

- a. The JIT production system was one of the most significant production management approaches of the post world war II era. Using JIT, Taiichi Ohno revolutionized the production system at Toyota. Discuss in details the concepts of JIT and its advantages with reference to Toyota. Some analysts, however, pointed out that JIT had many drawbacks. Briefly explain the disadvantages of JIT. How can they be solved?

Ans.) "In an industry where cooperation is critical and supply chain efficiency determines success, an e-business strategy based on lean techniques is the only way to stay competitive" (Lopker & Gray).

The structure of production is changing from traditional mass production to individualization and customized production; 'where de-massification is replacing massification'. This trend is affecting the large corporations and small companies that function under the conventions of the mass production age. However, in order for the conglomerates to stay afloat in the New Economy, many corporations, from car manufacturers to fashion retailers, have implemented a restructuring plan which turns traditional manufacturing processes and thinking on its head.

Just-In-time manufacturing, or **JIT**, is a management philosophy aimed at eliminating manufacturing wastes by producing only the right amount and combination of parts at the right place at the right time. This is based on the fact that wastes result from any activity that adds cost without adding value to the product, such as transferring of inventories from one place to another or even the mere act of storing them.

The goal of JIT, therefore, is to minimize the presence of non-value-adding operations and non-moving inventories in the production line. This will result in shorter throughput times, better on-time delivery performance, higher equipment utilization, lesser space requirement, lower costs, and greater profits. JIT is most applicable to operations or production flows that do not change, i.e., those that are simply repeated over and over again. An example of this would be an automobile assembly line, wherein every car undergoes the same production process as the one before it.

JIT relies on extremely accurate forecasting of sales figures so that the exact quantities of what will be consumed can be ordered and delivered to the right place at the right time. This requires an extensive volume of quantitative data based predominantly on previous sales figures, figures which new companies do not have access to, simply because they have no previous sales. Therefore no matter how much market research is conducted prior to the manufacturing process (which also needs to be subjected to cost/benefit analysis) there will inevitably be some guesswork in their estimates. It is better for these establishing companies under a JIT production process to under-order so that cash flows are not impaired at such an early juncture.

In accordance with JIT production, progressive technology, including the web, serves as an important medium in communication. Database technology and a 'pull' inventory system could implement an automated inventory control. This allows orders from suppliers to be placed electronically via the

web when stock levels are running low, say at 30% of 'full' levels. This saves labour time and costs, and also avoids shortages by preordering before selling out of a particular line. Although JIT production is a fitting system for companies with the prevalence of demassification in today's society, there is a fine line between success and failure.

Key Elements of JIT

- 1. Stabilize and level the Master Production Schedule (MPS) with uniform plant load.** It creates a uniform load on all work centers through **Constant Daily Production** to prevent changes in the production plan for certain period of time and **Mixed Model Assembly** produce roughly the same blend of products each day using.
- 2. Reduce or eliminate setup times.** With better planning, process redesign, and production design to eliminate setup times to single digit (less than 10 minutes).
- 3. Reduce manufacturing and purchase lot sizes.** Since more frequent deliveries will be requires, close cooperation with suppliers is necessary to achieve reduction in order lot size for purchased items.
- 4. Reduce production and delivery land times.** Production lead times is reduced by moving work station closer, applying group technology and cellular manufacturing concepts, reducing number of job waiting to be processed, and improving the coordination and cooperation between processes. Delivery lead time is reduced through closer cooperation with suppliers.
- 5. Preventive maintenance.** To use machine and worker break time to maintain equipment in order to stay away from mechanical breakdown.
- 6. Flexible work force.** Worker is trained to be able to operate several machines, such as to perform maintenance tasks or to perform quality inspection.
- 7. Require supplier quality assurance and implement.** Since there are no shields of excess parts, errors leading to defective items must be eliminated.

