt some of the methods available to make them more competitive at home and in the global marketplace (Moskal, 1988).

The survival of manufacturing organizations has necessitated that management focus their attention towards new methods of dealing with rising costs, poor quality, and intensified competition. It is no longer acceptable to approach manufacturing using old management philosophies (Byard, 1987). The use of modern information technologies to attain a competitive advantage is essential for organizational success. One such method is the implementation of the Just-In-Time (JIT) approach. Just-in-time is an operating philosophy which was created in Japan around 1950.

According to Schonberger (1982), Japanese management developed expertise in repetitive manufacturing whereas the United States management was developing expertise in job-lot manufacturing at this time period. Job-lot manufacturing is the process of building a variety of products and storing them in inventory. Repetitive manufacturing, on the other hand, is the process of building a narrow product line at a faster rate as needed. This process of building a narrower product line based on demand and at a faster rate has allowed Japanese manufacturers to produce higher quality products at a much lower cost. This paper examines the JIT philosophy, reasons for implementing JIT, weaknesses inherent in JIT, steps to implement JIT, and the benefits that can be achieved by implementing a just-in-time system. The need for such a paper was highlighted by a recent survey conducted by Price Waterhouse (Moskal, 1988).

WHAT IS JIT?

Just-in-time has been around the United States for several years, but manufacturing executives have failed to grasp the JIT concept. A survey conducted by Price Waterhouse found that of 210 manufacturers contacted only 37% were involved in JIT activities (Moskal, 1988). When the executives of these companies were asked what they believed the benefits of JIT to be their responses were: 58% indicated inventory control/reduction, 28% cited capital savings, 8% attributed it to space saving, and 6% believed that it

increased efficiency/productivity (Moskal, 1988).

There seems to be much confusion and misconception of what just-in-time is really about. According to Bockerstette (1988), several key misconceptions of JIT are: JIT is a set-up reduction program, JIT is a supplier program, and JIT is implemented quickly. The first two components are encompassed within a just-in-time system. However, there are other components which must be included for a complete JIT system.

JIT is a way to identify and solve problems. It is a process of continual improvement. JIT is a philosophy that addresses the methods and timing of movement, storage, processing, and distribution of material within a manufacturing operation (Tompkins,1987). The objectives of JIT are to increase profits by reducing costs and reducing costs by the elimination of waste.

WHY IMPLEMENT JIT?

Executives implement a just-in-time system for a number of reasons. According to Moskal (1987), some of the reasons cited by management are: to reduce leadtimes, improve quality, and increase cash flow. In order for a JIT system to achieve these benefits, several components must be included. These are:

1. Set-up reduction
2. Containerization
3. Equipment reliability
4. Purchasing procedures

5. Material consideration

Set-up Reduction

Generally, companies reduce setup times to improve manufacturing and reduce inventory levels. Reducing machine tool setup times so that parts can be made in smaller quantities with quick changeovers is an essential element in a JIT system. According to Sepehri (1987), setup time reduction is a fundamental aspect of JIT.

Setup time reduction may be obtained through a number of different ways. Usually, setup procedures should be analyzed using a micromotion study. This procedure will allow the observer to eliminate unnecessary steps, and to reduce and simplify the setup procedure. The objective of this process is to simplify the setup so the first part produced after the setup is perfect 100 percent of the time.

There are some basic rules to follow to reduce setup times according to Sepehri (1987):

Rule 1: Move main-line setup steps to off-line preparation. Main-line setup is work which is performed when the machine is shut off. Searching for fixtures, waiting for equipment, and setting of tooling are all elements that should not use up main-line time. These items should be handled off-line while the machine is running.

Rule 2: Eliminate unnecessary movement. This can be done by reducing and eliminating unnecessary walking and manual effort. If possible, tooling should be dedicated to specific

machines and stored next to those machines. Also, preparing written setup procedures and setup teams are additional ways of reducing unnecessary movement.

Rule 3: Eliminate nuts and bolts from the tooling. Slotted holes should be designed into the machines so that fasteners do not have to be removed when performing setups.

Rule 4: Eliminate machine-based adjustments. The goal is to design and build the fixture so that it can be changed without having to adjust anything else. Using preset tooling, spacers, and guide blocks will help to eliminate unwanted machine-based adjustments.

