JUST-IN-TIME INLAID WITH LEAN PRODUCTION PERSPECTIVE

Dr. Mohamed Baymout

Dr. Mohamed Baymout is a professor at Telfer School of Management, University of Ottawa, Ontario, Canada.

Keywords


ABSTRACT

This research paper is analyzing the impact of implementing Just-In-Time (JIT) strategy on the manufacturing performance and production of any organization. Especially when the JIT is not applied alone, but with the interference of Lean production perspective. Hence a big competitive advantage is created to insure better flexibility, delivery, quality and cost in the long run production.
1. INTRODUCTION

Few decades ago, new manufacturing methodologies were introduced to improve the production process as well as increase profits and outcomes. The methodologies were focusing on reducing waste, WIP inventories, and turnover in operations and tasks. The manufacturing process is defined as the application of physical and chemical process to change the state, properties, and/or physical appearance of a given raw material to make finished products; the manufacturing process includes the combination of multiple sub parts to make an assembled finished part. This process is achieved by the combination of different processes like machinery, manufacturing tools, power or energy, and labour. It is always a sequential process of operations.

On the other hand, manufacturing is also defined as the production of goods for use or sale using labour machines tools, chemical & biological processing, or formulation.

Just-in-time (JIT) is a management approach used to resolve time management issues in the production process and integrate solutions in the production timeline, concentrating on high quality output at the shortest time possible. The approach is considering the needed quantity to produce at the right time to deliver. Therefore it facilitates and shortens the times of supply, release and distribution [1]. JIT offers organizations an efficient means to maximize the benefits of utilizing its employees, satisfying the client, and cutting expenses. JIT is producing only what is needed, when it is needed, and in the quantity that is needed. This is done by organizing exact quantity of raw materials for the exact production of final products on time.

From “Just-In-Time” name you can infer that the process is about meeting demand at the exact time instead of having inventory on hand just in case. In order to achieve that, some characteristics are strictly followed in this methodology as minimizing raw material, minimizing defected goods, simplifying the production process, and creating multi-skilled work force with continual improvement.

Three main objectives are targeted based on [2]:

1. Increasing the organization’s competitive advantage for the long run. The JIT methodology will provide flexibility for the production process, accuracy for the delivery system to satisfy on time demand, high quality products, and reduction in the total unit cost. Thus companies can get competitive advantage.
2. Increasing the production efficiency. Efficiency is obtained through the increase of productivity and decrease of cost.
3. Decreasing waste in materials, time and effort. Thus increasing profit through reduction in total cost.

Lean production is another methodology used to reduce wastes in the product development process in order to allow engineers to do more what they want to do. Wastes are identified under seven types based on [20]:

1. Overproduction wastes.
2. Wastes from unproductive idle time waiting for job processing.
3. Wastes from unnecessary transportation or movement of the job.
4. Wastes from unnecessary operations performed in the process.
5. Wastes from excess inventory products.
6. Wastes resulting from unnecessary human or machines.
7. Wastes resulting from defected products and scraps.

Lean Production approach has five fundamental practices starting by specifying the value needed by the costumer (specific products), then identifying the value stream which is the production process used to transform inputs into outputs, then making value flow continuous through eliminating the wastes, idleness, etc., then let customers pull value through providing the product for customers at the right time, and ending by pursuing perfection through ensuring a high quality final product [20].

IJOAR© 2013
http://www.iJOAR.org
JIT implementation has several benefits for the accounting department and these benefits will increase with the plus of the lean production strategy. As a result, organizations will lower the investment in the cost of purchasing inventory, reduce the cost of carrying and handling inventories, reduce the costs coming from the obsolescence of inventories, lower the investment in space for inventories and production (discussed in Toyota case study section), and reduce total manufacturing costs through creating better coordination between production departments to operate at lower inventory levels and less paperwork.

JIT inlaid with Lean perspective requires an introduction of different concepts when implementing its strategic plan like providing training in new skills, rationalizing production flow for the pull system, guarding against bottleneck vulnerability through total productive maintenance, process capability study, authorizing machinists to take advantage of JIT's visibility features, producing small lots and shortening setup times, establishing close working relationships with suppliers.

