

A REVIEW OF THE ADOPTION OF JUST-IN-TIME METHOD AND ITS EFFECT ON EFFICIENCY

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ABSTRACT

The just-in-time (JIT) process has been around for many years, and it has successfully been implemented by many Japanese companies. Some companies in the United States (U.S.) presently use JIT ideas and techniques in their operations. JIT is more of a philosophy than an actual process. The JIT philosophy emphasizes the performance of activities based on immediate need or demand. JIT has primarily been used in the manufacturing area, but it may also be broadly viewed as a procedure for helping companies manage and reduce their total processing times. This paper will discuss the JIT process mainly as it applies to the manufacturing industry. First, the applications of JIT techniques will be examined, focusing primarily on the Kanban system developed by the Japanese. Secondly, examples of several U.S. companies using JIT procedures will be described, along with some of the changes they have made in adapting to this new environment. Next, the cost accounting implications associated with JIT will be discussed focusing on how information required by management, may or may not change, under a JIT environment. Finally, the advantages and disadvantages of JIT will be examined, and conclusions will be reached regarding its future applications in the U.S.

INTRODUCTION

Kaplan and Atkinson (1989) revealed that the JIT philosophy revolves around four major points: the elimination of activities that do not add value to a product

or service; a commitment to a high level of quality; a commitment to continuous improvement in the efficiency of an activity; and an emphasis on simplification and increased visibility to identify activities that do not add value. With these four major aspects in mind, different techniques have been developed when adopting JIT methods in different types of industries. JIT may be applied in both the purchasing and the production areas. The purchasing applications of JIT are broader, in terms of the types of organizations which may benefit from its adoption, than its production applications. Any company may use JIT purchasing techniques by developing close relationships with their various suppliers.. JIT purchasing will be discussed in more detail following the discussion of JIT production. JIT production is applicable only to the manufacturing area, Kaplan and Atkinson (1989).

JIT manufacturing involves the production of goods based on demand. It contradicts the conventional American manufacturing ideal of producing as much inventory as possible in anticipation of demand. Ideally, JIT eliminates all work-in-progress, and produces only goods that are immediately needed. According to Drury (1990), JIT attempts to manufacture products from start to finish, the first task in applying JIT production, is to rearrange the factory floor layout away from batch production toward a product layout using flow lines. Additionally, each flow line will normally be U-shaped. This layout allows workers access to more than one machine, and the ability to help other workers if any trouble occurs in the production line. If any problems are encountered during the production flow, the entire line shuts down, and the problem is resolved immediately. Since parts are produced based on demand, there is a constant flow of components rather than batches of work-in-progress (WIP). Under this environment, defective parts must be eliminated. When

only minimal levels of inventories are maintained, any hold up in the production process may cause delays in customers' deliveries. Doing the job right the first time is one of the main emphases of JIT production, Drury (1990)

One of the most popular JIT production methods used is known as the Kanban system. Neumann and Jaouen (1986) implied that "Kanban, the Japanese word for card originated from the use of cards to operate "a pull system" of material control that linked all supplying operations to a final assembly line." Furthermore, the ultimate goal of this system is the conversion of raw materials into finished products with lead time equal to processing time. Kanban attempts to achieve this goal by concentrating on the following areas: reduction of inventory and lot sizes; reduction of setup costs; elimination of queues; providing effective maintenance programs to eliminate production defects entirely (improving quality); reducing lead times; making vendors part of the team in terms of planning needs and delivery times; and minimizing employee turnover through consensus management, Neumann and Jaouen (1986). A comparison of these factors with the typical American manufacturing philosophy reveals why JIT implementation in the U.S. has been a slow process. Inventory is regarded as an asset in an ordinary manufacturing plant, and the plant strives to produce more, just in case, any manufacturing problems arise. Formulas are used to determine optimum lot sizes based on the trade-off between cost of inventories and the cost of setup, and no attempts are made to reduce these lots. Setups costs are not considered very important, as usually the plant's main goal is to maximize output. Investment in queues is necessary since queues permit succeeding operations to continue in the event of a problem with the feeding operations. Vendors are considered adversaries, and competition between them is encouraged. Defective parts