Rule 5: Standardize dies, tooling, fixtures, and part design. Design and manufacturing personnel will need to be involved in this step. The idea is to standardize the dies and tooling to produce multiple parts with the same tooling/fixtures. This will eliminate the need to change dies or tooling to run similar parts which will save time and money.

Setup procedure reduction can be categorized into three phases. In the first phase, employees and supervisors look for ways to reduce the setup time. The solutions can be achieved in a short time and very little costs are incurred in implementing the suggestions. Results typically obtained in this area are a reduction in setup times of 20-30 percent (Sepehri, 1987). The second phase of setup reduction is usually done at the same time as the first area. Some

expenses will be incurred in making minor modifications to the tooling, dies, and fixtures. These changes can be made in a short period of time as well and usually yield savings of 30-50 percent (Sepehri, 1987). The last phase of setup reduction are those items which take large capital expenditures and time to make the proposed changes to the tooling, dies, and fixtures. An additional 10-40 percent reduction in setup times can be achieved in this area (Sepehri, 1987).

Containerization

The procedure for handling parts changes when using just-in-time philosophies is containerization. Before JIT, orders were issued and parts were produced and "pushed" down the assembly line. The thrust of the system was to keep people busy producing parts whether they were needed or not. In a JIT environment, final assembly "pulls" parts as needed from the subassembly areas. Parts are not produced until they are called for. This calling is a signal to start producing more parts. The signal can be as simple as an empty square on the floor or the return of an empty container from the end of the assembly line.

In the JIT environment, smaller lot sizes of parts are produced and delivered more frequently. According to Krepchin (1986), material handling in this type of an environment becomes much more important. Krepchin (1986) states that the difference in material handling is the

preparation of materials for assembly. Instead of sending material in batches, special JIT carts will be used to transport the materials. Ideally, the cart would hold enough material to build only one part.

Dual purpose containers could also be used for materials. These are containers which are used to ship parts to the plant being used additionally as racks on the assembly line. This would eliminate unnecessary material handling and changing of parts from one container to another.

Equipment Reliability

Equipment reliability is a must in a JIT system. Data should be collected on the machines concerning downtime, maintenance, setups, and other such problems encountered. This data will need to be evaluated to determine the capability of the equipment. Eliminating unplanned/unexpected downtime will help to ensure a successful just-in-time program.

One way to reduce downtime is to involve the machine operators in a preventive maintenance program. This program should have the operator responsible for periodic lubrication, daily cleanliness, and checking of the equipment for any abnormalities. In a JIT system there is more operator idle time because they only produce parts as needed. Having them perform preventive maintenance on their machines is an excellent way of keeping people busy and increasing the reliability of that equipment.

Purchasing Procedures

One of the key aspects to a successful JIT system is the function of the purchasing department. There are different philosophies and objectives to be used by purchasing agents in a just-in-time environment. For the purchasing department to be successful, they will have to involve the suppliers. In addition, purchasing procedures must thoroughly accommodate JIT objectives and principles as it applies to their new role (Westland, 1988).

Just-in-time purchasing is directed towards the reduction of waste that is present in virtually all production processes. According to Heizer and Render (1988) the goals of JIT purchasing are:

1. Elimination of Unnecessary Activities
2. Elimination of In-Plant Inventory
3. Elimination of In-Transit Inventory
4. Quality and Reliability Improvements
5. Procurement Techniques

Elimination of Unnecessary Activities

The receiving activity and incoming inspection activity are not required when using just-in-time. Lot-by-lot sampling inspections by the receiving area is thus eliminated. According to Pennucci (1987), the emphasis of the receiving personnel will be placed on monitoring the suppliers quality through the use of control charts and process capability studies. In order for this to take place,

purchasing will have to be effective in selecting and developing vendors so that purchased parts can be received without formal counting and testing procedures. They will also have to encourage suppliers to use process control charts, provide technical assistance for suppliers to improve quality requirements, develop a close relationship and strong communications with their suppliers, and have an ongoing liaison with each supplier's representative for continuous improvement projects.