JIT inlaid with Lean perspective operates much better in a high volume and repetitive process where these two are considered as common features of automotive assembly plants. It involves firm means of production and cultural dissimilarities that can be considered as one of the possible curbs of this new strategy [3].

A discussion of the continuous improvement, implementation and performance issues related to the application of JIT inlaid with lean production perspective in organization system will be presented and discussed in this report.

2. HISTORICAL REVIEW

In Japan:

The waste is considered as undesirable due to its overpopulation and lack of natural resources. Therefore, it is important for them to improve productivity by increasing the output using fewer resources. A certain number of Japanese organisations maintain a “retain” relationship that means a “joint responsibility” between managers and staff, in which every member of the team is treated equally. As a result, each worker respects the leadership trying to perform without mistakes, cooperating with coworkers, and generating creative ideas to improve the firm’s moral and capability. This kind of culture reinforces the basic elements of JIT and lean manufacturing: waste minimization, continuous development and good working relations [23].

The idea was originated in Japan in the 1970’s by Toyota Motor Corporation (TMC). This concept is basically about minimizing waste of materials, space and manpower. System was regularly monitored for reduction of waste produced, and the corporation constantly strived for better quality with the minimum possible labour, resulting in increased productivity. Using JIT/Lean, Toyota remarkably reduced the time required to produce cars from 15 days to one day [23].

In the United States:

In the early 1920’s, Henry Ford’s Highland Park and the River Rouge operation introduced and implemented the Model-T parts Just In Time mass-production for assembly. It involved a large number of daily unloaded freight cars of material going through the process of fabrication, subassembly, final assembly, and back onto the freight cars. The production cycle improved from 21 days to 4 days, including processing ore into steel at the on-site steel mill [23].

JIT manufacturing of this type was slowly replaced by large lot sizes and lengthy cycle times, influenced by economies of scale of mass production, mass markets, and standard designs with interchangeable parts. US manufacturers adopted this strategy in the early 1980’s, when the development of Toyota production system made it change. US manufacturers thought that this concept was not going to work for them because it was
developed under the Japanese work environment. However, this idea changed when Hewlett-Packard and Harley-Davidson got significant benefits from implementing this system [23].

3. IMPACTS OF JIT INLAID WITH LEAN PRODUCTION PERSPECTIVE ON MANUFACTURING PERFORMANCE

3.1. JIT Infrastructure Practices

JIT infrastructure practices involve the organizational infrastructure and management systems, despite the fact that organizational infrastructure can explain the manufacturing performance. There are several aspects that have been studied in order to see and understand how they were affected by JIT implementation. These aspects are: quality management, workflow management, manufacturing strategy, organizational characteristic, product design, inventory turnover, on-time delivery, lead time and cycle time. Figure-1 below is a simple and great representation of the reflex of implementing JIT practices in an organization’s infrastructure on its manufacturing performance. This application will lead to tremendous competitive advantage on flexibility, delivery, quality and cost [4].

![Diagram](image)

Figure 1: The Reflex of JIT Practices (Inlaid with Lean) on Manufacturing Performance and Its Competitive Advantage©

3.1.1. Quality Management

It is related to JIT through providing assistance and support. Quality management helps the progress of an unrestricted movement of products across the process, and allows dropping in the buffer inventory. The establishment of precise feedback related to the manufacturing process helps to notice, identify, analyze, and solve any difficulty or delinquency as they happen [4].

3.1.2. Workforce Management

Workforce practices involve selection, benefits and compensation strategies that excite and improve team workers who participate in problem-solving issues. Workers and operators should be well trained in order to be flexible when shifting to the needed place in the process to enable smooth production flow. The groups working on problem-solving usually offer answer, explanations, and resolutions to manufacturing problems. Therefore, the production cycle will improve and so the efficiency [4].

IJOAR© 2013
http://www.ijoar.org
3.1.3. Organizational Characteristic

JIT and Organizational Characteristics relate to each other by the reorganization of decision making rights within a company. The synchronization of the decision making process among the sections of the company leads to fast and effective decisions that elucidate upcoming problems. With such features, it is possible to develop a flexible, accommodating, up-to-date and involving labour force able to deal and resolve any problems and difficulties [4].