are tolerated, and methods are developed for forecasting future production of scrap. Equipment maintenance is done as required, and it is not critical because queues are available. Again, in terms of lead times, more not less is considered better. Finally, workers do not have much input regarding new systems installed. However, they are evaluated based on those new systems. It is evident from this discussion that most of the goals of a Kanban (JIT) system contradict the traditional manufacturing or management philosophies of a typical U.S. manufacturing company. Therefore, implementation of Kanban or other JIT processes involves significant changes in the way U.S. companies are used to operating. Any successful implementation of JIT must involve a total commitment of the firm's top management as well as of its employees. The implementation of JIT in the purchasing area involves the availability of materials from suppliers just when they are needed by the company. Under this type of environment, a company must develop a very close relationship with its vendors in order for them to deliver quality parts on time. Walleigh (1986) study found that companies using JIT purchasing, usually select a small group of vendors as their suppliers, and try to arrange long-term commitment contracts with these vendors. The vendors must become part of the manufacturing team, and they are essential for a smooth production flow. JIT purchasing techniques are a must for companies that are trying to implement JIT production. If the materials needed to produce a product are not available, the entire production process will be affected. Some companies using JIT purchasing have developed rating systems for the selection and evaluation of their vendors.

The study by Robinson and Timmerman (1987) revealed a vendor rating system based on ten performance factors developed by a company in their study. The ten factors were: dollar cost, quality costs, terms of sale,

meeting product specification, meeting product expectations, quality assurance, delivery quality, lead time, administrative accuracy, and product support. Weights were determined for each of these factors, and the company's suppliers were rated based on their performance. The company sponsored a vendor day, in which it presented awards to its top performing vendors. The vendors' reaction to the company's system was generally positive. They viewed the company as being on top of things, and it was an incentive for them to try to improve their quality and service to the company. As the company became more aware of the type of service required from their vendors a modified rating system was developed. Although their system involved several judgment calls, it was a quantitative system that any company may use when evaluating vendor performance.

The study by Burt (1989) found that the automobile industry has also been heavily involved in the JIT purchasing area, and that both General Motors and Ford have sophisticated systems in place for evaluating and selecting potential suppliers. Additionally the study listed several factors that should be considered when choosing JIT suppliers: 1: more is not necessarily better, and better is not necessarily cheaper -when purchasing supplies management must consider all of the cost involved, not just the lowest price per unit (cost of poor quality involves downtime, etc.); 2: a selection team must be chosen to evaluate and select suppliers -this team should involve personnel from the various areas of the firm that will be affected by the suppliers' performance; 3: suppliers may be used as designers by aiding in the improvement of the company's existing products and in the development of new product lines; 4: quality standards should be established up front; 5: price, of course, is important, and it must be negotiated between the company and the suppliers; 6:

suppliers must be motivated to provide good service to their customers.

Although all of the above may not be necessary to implement JIT purchasing, they provide some general guidelines for companies to follow when trying to establish solid relationships with their vendors. Supplier performance in a JIT environment is critical, and the time spent in the selection process will have positive long-term effects to the companies' future operations.

Several U.S. companies have been using JIT techniques since the mid-1980's. The discussion that follows will describe three very different types of organizations that have adopted JIT processes in their operations. These three companies provide examples of the diversity of environments to which JIT may be applied. The first company discussed will be Hewlett-Packard, a leader in the computer industry. The second is Valmont/ALS, a steel fabricator in Brenham, Texas, and the third *is* a small manufacturing company named Norfield Manufacturing Co. JIT applications will be discussed in a large company setting, a job-shop type environment, and from the perspective of a small closely-held manufacturing company. The discussion will also include some of the cost accounting changes made by these companies because of JIT.