Elimination of In-Plant Inventory

Excess inventory is usually the result of production process problems or unreliable delivery of parts by suppliers. Holding extra inventory on hand not only hides these problems, but it also adds extra costs to the product in the form of inventory carrying costs. To help reduce these problems, Bose and Rao (1988) state that suppliers should make more frequent deliveries in smaller lot sizes and should also deliver material directly to the point of use. Because materials are received at individual locations instead of one central receiving dock, verification of receipts will be especially important in this environment.

Several other ways purchasing can help to eliminate in-plant inventory are: work with suppliers located nearby - this facilities receiving more frequent deliveries, encourage suppliers to pack and ship exact quantities ordered, encourage suppliers to extend JIT to their environment, and

develop repeat business with the same suppliers.

Elimination of In-Transit Inventory

Having a large time frame of in-transit inventory is time consuming and costly for the manufacturer. It is much better to have a shorter time frame of flow and material. This results in less inventory in the system and a reduced cash flow. Once again, encouraging suppliers to locate in close proximity to the plant reduces the amount of inventory that is in-transit. In addition, scheduling the delivery of inbound freight is also important. In the past, delivering material a little early or late was acceptable because of the amount of buffer inventory on hand. With just-in-time, delivery must take place within a "window" of the specified time period. The length of the "window" can be any amount of time specified such as two or four hours. Delivery outside that specified time is considered unacceptable.

Another way to reduce in-transit inventory according to Heizer and Render (1988) is by consignment. Under a consignment arrangement, the supplier maintains title and control of the inventory. For example, the supplier may relocate its warehouse to the user facility. The parts are stored on the premises and the user is charged for the number of units shipped. The supplier could also ship parts from the new warehouse to other vendors that use the same parts.

Finally, purchasing can schedule company-owned or contract shipping for the delivery of material instead of

using common carriers. This would provide purchasing more reliable delivery times and possibly lower shipping costs.

Quality and Reliability Improvements

To achieve improved quality and reliability from suppliers requires a good relationship and trust between the supplier and purchaser. To strengthen this requires purchasing to have few suppliers, long-term contract agreements, schedule frequent delivery of parts, and develop a supplier rating system that measures quality, delivery performance, operating costs, and price. It is essential in a JIT environment, that the supplier deliver defect free material at the right time and exactly the quantity needed in order for the purchaser to continue operating. As a result, suppliers can no longer be selected on the basis of price and/or delivery alone.

Procurement Techniques

There are a number of different procurement techniques that a purchasing agent can use to obtain materials. The first technique is called a blanket order which consists of unfilled orders with a vendor. Essentially, it is an agreement to purchase certain items from a particular supplier. With this technique, materials are not shipped until there is a shipping requisition.

The next technique which can be used is called invoiceless purchasing. This arrangement consists of one

supplier for all units of a particular item or product. If the supplier provides every seat for each bicycle produced, then purchasing knows how many seats were purchased based upon the number of bicycles produced. A check is then issued to the supplier accordingly.

Electronic ordering and funds transfer is another procurement technique. This technique was created to reduce the number of paper transactions that normally occur in a procurement cycle. The typical procurement cycle consists of an order cycle which takes one to three weeks, followed by the vendor cycle which can take a couple of weeks, and finishing with the receiving cycle which takes approximately one week. Purchasing can save time and money by electronically ordering and transferring of funds as compared to manually authorizing and verifying invoices and the issuance of checks.

Finally, stockless purchasing is a procurement technique where the supplier maintains the inventory for the purchaser. This does not mean that the supplier holds the inventory for the purchasing company. That scenario would not result in any savings at all. However, if the supplier had several customers using the same product, then there could be some savings for having the supplier maintain the inventory on their premises.

Of all the procurement techniques discussed, blanket purchase orders generally works best according to Wallace

(1987). They allow purchasing to commit a particular sum of money based on a year or two requirement. The order can then be charged against this sum of money daily, weekly, or by the month. The main benefit of this technique is that you receive the cost advantage and commitment of a large quantity without having to store or handle the material.

Material Considerations

The success of just-in-time manufacturing depends in part on changes in methods of managing material flow. The changes can involve all aspects of the material system from incoming materials to the final product. The objective of this procedure is to reduce the inventory levels in the system.