3.1.4. Product Design

Reliability engineering and Design for Manufacturability (DFM) concepts are significant to JIT, as well as for product design. DFM is the ability to design products to be simply manufactured. This includes reducing parts and avoiding discrete fasteners. Reliability engineering is the elimination of the losses and reduction of risks through simple designs. This means that as much as the assembled parts are reduced, the failure rate is reduced as well. Therefore, the buffers capacity will reduce too, and so the production cycle will speed up by the improved amount of time [4].

3.1.5. JIT Manufacturing Strategy (Lean Perspective)

In the literature, the link between JIT and Lean Production is barely discussed. JIT with lean production methodology is considered as a vital measure of the business approach or that the business plan is based on the competencies provided by JIT. In the first step, the production processes are refereed to be a loss or in the best case scenario neutral. Subsequently, in the second step, manufacturing is still counted as neutral, while companies are looking for equality with the major opponents, instead of minimizing the ability of the negative impact in the production process through controlling the internal mechanisms. However, in the third and last step, firms increasingly integrate the manufacturing competences into their business approach or even rely on production as the driver of their business approach. Manufacturing strategy encompasses a long-standing coordination and incorporation of planned and useful decisions. Lean production used in JIT exhibits a significant attraction especially for dynamic firms and environments [4, 20].

3.1.6. Lean Production

Lean production is the operation carried out by a factory or industry with the minimum possible resources and still increases the amount of work to be accomplished with available resources to the maximum. Resources consist of workers, equipment, time, space and materials. Lean Production is also completing the assembly or production of products in the minimum possible time and still achieving an extremely high level of quality, in order to achieve customer satisfaction. Furthermore, lean production is when an organization is doing more with less, and yet achieving their tasks better [5].

Lean production works by eliminating the wasteful activities so that only the value adding and auxiliary activities are performed. When it is being achieved, this result in reduction of resources required for the manufacturing process, the work is completed in less time and higher quality standards are presented in the final product.

Mr. Ohno managed to develop numerous tools for operating his production cycles in a systematic way. He identified the seven major forms of waste in manufacturing that were to be eliminated for improved efficiency which builds the foundation for Lean Production systems. Ohno’s disciples improved his contributions into what is now known as the Toyota Production System. The types of wastes inferred from [20] are as follow:

1. Reduce production of defective parts in any given cycle.
2. Avoid over production and stick to the demand.
3. Refrain from excessive inventories to avoid holding costs.
4. Eliminate unnecessary processing steps.
5. Stream line the production layout in a way that the workers work on their stations.
6. The layout of the production systems should be designed in a way that unnecessary transport and handling of materials is avoided.
7. Avoid bottle necks in the system.

IJOAR© 2013
http://www.iuoar.org
3.2. Manufacturing Performance

The first tangible impact of JIT (inlaid with Lean perspective) implementation in the manufacturing process is on its performance. Manufacturing performance has a significant role at the beginning and at the end of each assembly process. Normally, the effectiveness of any manufacturing performance strategy gets assessed and evaluated based on the level of inventory and agility of production system in fulfilling the orders incurred. Some of the key performance indicators (KPI) that measure the effectiveness of any inventory management policy implemented are: inventory turnover, on-time delivery, lead time, time delivery of parts, and cycle time [4].

3.2.1. Inventory Turnover

Inventory turnover is one of the most important indicators of efficiency in product planning and sales management. It is defined as the firm’s cost of goods sold to its average inventory level. It is calculated as:

\[
\text{Inventory turnover} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory Level}}
\]

A high level of inventory turnover is a sign of system productivity which shows low failure levels, shorter lead time and stronger cash flow.

Materials and inventories in a JIT system are stored in the shop floor at the point of use. Therefore, materials are available when needed for manufacturing, which leads to a reduced response time. These materials are refilled directly from the suppliers and the inventory records are updated after shipping the finished goods. In JIT, stocks are ordered when the inventory reaches to a defined level, so there is no overstocking of parts. This reduces the warehouse costs.

Moreover, several studies have been done to assess how the improvements in the manufacturing system can affect the financial performance. The results indicate that manufacturing firms that implemented JIT, MRP and TQM achieved better inventory turns [4, 9].