Several articles have been written describing the various JIT applications that Hewlett-Packard (H-P) has adopted over the past several years. This discussion will focus primarily on an articles published in the in August 1986.

One more major result for the study was HPD began developing the Kanban manufacturing system for the production of personal mass storage units {disk drives}. The production process was set up in a U-shape, passing one unit at a time with no buffer stock. "If the employee's Kanban out-square is filled, he or she may either complete

the unit being worked on, sit idle, or help a downstream employee; once the unit an employee is working on is completed, the employee cannot work on another unit, Jaouen and Neuman (1987). If a problem occurred during production, the problem was immediately corrected before the production process continued. Therefore, inventories of defective parts were eliminated. Under this system, employees were encouraged to perform quality work and improve productivity. The Kanban system implemented also included JIT purchasing. HPD managed to reduce total inventory supply from 2.8 months to 1.3 months within a 6-month period, and only 24 vendors were supplying 100 parts "just- in-time". The company managed a 48% reduction in the number of vendors; a 30% reduction in the number of raw material inspections; and total factory output tripled over a period of eight months.

HPD's cost accounting system was previously a work-order- based job-cost system. Since the arrival of the Kanban system, HPD has eliminated the use of work orders, and it no longer uses a WIP account. Under the Kanban system, specific unit costs are de-emphasized, and the accounting system used combines some of the elements of process costing, in the use of standard material cost and in assigning overhead to production processes, but many of the traditional process and job order cost accounts have been eliminated. The company has created a new account, called the raw-and-in-process (RIP) inventory account, which combines raw materials inventory and work in process into one account. Since RIP should be insignificant under a JIT system, HPD uses the backflush accounting method for recording its manufacturing costs (the backflush method will be discussed in more detail when the accounting implications of JIT are examined). A major change in cost accounting at HPD involved the treatment of direct labor costs. Because of the small percentage of total product costs attributed to direct labor, cost accountants

decided not to charge direct labor to each manufacturing unit. Direct labor costs are still analyzed and tracked, but not at the same level of detail as was done in the past. The division has also changed its method of allocating overhead because HPD realized that about half of its overhead costs were related to materials procurement and manufacturing support. As far as inventory control, HPD's primary goal is to minimize their investment in inventory. Physical inventories of finished goods are now performed on a monthly basis; the RIP inventory account is verified using an ABC classification method. "A" parts, which account for 90% of the total dollars, are counted twice a month, while "c" parts are counted every two months. HPD also changed the methods used to compute its variances.

In another work, Jaouen and Neuman (1987), clarified that the division now recognizes variances only at the point of purchase and production, and labor efficiency variances are no longer calculated as labor hours are incurred. Variances are computed combining labor and overhead costs. Because of this cost aggregation, some of the resulting variances are producing misleading information. HPD may be able to improve its variance analysis by separating the fixed and variable components of direct labor and overhead, and computing the variances for fixed and variable costs separately. Through the use of Kanban system, HPD simplified its accounting as well as its inventory procedures. The plant showed a decrease in direct material costs per unit, but no change in labor and overhead costs due to additional investments in these areas. There was also an increase in the number of units produced during this period, but a reduction in the amount of storage space, indicating faster turnover of inventory. Because of the Kanban philosophy, HPD spent time and money helping employees develop a team attitude. Employees were trained and educated on the JIT philosophy, and team meetings were held regularly to deal with topics such as

stress, quality and line balancing. Overall, it appears that HPD has been successful in the implementation of a Kanban (JIT) system, and the division is pleased with the accomplished results thus far.