Changes in material methods should consider the amount of handling of material by support groups, and providing a more direct flow of material from start to finish. Reduced handling of material outside the actual production process should start upon receipt of material from vendors. This could range from parts being requested daily by using facilities on a need only basis from a warehouse to, drop shipment from vendors directly to the production area eliminating warehousing. This requires emphasis on defect free material being delivered due to the elimination of buffer inventory in the plant. After receipt of material in a manufacturing area, the concept of less handling continues throughout the entire production process.

Besides reduced material handling, a just-in-time manufacturing environment forces a simpler and more direct flow of material. Due to reduced lot sizes of parts, moving the material from one operation to the next within the JIT cell is simpler and more direct. In addition, there is less of a chance to affect the quality of the parts as a result of the reduced material handling.

WEAKNESSES OF JIT

Lately, the topic of just-in-time manufacturing has been receiving a lot of attention in print and by the media. It seems that most of these articles promote JIT as a panacea for managements problems. As a result, many managers believe that JIT is the answer to all of their problems. All that they have to do is implement a JIT program and their manufacturing problems are solved. This could not be further from the truth. Hall (1989) states that inappropriately applying just-in-time creates more problems than it solves. In order for managers to appropriately apply JIT they must have a clear understanding of both its strengths and weaknesses. To blindly adopt JIT principles to a situation which is not appropriate could cause severe consequences on the organization's performance. Implementing a JIT system that is not compatible could actually lower the organizations performance level.

Before outlining the weaknesses with just-in-time, it should be noted that the organization does not operate in

isolation. The firm is constantly interacting with many other components within the environment. Each of these components will place different threats and demands on the firm. The philosophy of JIT cannot account for all of these different demands. Therefore, it is important that management fully understand the effects that the environment can have on JIT.

The weaknesses of just-in-time can be outlined using Porter's five forces model of competition. Porter (1980) states that these forces are:

1. Moves and countermoves of rivals and competitors
2. Potential new entrants into the industry
3. Power of suppliers
4. Power of customers
5. Potential new substitutes

Moves and Countermoves of Rival Firms

A major concern for most organizations is the amount of competition in their market segment. There will be varying degrees of competition placed on an organization based on a number of factors such as the number of competitors, size of competitors, and the market structure. Porter (1980) claims that the greater the level of competition, the less likely it is that JIT will succeed. As a result of this intense competition, it will be difficult to accurately forecast demand or changes in demand. Also, should an organization capture a share of the market held by a competitor, the

increase in demand could not be satisfied. The philosophy of JIT operates on the premise of zero inventory. Therefore, the increase in demand would be lost because the firm will not have the inventory on hand to fill the orders. Krawjewski, King, Ritzman, and Wong (1987) claim that this tradeoff will be inevitable when using just-in-time.

Potential Entry of New Firms into the Industry

Pappas and Hirschey (1987) define potential entrants as those firms or individuals who have the economic resources to enter a market segment, given sufficient economic incentives. A firm will only enter into a market if the existing organizations are making a profit. Using JIT could actually be increasing the level of competition and potential entrants in your market segment. If JIT is successful in lowering operating costs and increasing profits, then the increase in profits will attract new competitors unless there are substantial barriers to entry. Barriers to entry are any factor that creates an advantage for existing organizations over new entrants into the market such as large capital requirements or substantial economies of scale. Economies of scale cause long-run average costs to decline, and result from specialization of labor, and technological factors. In the short run, firms will stay in a market as long as profits are being made. As more firms enter into a market segment, supply will be greater than demand and profits will fall. This will cause an increase in competition among the firms.

Power of Suppliers

As discussed earlier, the relationship between the supplier and manufacturer must be excellent. When a manufacturer implements just-in-time, the supplier must either implement JIT as well or hold more inventory in stock. Also, JIT requires more frequent deliveries and less economical loads of the material. Typically, these costs are placed on the supplier which in turn can lead to higher material prices. According to Hutchins (1986) this is what happened to Harley Davidson when they first implemented just-in-time.

In addition, there is the lack of a buffer or security stock in a JIT environment. The premise of JIT purchasing is to have few suppliers, but strong relationships with these suppliers. This makes the manufacturer extremely dependent on their suppliers. This could be very costly if a supplier should encounter some troubles.