3.2.2. On-time delivery

On-time delivery is measured as the percentage of on-time delivery customers. The most important factors in JIT are quality and delivery time. Considering zero defect errors in JIT, goods are delivered on time, with the right quality and quantity [11].

3.2.3. Lead time

Lead time is the amount of time, defined by the supplier, which is required to meet the customer request or demand. It is measured as the average amount of time between ordering a product and receiving it by the customer.

The aim of JIT is meeting the market needs by avoiding all forms of waste. Anything that increases the cost without adding value to the product is considered as waste. Therefore, minimum waiting time and inventory are some of JIT goals. On the other hand, in order to effectively respond to the market, JIT needs a strong integration and synchronization of processes. It also needs a close relation between customers and suppliers. Moreover, the capacity of the firm should match the market demand to reach success in responding the customers.

As a result, having a good implementation, lead time will be reduced and a competitive advantage will be achieved due to the improvement on delivery-time and quality, satisfying customers’ needs [11, 12, 13].

3.2.4. Cycle time

“Traditional definitions of cycle time include the time it takes a machine to cycle through its process or the time from start to completion of a product (throughput time)”. While in lean production using Just-in-Time inventory system, cycle time is the completion time of one operation cycle for a worker. It contains walking,
loading, controlling, unloading and etc. To satisfy customers’ need, cycle time should be set in the balance combination with sales rate. It means under JIT we go one step further from completing of product and view the last manufacturing step as when it is sold. Therefore, the production rate (cycle time) in JIT implies customer requirement rate instead of machine rate [13]. In general, JIT as a lean production strategy which follows the pull principle, manufacture/assemble the product whenever demand has been created, automatically should help the business to minimize its level of raw material and final product inventory. It also can help the firm to attain competitive advantage in terms of flexibility, delivery, quality and cost.

3.2.5. Waste Reduction
It represents the manner in which parts are delivered to the downstream workstation immediately before that part is needed at the station. Thus minimizes the amount of work in process (WIP) inventory between stations and also produce high level of quality in parts that are manufactured.
Several types of wastes are identified with the Lean production strategy like the wastes that result from overproduction, unproductive idle time waiting for job processing, unnecessary transportation or movement of the job, unnecessary operations performed in the process, excess inventory products, unnecessary human or machines, and defected products and scraps [21].

4. IMPLEMENTATION OF JIT WITH LEAN APPROACH

4.1. What are the Requirements, Enablers, and Considerations?

4.1.1. Organizational Considerations
A just-in-time system is the group of information flows, resources, and decision rules that can assist an organization to recognize better benefits in manufacturing. Crisis often motivate management and labor for working together to change traditional operating practices. Transforming from traditional manufacturing to a JIT system gathers inventory control, process management and scheduling together. In this section we will elaborate on the characteristics of gradual concern for continuous improvement of manufacturing and indicate how manufacturing operations utilize such systems.

4.1.2. Human Costs of JIT Systems
Just-in-time systems can be combined with statistical process control (SPC) to decrease deviations in production. In a JIT system, workforces must organize definite cycle times, and with SPC they must follow recommended problem-solving methods. This arrangement entails a high degree of regulation and actually causes stress for workers. Nevertheless managers can moderate some of these effects by putting emphasis on material flow instead of employee pace.

4.1.3. Cooperation and Trust
In a JIT system workers and supervisors must undertake the responsibilities that were earlier assigned to middle manager. On the other hand, organizational interactions must be reorganized to form close collaboration and common trust among the employees and management.

4.1.4. Reward Systems
In some occasions the reward system must be renovated when a JIT system is executed, but this is not the only difficulty. Traditionally, labor contracts have caused rigidity in reassigning workers in urgent cases. Therefore to reach more flexibility, management has acquired union concerns and transfer plants to take benefit of different labor classifications in a typical plant.

4.1.5. Process Considerations
JIT systems classically have some dominant material flow. Firms might have to change their existing layouts to reap the benefit of JIT practices. For example workstations might have to be moved closer together. The
key factor in successful implementation is changing product flows and layout to a cellular design. However, reorganizing a plant to follow JIT practices can be expensive. Loading section might have to be reconstructed and certain operations relocated to accommodate the change in transportation mode of arriving materials.