The Advantages of JIT

The key benefits offered by JIT are increases in production efficiency and a strengthening of competitiveness. These result from the elimination of waste of time, raw materials and other resources, thus saving on inventory costs. Implementing just-in-time production can:

- ✓ Lower stock holding means a reduction in storage space which saves rent and insurance costs
- ✓ As stock is only obtained when it is needed, less working capital is tied up in stock
- ✓ There is less likelihood of stock perishing, becoming obsolete or out of date
- ✓ Avoids the build-up of unsold finished product that can occur with sudden changes in demand
- ✓ Less time is spent on checking and re-working the product of others as the emphasis is on getting the work **right first time.**

As a result of **advantages** such as those cited above, more companies are embracing **just in time manufacturing system** each year. Most companies find, however, that simply reducing inventories is not enough. To remain competitive in an ever changing and ever competitive business environment, must strive for continuous improvement.

JIT finds its origin in Japan, where it has been in practice since the early **1970's**. It was developed and perfected by **Taiichi Ohno** of Toyota, who is now referred to as **the father of JIT**. Taiichi Ohno developed this philosophy as a means of meeting customer demands with minimum delays. Thus, in the olden days, JIT is used not to reduce manufacturing wastage, but primarily to produce goods so that customer orders are met exactly when they need the products.

There are a **number of assumptions** to a successful JIT system that companies deciding on implementing JIT have to overcome. The first of these is market power. In order to have stock on demand, they must have significant power over their suppliers. In the auto industry companies such as Toyota source parts from an array of smaller companies. Due to Toyota's massive market capitalization and market dominance, it is able to demand the quantity, quality and precise timing for all the parts ordered in its cars. While smaller companies operating a JIT system depends almost solely on the large corporations, such as Toyota, for their business. If one of their crucial suppliers walked out, it would throw their entire business plan into jeopardy.

Toyota was able to meet the increasing challenges for survival through an approach that focused on people, plants and systems. Toyota realised that JIT would only be successful if every individual within the organisation was involved and committed to it, if the plant and processes were arranged for maximum output and efficiency, and if quality and production programs were scheduled to meet demands exactly.

JIT manufacturing has the capacity, when properly adapted to the organisation, to strengthen the organisation's competitiveness in the marketplace substantially by reducing wastes and improving product quality and efficiency of production.

There are strong cultural aspects associated with the emergence of JIT in Japan. **The Japanese work ethic involves the following concepts.**

- Workers are highly motivated to seek constant improvement upon that which already exists. Although high standards are currently being met, there exist even higher standards to achieve.
- Companies focus on group effort which involves the combining of talents and sharing knowledge, problem-solving skills, ideas and the achievement of a common goal.
- Work itself takes precedence over leisure. It is not unusual for a Japanese employee to work 14-hour days.
- Employees tend to remain with one company throughout the course of their career span. This allows the opportunity for them to hone their skills and abilities at a constant rate while offering numerous benefits to the company.

These benefits manifest themselves in employee loyalty, low turnover costs and fulfillment of

company goals.

DISADVANTAGES AND HOW THEY ARE SOLVED

- × Just-in-time operation leaves suppliers and downstream consumers open to supply shocks and large supply or demand changes. For internal reasons, Ohno saw this as a feature rather than a bug. He used an analogy of lowering the water level in a river to expose the rocks to explain how removing inventory showed where production flow was interrupted. Once barriers were exposed, they could be removed.
- × Since one of the main barriers was rework, lowering inventory forced each shop to improve its own quality or cause a holdup downstream. A key tool to manage this weakness is production leveling to remove these variations. Just-in-time is a means to improving performance of the system, not an end.
- × Very low stock levels means shipments of the same part can come in several times per day. This means Toyota is especially susceptible to flow interruption. For that reason, Toyota uses two suppliers for most assemblies. As noted in Liker (2003), there was an exception to this rule that put the entire company at risk because of the 1997 Aisin fire. However, since Toyota also makes a point of maintaining high quality relations with its entire supplier network.