Although, JIT processes seem best suited for companies dealing with repetitive manufacturing, they have been effective in job-shop operations. The study by Kozoil(1988) describes how Valmont/ ALS, a job-shop steel fabricator in Brenham, Texas, adopted a modified form of JIT in order to improve its operations during down times in the steel industry. The company attempted to produce only to customer order, and to reduce the amount of time it took to produce an order. The company first focused on determining their main constraints. Additionally, they identified two external constraints: a marketing constraint (the company could produce more than it could sell), and the location of the engineering function. The bottlenecks at the plant occurred primarily at the weld assembly area. The company adopted a new system to operate the job- shop, which they considered a modified Kanban (JIT) system, in which inventory would be pulled through the shop at a rate dictated by their constraints. Their prior Material Resource Planning (MRP) system pushed inventory through the shop without acknowledging the constraints. The company encountered two major problems in the implementation. First, the plant's engineering and marketing departments reported directly to the home office, and these two groups were not aware of the production changes being made at the plant. Therefore, training had to be expanded to the organization as a whole. Secondly, the plant had to determine how to schedule the shop in the most efficient manner. Again, this involved some changes to the company's MRP system. Since the company could not afford a new computer system, modifications were made to the current system to schedule job-shop operations on a daily basis. The company was

able to reduce its inventory, reduce lead times, and deliver products to customers on time. Overall, the company experienced positive results from the implementation of the modified JIT process, and the company is constantly improving the system's performance.

Krause and Keller (1988), study presented another example for the Norfield Manufacturing Co., which is a small closely-held business employing about 60 production workers in 1988. It illustrates JIT applications in a small company environment. The company manufactures pre-hung doors, and the machinery used to manufacture these doors. The company continued to expand, but it still maintained its inventory accounting under the periodic method. "Management recognized the need for a standard cost system to track costs of inputs for production. The president of the company was aware of the production advantages of world class manufacturing, and management decided to look at methods such as that being used by Hewlett-Packard, to improve their production process and their accounting systems.

The company identified five goals in attempting to improve its production operations:

1. "Engage employee involvement, not just participation;
2. Implement just-in-time production techniques;
3. Institute total quality control;
4. Operationalize total preventive maintenance; and
5. Work toward continual rapid improvement."

Through achievement of these goals, the company hoped to provide a higher quality product that would reach customers quicker at a lower cost.

The first changes made by the employees, were the redesign of the shop floor layout and the collection of accounting data on the job floor. Once employee involvement was established, the next step was the implementation of just-in-time production. In this area, Norfield was able to reduce throughput time; it was able to

reduce inventory as well as handling and storage costs; and it was able to redesign its raw materials inventory procedures by focusing on a single supplier for its primary material –steel. The three additional goals were achieved as the JIT process continued to evolve.

The major findings in Ferguson (1988) study were that: first, accountants have been accused on hindering the implementation of JIT processes due to the following reasons:

- 1- "Costing systems foster anti-JIT attitudes,
- 2- Accountants don't want their systems messed up,
- 3- Accounting costs mislead about the benefits of JIT,
- 4- Accountants cannot (or at least do not) provide some of the information needed for the control of a JIT system, but they do waste resources providing information which is of no use, and
- 5- Where JIT involves capital expenditures; capital appraisal methods ignore many of the benefits.

Second, under current costing systems, fixed overhead recovery is based on machine or direct labor hours. This allocation encourages the company to produce as much as possible in order to recover all of its overhead. Also, manufacturing plants tend to organize production processes into cost centers. These cost centers strive to increase their own production goals, and they are not concerned if defective items are passed on to other departments. Both of these factors go against JIT goals. JIT systems also attempt to simplify accounting procedures. Third, one of the ways in which this has been accomplished is through the elimination of work orders. Accountants previously used these documents as one of their main sources of data. Forth, employees become more flexible under JIT; they may even perform indirect labor functions such as machine maintenance. Therefore, time sheets and detailed time reporting as well as incentives based on individual performances may need to be abandoned. Since