4.1.6. Inventory and Scheduling
Manufacturing firms need to have steady production schedules, short setup times, reliable supplies of materials and the mechanism to accomplish the full potential of the JIT idea as follows:

1. In high-volume daily production schedules, make-to-stock environments must be stable for stretched periods. Just-in-time systems used in this situations, and make-to-stock environments can't respond quickly to scheduling changes because little slack inventory absorbs these changes.
2. Lot sizes must to be used to take the advantage of the inventory in a JIT system. However, because small lots require a large number of setups, companies must significantly reduce setup times. JIT systems are exposed to long exchanges because the low levels of finished goods inventory will be inadequate to cover the demand while the system is down.
3. In JIT the Purchasing and Logistics are very essential; it means that frequently, shipment of purchased items cannot be agreed with suppliers, so large inventory savings for these items cannot be recognized.

4.2. What Are the Software Used?
Two softwares are introduced in this section. Kanban software highlights JIT delivery concept through six core practices: visualize, limit WIP, manage flow, make policies explicit, implement feedback loops, and improve collaboratively. On the other hand, TUPPAS software is used to schedule the production flow and process, with TUPPAS you can view, change, create and arrange production schedule. It is a great tool in lean manufacturing.

4.3. Software Implementation, Kanban©
The fundamental concept of Kanban system is to minimize costs through smoothing and harmonizing material flows in high volume production lines by means of controlled inventories. Kanban shapes the systems to reduce production lead time (cycle time) and the inventory required, as a consequent. The optimum Kanban system designs, simulates, and determines numbers of Kanbans in order to investigate numerous features (More description in [5, 6]). Also the heuristic design method has been developed by Ettl and Markus in [7], which can be used to assess a Kanban System’s performance by using alternative network panel.

Kanban is simple-to-operate visual control software for emerging products and processes with an emphasis on just-in-time (Lean production) delivery using tool to create a "Pull System" which offers the opportunity to delegate routine material transactions. Via a visual scheduling signal which organizes supplier product replacement based on time delivery to the customer, Kanban is used to connect processes that are separated by distance. Although, the guidelines for Kanban systems seem simple, they are actually very strict and deep. The highlighted features of Kanban based on [7] are:

1) Manages the production quantity in a process by communicating the types.
2) All-inclusive applying to all parts, assemblies and information.
3) Production paced based on “customer demand“.
4) Work-in-process and raw material inventories are minimized.
5) Kanban systems spotlight frozen situations.
6) Kanban Cards - if used, always supplement containers from the supplier until removed from the Kanban staging area, thus ensuring visual control.
7) Each Container such as consumer, producer, location, and quantity must have a Kanban card.
8) No defective parts should be sent to the consuming process (All parts to be effective).
9) The Number of Kanbans should be optimally calculated.

These systems are frequently used to implement the pull-type control in lean production systems through reducing costs by minimizing the W.I.P. inventory. A pull-type production line is a sequence of stages that
performing some work stations in cycle. The flow of batches through the overall process is controlled by a combined push/pull control policy which is recognized by the Kanbans.

As Figure 2 illustrates the Kanban can implemented from customer to supplier, but totally the flow of a Kanban system consists of a cycle network of stations, amongst production stages. Each terminal has an limitless local buffer for storing unfinished parts. In a production stage, there are Kanbans and work stations. As a consequent, for a part to enter into production stage, it must get a free Kanban first, $K_i$. Once the part has entered the workstation, it receives a new production Kanban that remains attached to the part while until all work steps related with the Kanban card has been finished. If the part has completed the stage, the production Kanban is detached. The part is then moved to the output buffer where it awaits a new Kanban to move/pull it along to the next production stage. The Kanban that was associated with the finished part is removed as soon as the part has been withdrawn by the next stage downstream. The newly unattached Kanban is then returned to the input buffer where it serves as a pull signal for the upstream stage $(i - 1)$ [7].