Power of Customers

One of the problems affecting most businesses today is the unpredictability of demand. When demand is fluctuating and difficult to forecast it becomes almost impossible to match production with demand. Once the flow of production is disrupted, the firm will be unable to fill its present demand without long lead times or delays. Being able to provide the product to the customer when they want it is essential to achieve customer satisfaction. If there is going to be

delays or long lead times between ordering and delivery, the firm could lose sales to a competitor that can meet the demand. Hall (1989) states that JIT works well when the product is ordered well in advance and there is a significance lead time for delivery of the good.

Substitute Products

The demand for most goods is influenced by the prices of other goods. Substitutes are related products where the increase in price of one good leads to an increase in quantity of another. That is to say they are directly related. Compliments, on the other hand, are inversely related. That is, an increase in price of one good leads to a decrease in demand of another. The differences among products leads manufacturers to believe that substitutes are not available. If this is the case, then the customer will have to accept long lead or delivery times. The supplier will also be able to capitalize on increased demand because of no close substitutes. However, if substitutes are available for a product, then the firm will be unable to capitalize on the increased demand because of JIT. They will not be able to fill the orders in a timely manner. Hall (1989) states that JIT has a greater chance of being successful if the product is highly differentiable. In addition, industries that are small-batch or craft-oriented are also more successful implementing just-in-time. This is because these industries generally have long lead times and

high customer loyalty.

BENEFITS OF JIT

The list of companies reporting benefits from the implementation of a JIT system is impressive. Companies such as Hewlett-Packard, Kawasaki Motors, General Electric, Harley Davidson, and Dupont, to name a few, have benefited from a JIT system. The list of benefits achieved by these companies is even more significant.

International Business Machines (IBM) for example, saved more than 600,000 dollars in inventory carrying costs and an additional 150,000 dollars in "in and out" handling costs as a result of implementing JIT (Wallace, 1987). At Calcomp's Products Division, management was able to accomplish the following by implementing JIT: 30 percent reduction in floor space, 70 percent reduction in work-in-process (WIP) inventory, increase in quality levels, and decreases in production cycle time from 12 weeks to just under 5 weeks (Krepchin, 1988). Finally, Harley Davidson has been able to record substantial savings as a result of implementing just-in-time. These savings are: inventory reductions by 50 percent, reductions in scrap and rework by 50 percent, increase in productivity per employee 32 percent, increase in inventory turns per year from 5 to 17, and a 30 percent reduction in suppliers (Sepehri, 1987).

The list of benefits achieved by companies instituting just-in-time systems seems to be rather similar. It is

evident that by implementing just-in-time production personnel can expect an increase in quality, and reductions in inventory, leadtimes, and overall costs. These benefits lead to increased cash flow for the company and ultimately to more satisfied customers. In turn, the company can produce the product with higher quality levels and shorter delivery times, all for a lower cost. This is a win-win situation which more executives should consider adopting for their companies.

RESISTANCE TO CHANGE

Accepting a new way to do something or some new technology is usually met with resistance. So it should not come as a surprise to find that people resist JIT implementation. The resistance to JIT is not only from the hourly workers, but from management as well. There are many reasons why people resist new technology. The reasons are varied and depend on where the employee is in the organizational hierarchy of the company. Most of this resistance can be directly attributed to the lack of understanding of the new technology.

There appears to be three common reasons for resistance to JIT (Rohan, 1987). The first reason is that systems are often conceived by high-level corporate personnel. The task of implementing this new idea is then forced upon middle management. In cases where systems are decided upon in high, far-away places are imposed on middle managers constitute a

major obstacle during implementation, according to Charles Downey, vice president of marketing for Gould Incorporated's Industrial Automation Group (Rohan, 1987). To overcome this resistance requires involving middle management in the design specifications of the system. In addition, show them a JIT operation that is currently operating such as Hewlett Packards, to remove their apprehensions of the system. Finally, start with several smaller projects and implement in phases to build trust and confidence of the program.