CONCLUSION

Hence we can see that to have a Total **JIT** manufacturing system, a company-wide commitment, proper materials, quality, people and equipments must always be made available when needed. In addition; the policies and procedures developed for an internal **JIT** structure should also be extended into the company's supplier and customer base to establish the identification of duplication of effort and performance feedback review to continuously reduced wastage and improve quality. By integrating the production process; the supplier, manufacturers and customers become an extension of the manufacturing production process instead of independently isolated processes where in fact in clear sense these three sets of manufacturing stages are inter-related and dependent on one another. Once functioning as individual stages and operating accordingly in isolated perspective; the suppliers, manufacturers and customers can no longer choose to operate in ignorance. The rules of productivity standards have changed to shape the economy and the markets today; every company must be receptive to changes and be dynamically responsive to demand. In general, it can be said that there is no such thing as a **KEY** in achieving a **JIT** success; only a **LADDER**; where a series of continuous steps of dedication in doing the job right every time is all it takes.

- b. 'Kanban was an important concept of Toyota's JIT system'. Explain the concept of Kanban used in Toyota. What are the advantages of 'Kanban' over the Western manufacturing system?

Ans.) Kanban is a concept related to lean and just-in-time (JIT) production. According to Taiichi Ohno, the man credited with developing Just-in-time (JIT), kanban is one means through which JIT is achieved. Kanban is not an inventory control system. Rather, it is a scheduling system that tells you what to produce, when to produce it, and how much to produce. The need to maintain a high rate of improvements led Toyota to devise the kanban system. Kanban became an effective tool to support the running of the production system as a whole. In addition, it proved to be an excellent way for promoting improvements because reducing the number of kanban in circulation highlighted problem areas.

The term Kanban is a **Japanese word** whose English translation **means signboard or visual signal**. A well-timed Kanban system works exactly like a traffic signal in managing the flow of traffic and meeting the real time needs of customers by sending clear signals on when to start, slow down, and stop production. Each Kanban signal also carries valuable information about the volume and sequencing of the production. Toyota originally used cards attached to different supply containers to communicate what materials in the production line were needed, but today many variations exist, including signboards and electronic systems. The result is an efficient system where products are only replenished when they are consumed further downstream in the process.

A kanban is a card attached to the carrier or container of a lot used to match what needs to be produced in a work station and what needs to be delivered to the next station. As mentioned, a JIT system is basically a 'pull' system, which means that what needs to be produced in a particular station depends on what the next station needs. Ultimately the production is therefore modulated by end customer orders. Kanbans, which contain information about the lots and quantities involved, are therefore used to facilitate the execution of this 'pull' system. With this 'pull' system, no parts that can not be processed in succeeding stations will be produced.

There are **two types of kanban** assigned to every lot, namely, **a production kanban (P-kanban)** and a **conveyance kanban (C-kanban)**. The P-kanban denotes the need to produce more parts while the C-kanban denotes the need to deliver more parts to the next station. No parts can be produced unless authorized by a P-kanban. On the other hand, a C-kanban triggers the 'pulling' or 'withdrawal' of units from the preceding station. C-kanbans are also known as 'move' or 'withdrawal' kanbans.

OPERATION

An important determinant of the success of production scheduling based on "pushing" the demand is the quality of the demand forecast that can receive such "push."

Kanban, by contrast, is part of an approach of receiving the "pull" from the demand. Therefore, the supply or production is determined according to the actual demand of the customers. In contexts where supply time is lengthy and demand is difficult to forecast, the best one can do is to respond quickly to observed demand. This is exactly what a kanban system can help with: It is used as a demand signal that immediately propagates through the supply chain. This can be used to ensure

that intermediate stocks held in the supply chain are better managed, usually smaller. Where the supply response cannot be quick enough to meet actual demand fluctuations, causing significant lost sales, then stock building may be deemed as appropriate which can be achieved by issuing more kanban. Taiichi Ohno states that to be effective kanban must follow strict rules of use¹ (Toyota, for example, has six simple rules, below) and that close monitoring of these rules is a never-ending task to ensure that the kanban does what is required.