![Figure 2: Kanban Flow Distribution](image)

### 4.4. TUPPAS - Lean Manufacturing Software

Lean manufacturing software such as TUPPAS provides a method for boosting production and distribution effectively. With the aid of manufacturing software manufacturing companies can easily match production to demand; also reduce inventories, raw materials and finished goods. They help in lowering the costs and the organizations are better equipped to respond effectively to market fluctuations. Lean Manufacturing Software usually has the following modules of operation [22]:

1. **Production Scheduling**: Preparing Gant charts, CPM, PDM, PERT etc. in order to make a smooth flow of the system process.
2. **Production Reporting**: Automatic generation of reports based on fresh and previous data.
3. **OEE (Overall Equipment Effectiveness)**: With constant data being fed into the system a profile for equipment effectiveness can be generated.
4. **Inventory**: One of the biggest advantages of the software is easy inventory management.
5. **Total Quality Management**: The software has the provision of crating different modules which could be created on the user end according to the organizations requirements.
6. **Purchasing**: Having knowledge of the inventory levels in the same software, it becomes very easy to make procurement for low level inventories.
7. **Downtime Reporting**: The software has provision for downtime analysis, this information comes in very handy when analysing system efficiency.
8. **Financials & Accounting:** Modules in the software allow the user to conduct required financial and accounting analysis.

9. **Defect Tracking:** Constant data feeding into the software a profile crates each equipment profile thus in helping in defect tracking of the system.

10. **Closed Loop Manufacturing/Green Manufacturing:** With all the data and information of the system, a streamlined, efficient and environmentally friendly system could be achieved.

11. **Project Management:** Another feature in the software that helps with managing a particular project for the management.

12. **CRM Customer Relationship Management:** Given Customer feedback, consumer response, data could be used to analyse customer expectations.

13. **Cost Accounting/Job Costing/Product Costing:** All these analysis tools are provided as a module in the software depending on the nature of the user.

14. **Business Apps:** Specified modules or application could be created in the TUPPAS software to help with the business needs by the organisation.

15. **Material Requirements Planning:** Easily created in the system with the correct set of data, and variable manipulation.

16. **Job Tracking:** Tracks jobs within the systems creating bottle necks.

17. **Scrap Reporting:** The software could also be used efficiently for ware house and scrap yard managing

### 4.5. Case Study

*The following case study was taken from: Black, J. (2008). Lean Production: Implementing a World-Class System. Industrial Press*

In order to acquire and grasp the knowledge about world-class performance in production systems, it is essential to have comprehensive awareness of manufacturing methodologies, mainly those which are efficient and effective in time delivery of products. Japan is one of the first countries, to introduce the concept and techniques which, if used correctly, can enhance the production output significantly while minimizing input resources. In this section we are going to consider Toyota Production System (TPS). The company introduced in its manufacturing process the JIT methodology and lean production as the people of the company realized that they are limited with the available land used to hold the finished products and parts. Therefore, the solution started with smaller lot sizes to adapt with the small warehouse space. Toyota was one of the first companies that apply flexible robotic systems in its production process. These systems were used instead of hand tool systems, therefore less time spent on installing the systems and the process was not down for several weeks for retooling and installation. Moreover, Toyota applied a new system addressed as “The Single Minute Exchange of Die” SMED, in which, with very simple fixtures measurements, acts as adjustments. As a result, die change times reduce to almost half an hour while the quality of the process increased by reducing the skill required for changing the tool.

#### 4.5.1. Lean Production - Building Blocks

While having a look over the history we came across the name, “Ohno” who was among the pioneers of production technology known as lean production system. Following initial framework, his followers contributed essential modification and developed a coding system after thorough refinement process, matching with the needs of production environment. This developed system was named as “Toyota Production System”. The theme of this production technology is represented in the below diagram which is further adopted as global production system which is equally adoptable by any organization wishing to improve the production output at optimal cost.
The main theme strategy of Toyota Production System is defined in the following steps as:

- Elimination of waste completely from the production system
- Reduction in cost up to significant possible amount
- Production of exact quantity along with high quality standards

This concept also takes into account the resource optimization and teamwork approach with the continuous improvement strategic thought. The process starts from the roof by clear identification and goal setting approach which is thoroughly honored by the top and lower management. This global production system keeps into account the operating philosophies like

a) Just in Time known as JIT (The main theme of this philosophy is: supply of the right quantity as needed, at the right time, and at the exact location, also mentioned in the building block diagram)

b) Jidoka (This philosophy explains the idea of manpower utilization in efficient way with appropriate degree of allocating the right person with the best skills to perform the right job and ensuring the fact that machines are producing quality products with self-regulating capacity.)

c) Reduction in cost aspects by waste elimination process

d) The roof represents the goals setting process for the efficient accomplishment of the global production system, capable of producing high quality products with the aim of attaining complete customer satisfaction.