The second reason for resistance is that systems are designed by engineers with little or no thought given to the people who will run them. The focus seems to be on performance characteristics of the system rather than the people who will be using it. This creates problems for the people responsible for implementing JIT. To overcome this obstacle requires involving the people who will be operating the equipment in the design stage of the project. Also, prototyping the system is a good way to find problems inherent in the system and to receive feedback from the people using the system (Rohan, 1987).

The final area for resistance is with the workers on the shop floor. The workers think that just-in-time will take jobs away from them and create the threat of job obsolescence. Many workers are convinced that the new system will never work. In addition, many workers keep excess inventory on hand in case of problems and tend to order their quantity of

parts with the same safeguard. To reduce their resistance requires showing them what the system can do for them; that it can improve their productivity and lower their scrap rate and downtime. Start the implementation process with a small project. The workers will gain confidence in the system and will become more cooperative and willing to work with it as the end result.

IMPLEMENTING JIT

Implementing just-in-time techniques is not an easy task. There are many items that must be understood and taken into consideration. JIT programs are going to vary in scope from company to company. However, there are some basic elements that should be included in a statement of philosophy when developing a JIT strategic master plan.

Implementing a just-in-time manufacturing plan requires that a project team be developed. The project team should be viewed as a steering committee to guide and control the project. Craner and Tompkins (1987) state that the steering committee should be well diversified in its membership. The members chosen should be competent and open to discussing new ways to do things. The functional areas that should be represented are manufacturing, purchasing, research and development, personnel, training, accounting, and marketing.

The steering committee should be familiar with the overall operational objectives of the organization. These objectives, which are usually determined by top management,

serve as the direction which the organization should move as a whole. It is important that these objectives are known and that the committee develop a plan that is congruent with these objectives. The goal is to create a JIT program that will compliment the corporate plan in a clear and defined manner.

The next step is that a clear set of objectives for the program be identified. Items such as inventory carrying costs, production disruption costs, and lead times must also be defined. The steering committee can get some outside help in defining those objectives. There are numerous JIT consultants willing to share their expertise and experiences implementing such programs. In addition, there are several excellent books in the field - Japanese Manufacturing Techniques and World Class Manufacturing both by Richard J. Schonberger. After utilizing these sources the committee will be able to analyze their requirements and select the best courses of action.

Krepchin (1988) states that a public statement of support for the program by top management is a must to implement JIT successfully. Ideally, there should be support for the program from top management to hourly workers. Several methods to gain support for the program are education, training, and the use of a pilot project.

Furst (1988) states that educating the employees about JIT can be accomplished by showing films such as just-in-time

tutorial from Hewlett Packard Company and NBC White Paper report on Japanese productivity. In addition, distributing literature and having employees visit other companies where JIT has been implemented are also helpful.

Training of the employees is important for JIT to succeed. The workers will need to be trained in problem-solving skills, JIT philosophy, and teamwork. Also, the employees should receive cross-training which enables them to perform a variety of jobs in their respective areas. This further adds to provide flexibility to the manufacturing process. In a JIT environment, the responsibility for activities on the plant floor is placed on the hourly workers. As a result of this added responsibility, they will need the additional training.

Finally, the pilot project to demonstrate just-in-time should be carefully chosen. It should be an area that can easily be converted to the JIT environment. It should also be able to show the employees the full potential of JIT. This initial JIT project must be successful. Once the concept is proven, it will be easy to sustain and gain additional support and commitment. After the pilot project, an implementation schedule must be developed and communicated to everyone. Allocation of resources for the program should be provided. A start date should be selected and the program fully implemented.

EMPLOYEE PARTICIPATION

The benefits achieved by implementing just-in-time are impressive. However, it takes more than just implementing a JIT system to be successful. According to Savage-Moore (1988), there must be management commitment and employee involvement in order for the program to succeed. Management at all levels of the organization must be committed to the program. They must convey that continuous improvement of quality is a way of life and not just another program.

Management must encourage participation from everyone. To begin with, there needs to be a more open management style. This means listening to the employees' ideas and suggestions for improvements. The employees know more about their jobs than management so why not take advantage of this resource.

Management must establish solid lines of communication to the employees. Management must let people know what is happening and this information must be accurate and honest. In addition, two-way channels of communication are necessary to provide important information to the top of the organization. This can be done by giving out accurate information, telling people the truth, and creating an atmosphere where truth is the norm. This process is important to allow management an effective means of educating the employees about JIT philosophies and procedures.