JIT processes units based on demand, certain workstations may be idle during the day thereby increasing labor cost per unit of output, and decreasing the number of machine hours and the amount of overhead recoveries. JIT involves a heavy emphasis on reducing WIP. Information on how much stock is held, and where it is located is very important in a JIT system. JIT also places significant emphasis on the quality of products, but accountants does not have measures in place to compute the financial benefits derived from improved product quality. An excessive amount of time is spent measuring labor costs which are a declining part of total product costs. Since most of the benefits of JIT appear gradually, are longer term, and are hard to identify, it may be difficult to measure how well a JIT system is performing. As explained above, accountants have a lot of obstacles to overcome when adapting to JIT techniques. Accountants should be involved in the implementation from the beginning, and they should make an effort to understand the new production system and how it functions, and what accounting changes need to be made to better cope with the new environment.

After reviewing why the implementation of JIT may be difficult for accountants, the discussion will now focus on the cost accounting implications of JIT. Adopting JIT in U.S. companies involves significant changes in management's thinking and overall goals. Implementation of JIT requires many manufacturing changes, and cost accounting information previously required by management may no longer be relevant. Although accounting is not considered a high priority when converting to a JIT process, management must realize that cost accounting information needed in a JIT environment may be different than that required under their old production process. Cost accountants provide information to management to help them in the decision making process. Cost accountants must change their reporting

methods to comply with the requirements of the new JIT system.

Foster and Horngren (1987), addressed some of the cost accounting implications associated with JIT. The authors examine the effects of JIT purchasing separately from JIT production. As was previously discussed, these two areas are not necessarily dependent on one another. JIT purchasing may be used without JIT production. However, JIT purchasing is very important if a company has implemented JIT production. If a company is using JIT purchasing, the authors suggest that its cost accounting system may be affected in one or more of the following ways:

- 1- Increase in the direct traceability of costs -under JIT, facilities may be used for material handling of a single product, thereby making the facility cost a direct cost.
- 2- Changes in the cost pools used to accumulate cost -generally, there is a reduction in the number of cost pools under JIT.
- 3- Changes in the bases used to allocate indirect costs to production departments -dollar value of materials or number of deliveries may be used to allocate indirect costs.
- 4- Reduces the emphasis on individual purchase price variance information -price variances are not as significant under a JIT system. JIT is more concerned with the total cost of operations, and with providing good quality products.

Discount prices may be obtained by entering long-term commitment contracts with suppliers.

5- Reduces the frequency of reporting of purchase deliveries in the internal accounting system -use of the backflush costing system.

When a company uses JIT production, the authors believe that cost accounting is affected in one or more of the following ways:

1- Increase in the direct traceability of costs -again in a JIT system, activities that were previously classified as indirect will become direct. For example, plant maintenance and setups previously classified as indirect labor will now be performed by the production line workers.

2- Elimination of cost pools for several activities classified as indirect -JIT eliminates activities that do not add value.

3- Decrease in the emphasis placed on individual labor and overhead variances -some firms have eliminated labor and overhead variances. However, when variances are still utilized, the emphasis of the analysis is at the plant level focusing on trends that may be occurring in the production process.

4- Decrease in the amount of detailed information recorded in work tickets -use of the backflush costing system.

5- Decrease in the level of detailed information recorded about labor cost -JIT philosophy emphasizes teams' not individual workers.

The above lists suggest some of the cost accounting changes companies involved in JIT purchasing or production should consider. As is evident from above, some significant changes may be necessary to conform to the JIT procedures. However, most of the suggestions

involve simplification to the current cost accounting system in place.

Generally, there has been a concern in the U.S. that accounting systems are too financial reporting oriented, and that they neglect internal reporting needs. Internal accounting systems, even before the adoption of JIT, are not providing management with relevant information to be used for proper decision making. The backflush costing system described above was criticized in an article published by Calvasina et al, (1989). The article examined the problems faced by Hewlett- Packard when applying the backflush cost accounting system after the implementation of JIT. The authors believe that the backflush costing system does not provide management with all of the information needed for decision making. This was evident from the need to perform physical inventory counts at H-P in order to keep track of its raw materials and finished goods inventory.