TOYOTA'S SIX RULES

- ✓ Do not send defective products to the subsequent process
 - ✓ The subsequent process comes to withdraw only what is needed
 - ✓ Produce only the exact quantity withdrawn by the subsequent process
 - ✓ Level the production
 - ✓ Kanban is a means to fine tuning
 - ✓ Stabilize and rationalize the process
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ADVANTAGES OF 'KANBAN' OVER THE WESTERN MANUFACTURING SYSTEM

- ✓ **Improvement in Production** - The main advantage of the Kanban system lies in its innate ability to drive down costs and waste by improving the flow of production. Many of the scheduling advantages of the Kanban system spring from naturally from the core elements of lean and just in time manufacturing strategies. These strengths become more pronounced when the flow of production is reduced to small batches to accommodate product variations. *With a Kanban system in place, managers and supervisors see the benefits of the Kanban system in:*
 - a. **Better managed inventory levels.** Too much inventory can result in cash flow problems by adding overhead expenses for storage, insurance, and security. On the flip side, too little inventory can damage the reputation of the business for being unreliable, resulting in lost sales and dissatisfied customers. The Kanban system combined with good inventory practices smooths out inventory levels and eliminates carrying costs.
 - b. **Smoother manufacturing flow.** Because the Kanban system focuses on current conditions, production levels are calculated to take into account downtime, scrap, and changeover time of equipment to ensure that the production schedule is met.
 - c. **Overproduction elimination.** As a demand pull system, Kanban is less likely to result in overproduction because of the need to create buffer inventory to address unexpected delays resulting from quality problems with suppliers or minor disruptions in the transportation network.
 - d. **Reduced risk of Inventory obsolescence.** Many products have a shelf life or product lifecycle that can expire unless the product reaches the consumer in a timely manner. In these

changing economic times, brand loyalty has faded and can no longer save a company that does not deliver its goods on time.

- ✓ **Responsiveness to Demand** - Manufacturing is more than just about the mechanics of production and a series of calculations to determine changeover, lead time, and downtime for equipment to derive an ideal production schedule. Production is foremost driven by customer demand which can run in a various patterns from predictable to sporadic, from increasing to declining, and from seasonal to nonseasonal. One of the biggest advantages of the Kanban System is that it improves the responsiveness to changes in demand. In this way, the Kanban system is similar to a smart traffic light with its ability to sense when the traffic, or in this case the demand, is building up. When the pent up demand reaches a predetermined level, the system sends the appropriate signal the traffic light changes to green or, in the factory, production is sped up.
- ✓ **Empowerment** - Another advantage of the Kanban system is that it places control in the hands of the operators who are in the best position to oversee production. People on the front lines have the most knowledge about the daily operations and have a pulse on the real-time flow of the work. Also, shifting accountability for monitoring the daily runs frees up the time of supervisors to focus on long term planning needs. Empowerment is an effective managerial tool because it reinforces education and training; increases mutual respect among employees, generates enthusiasm and dedication to a common goal; lowers absenteeism, and increases productivity. Another by-product of empowerment is conquering resistance to change because employees participate directly in the decision making process.
- ✓ **Quality Control and Self-Discipline** - A final advantage of the Kanban system is found in the fabric of its purpose to promote an environment devoted to quality improvement. Because the Kanban system uses small lot sizes at various points in the production, quality control issues can be more easily pinpointed at the source. Also, the Kanban system eliminates excess inventory which tends to mask quality problems by remaining undetected for longer periods of time. Thus, the need for buffer inventory to resolve quality problems is reduced, and this system becomes self-perpetuating as inventory reduction leads to further quality improvement results.

A Final Tally of the Advantages of the Kanban System

In adding up the advantages of the Kanban system, managers should recognize that the system's strengths lie in creating a more orderly and highly visual accountability system. The visual signals not only aid in improving production flow and responsiveness to customer demand but also in shifting workers' focus on quality improvement and team work through empowerment and self-monitoring activities.