Management must treat their employees as their most

important asset. They must acknowledge that these people are capable, thinking individuals who deserve respect and loyalty. To take this one step further, management should treat their employees as they would their most loyal customers. Treating employees in this manner will lead to workers who will take pride in performing their jobs.

Another aspect of employee involvement is education and training. According to Krepchin (1988), training is the key to break old habits and should cover all levels of the organization. Management should do a skills assessment of their workforce. Just-in-time requires a heavy problem - solving emphasis utilizing technical skills. The skills assessment allows management to determine which skills their employees have and any additional skills they will need to learn for the new system. The assessment process gives management the direction of the changes that are required and the type of training to provide their employees.

Finally, management must encourage employees to get involved in decision making. The key is to utilize the employees' talents and experiences to benefit both the employee and the organization. Employee involvement means just that, involving all employees at every level. It is giving responsibility and control to perform their jobs. People need to be clear about their jobs, have the proper information to do their jobs, and have the authority and responsibility to perform the given tasks. This sense of

partnership and involvement with the organization creates success and motivated employees. Management must listen to the employees, treat them as one of their most important assets, and use their input to make employee involvement successful. Howser (1987) concludes that how you educate, motivate, and treat people will make the difference in a successful JIT program.

CONCLUSION

The process of manufacturing has evolved over the years. Many changes have occurred throughout this process. The United States manufacturing process is changing from job-lot manufacturing to repetitive manufacturing. One tool to help manufacturing make this changeover is JIT.

The number of companies implementing just-in-time has risen at a slow pace. The reasons for the low acceptance of JIT is a misunderstanding of the philosophy by executives. Many executives believe the benefits of JIT to be inventory control/reduction or a setup reduction program. Although these are just two of the benefits of JIT, frequently they are not the major benefits.

Just-in-time is implemented for a number of reasons. Five of the reasons reviewed were: setup reduction, containerization, equipment reliability, purchasing, and material consideration. The benefits obtained when these areas are combined together are impressive.

As with most systems, there are strengths and weaknesses

inherent in the program. JIT is not an exception to this general rule. In order for management to be able to make an informed decision about adopting just-in-time they must be fully aware of its strengths and weaknesses. It is imperative that management understands the pros and cons of just-in-time philosophy.

The weaknesses inherent in JIT are based on basic economic premises. Five weaknesses that were reviewed are: moves and countermoves of rivals and competitors, potential new entrants into the industry, power of suppliers, power of customers, and potential new substitutes. Basically, the weaknesses of using JIT are - making your market segment look lucrative because of increased profits, having to rely heavily on suppliers, fluctuating demand by customers who want the product delivered instantly, and not being able to capture additional market share because of JIT's premise of zero inventory.

A number of companies report substantial benefits as a result of implementing JIT. Typically, management can expect an increase in quality levels while reducing inventory, leadtimes, and overall costs. More specifically, savings can range from 70 percent reductions in work-in-process to 32 percent increases in productivity per employee.

Most people resist change and are reluctant to adopt a new way of doing something. They resist change because they do not understand the new technology. Three reasons cited

why people resist change were: systems conceived by top management, systems are designed by engineers with little or almost no thought given to the people who will operate them, and that the hourly workers will lose their jobs to the new technology.

Implementing JIT requires effort and team work from all departments. A steering committee should be established consisting of personnel from key areas to guide and control the project. A clear set of objectives for JIT must be identified and defined. There should be a show of support for the program at all levels of the organization including the extreme top level. The employees will need to be educated about just-in-time philosophies and trained in problem-solving and team building. Finally, a pilot project should be selected and changed over to operate using JIT philosophies and techniques. Once this project is proven successful, an implementation schedule with start date is developed and set in motion.

Implementing JIT by itself is not enough to yield impressive savings for a company. The key to increasing employee productivity and morale is through employee participation. Management must include the workers in decision making concerning their jobs. They must also communicate and listen to the employees with respect and value their thoughts and ideas. If management can nurture worker involvement they would be taking a step in the right

direction towards growth and development of both the employees and the organization.

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