As Calvasina et. al. stated

“The need for this physical count system raises questions about the company's great advance in its accounting system.”

Use of the ABC method to classify materials indicates another flaw in the system, as under JIT, items are considered equally crucial regardless of dollar value. Another problem associated with the backflush system is that it eliminates the calculation of equivalent units of production (EUP). Additionally, the authors suggest, that under a JIT system, in order to obtain an accurate evaluation of production achievements, EUP must be calculated on the first-in first-out (FIFO) basis. Under the backflush system, entries are made only when the materials are transferred out, and any materials remaining in WIP are ignored. The article also recommends that cost accountants continue using standard costs in their planning process.

According to the authors, a good repetitive manufacturing accounting system should focus on the production process as events and transactions occur. The first entry, under their proposed method, will also be made when materials are purchased. However, materials will be charged directly to the WIP account, and any price variances will be recorded at this time. EUP for raw materials will also be calculated for the appropriate period and recorded. The same basic ideas apply when recording direct labor and overhead costs. When the goods are transferred to inventory or when the goods are sold, no variance will be recorded, and the goods will be transferred out at their standard cost.

A major criticism of the backflush system is that it records transactions only after the fact, and it does not track events or costs through the production process. This is why Hewlett-Packard is forced to take physical counts. The JIT philosophy attempts to eliminate wasting time on nonvalue-adding activities. The taking of physical inventory is an example of such an activity. The backflush system is very similar to the periodic system of inventory, and the authors feel that it does not provide management with enough accounting information on which to base its decisions. A perpetual system based on standard costs seems to provide more information to management than a periodic system when significant raw material or WIP inventories are still present.

The discussion of the methods above suggests that there are no clear cut answers as to how a cost accounting system should be structured in a JIT environment. Both of the methods described seem to make sense under certain circumstances. Under a true JIT system, the backflush costing approach may be all that management needs since any WIP or raw materials inventory will be insignificant. However, as explained above, some companies using JIT still maintain raw materials and WIP inventories, and under

the backflush system this inventory is not valued continually. Therefore, a perpetual type inventory system may be more appropriate.

In addition to the many accounting changes, and the choice of accounting methods discussed thus far, a company may also need to develop a new costing method for its products. The study by Sandwell and Molyneux (1989) shows that surveys conducted by Price Waterhouse have revealed that a majority of companies regard their existing costing system as inadequate even under their current approach to manufacturing. Therefore, it is not surprising that the introduction of JIT will require a new approach to costing systems, As Sandwell and Molyneux (1989) stated

"The key to designing the improved costing systems that are required is to understand the underlying business, and the way it conducts its operations, and then to build the costing system around those structures."

Additional findings in their study shows various tools are available that may lead to improved costing systems. These tools are considered compatible with the implementation of JIT manufacturing. They include the following: activity-based-costing, target costing, improved standard costs, life cycle costs, and improved investment justification techniques. Activity-based-costing is an approach to overhead costing which attempts to identify the factors which influence the cost. Costs are apportioned to products based on cost drivers which may include the number of set-ups in a manufacturing process, the number of material movements, or the number of different product variations. Target costing attempts to determine the target cost of the product in the long-run by determining what price consumers will be willing to pay for a product and then working backwards to achieve a target cost based on that selling price. Standard costs will still play a key role in measuring monthly performance. JIT attempts to eliminate

wasted costs such as the cost of scrap, and the cost of moving and storing materials and inventory. Therefore, these costs must be measured in order for them to be reduced. Improved standard costs can be related to target costing. Standard costs will be the costs expected to be achieved for a particular period, usually one year, while the target costs is the cost to be achieved over a longer period of time. Over time, the goal is for the standard cost to equate to the target cost. Life cycle costs are relevant when products are subject to rapid obsolescence, and where the cost of designing the product is a major component of long-term profitability. Traditionally, costing systems are focused on the manufacturing process, life cycle costing will entail involvement at the designing stage of the product. Sandwell and Molyneux (1989) stated

"Capital investment justification techniques must be improved to take account of the impact of improvements in areas such as inventory holding costs and quality. The goal is to maximize output of the organization as a whole and not the individual stations. "

A related technique involves the concept of maximum potential throughput (MPT).

The MPT is the theoretical capacity that could be achieved in the absence of any waste. Capital investment should strive to increase actual output to the MPT level. Of course, market demand constraints must also be taken into account.

There are many cost accounting implications associated with the implementation of JIT processes. In terms of inventory costing for financial reporting purposes, inventory should be immaterial and constant from year to year under a true JIT system. Therefore, cost of goods sold will equal cost of goods manufactured. The unit cost concept is greatly affected by JIT. The process improves quality, productivity, and reduces product costs.

Accountants need to be aware of all of the accounting changes that may be necessary because of JIT. Many of the cost accounting methods previously used may need to be modified. Since there are no established standards, accountants can develop accounting systems that directly satisfy management's needs. Attaining all of the JIT goals takes time and accounting systems should be modified as different levels of JIT applications are implemented. Accountants should keep in mind what JIT attempts to accomplish, and they should develop accounting standards that can measure those accomplishments. As more companies become aware of JIT methods, some uniformity in accounting methods and techniques will be established.

The implementation of JIT can provide many advantages to a company. The usage of JIT techniques can improve a company's problem solving capabilities by exposing problems in the production process as they occur. Problems do not remain hidden in excess materials as any problems encountered are immediately resolved. JIT reduces lead times and increases equipment utilization because of smaller lot sizes and delivery order sizes. Product quality is increased because quality is centered on the individual workers, and the workers are considered part of the team. Input from workers is encouraged. Adoption of JIT usually reduces paper work, and requires only simple planning systems. A reduction in inventory is always achieved as the JIT philosophy aims to eliminate nonvalue-added time or wasted time.

There are also some disadvantages associated with the implementation of JIT. It may be difficult for JIT to be effective in certain types of environments. JIT requires an atmosphere of close cooperation and mutual trust between the workforce and management. It is usually not as effective when labor is unionized. The use of JIT production or purchasing requires a large number of

production setups and frequent shipments of purchased items from suppliers. Therefore, suppliers become very important and crucial to the company's operations. The process is not well-suited for irregularly used parts or specially ordered products because it does not respond quickly to changes in schedules when there is little excess inventory available.

In conclusion, JIT is best suited for companies with uniform production flows, but as shown in the different examples discussed, JIT may be used virtually by all types of businesses. Although this paper focused primarily on manufacturing applications of JIT, the JIT philosophy can be applied to many types of organization. JIT techniques may be used in conjunction with other types of manufacturing systems. Karmarkar(1989) implies that even MRP systems may be modified and used in conjunction with JIT applications. Many companies have been successful in implementing JIT techniques, and they continue to try to improve their systems. Changes in cost accounting information provided under JIT environments have been diverse. Companies are making changes to their accounting systems as JIT implementation takes place. Most companies, under JIT, have been able to eliminate some of the detailed accounting information previously maintained. Presently, there is no one accounting method best suited for a company using JIT. The cost accounting system needs to be evaluated and modified, as necessary, to best fit the JIT requirements. The purpose of any cost accounting system is to provide management with useful information that will facilitate the decision making process. Under JIT, the cost accounting system should strive to achieve this same purpose.

The JIT methods can produce many advantages, and U.S. companies that have implemented JIT procedures have benefited from many of these advantages. The disadvantages discussed can be overcome through careful

planning at the early stages of implementation and through continual monitoring of the process as the system grows. Applications of JIT will continue to expand in the future as companies realize the many financial gains that JIT techniques can generate. Companies should definitely consider looking into JIT methods.

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