Thus the main essence of this approach can be defined as follows:

“Toyota Production System is based on quality control perspective with the idea of maintaining customer satisfaction and reducing cost factor by absolute elimination of waste from the production system.”

4.5.2. Main Features of Toyota Production System

In line with the Lean production strategy the main features of the Toyota production system can be classified as follows:
a) The foremost and basic strategy is reduction or elimination, if possible of waste from the production system.
b) Implementing the JIT technique, by minimizing the labour movement on the production line resulting in more effective utilization of resources and subsequently leading to time saving and enhancing output.
c) Jidoka philosophy utilization which emphasizes smooth flow of production without committing any mistakes and keeping close check on each and every step to enhance production.
d) Establishing high quality standards and efficiency enhancement approach
e) Organized the materials and products in well-mannered way
f) Keep track record of resource performance both the manpower and equipment
g) Provide each person with the piece of information that one must aware of, in order to add efforts for the improvement of production process
h) Implementing the Kanban technique, which is to produce the minimum required parts quantity sufficient enough to continue the process sequence

4.5.3. Limitations and Issues faced By Toyota
The implementation process of this theme and technology was coupled with many limitations and issues faced by Toyota. A brief description of which is explained below:

a) Costly process and implementation in the existing environment was difficult as resistance was faced by the existing resources
b) In order to introduce this new technique old system was required to be discarded completely. In addition either the existing employee’s elimination was required or the appropriate training and orientation, to work on the new system.
c) To maintain the inventory level deemed necessary to continue the sequential process only.
d) Another hardship point faced was the implementation of ware house and inventory management system which was not only costly to adapt but also a complex system at the same time.
e) The time duration required for the complete implementation was spanned over months

4.5.4. Solution to Limitations
In order to have better solution of these limitations a continuous improvement process in the system is necessary. This is achievable by adapting the following main points:

a) The main problem faced during the implementation of this intricate system is its complexity itself. The solution of this problem was to make the specifications clear and understandable to users by defining them in well and appropriate manner. In addition, the users were trained appropriately to get them acquainted with the new system and make the system as much user friendly as possible. This process enhanced the user interface with the system.
b) The second step in this process is to eliminate the unwanted and non-value added features from the system. As the presence of these steps not only increase the system complexity but also have significant impact on the cost. This approach reduces the cost factor of implementing this new technique in the production industry to considerable amount and thus enhancing the system efficiency.

5. SWOT ANALYSIS

In this section, a brief SWOT analysis is undertook within the framework of lean manufacturing. Knowing the definition and enablers of JIT, the influence of lean production on an industrial organization, and dynamic system characteristics, now the strengths, weaknesses, opportunities, and threats of Just-in-time manufacturing are concisely expressed. All items are implemented to our Toyota Motor Case Study to comprehend our understanding.

5.1. Strength:
These points are inferred from [8,14]:

IJOAR© 2013
http://www.i joar.org
JIT coordinate production operations more efficient and cost effective by reducing inventory and lead time.
  o Toyota: Impressive cash flow (1997, sales turnover: £131,511 million), sales growth of 29.3%

Lean production makes production operations more customers’ responsive and less capital tied up in raw materials and finished goods inventory.
  o Toyota: With perfect customers responsive, now, Toyota is a global organization, with a strong international position in 170 countries worldwide.

With the pull-to-order (Kanban) system, warehouses expenses are eliminated and the factory output is improved.
  o Toyota: Excellent penetration in key markets (US, China, EMEA) and now the second largest car manufacturer in the world, surpassing Ford

Dynamic inventory management makes it possible to use smaller amounts of inbound, in-process, and finished goods inventory.
  o Toyota: Was the first mover in car research and development, which implement TQM and JIT with result of about %45 sales growth in the first 5 years of change.

5.2. Weaknesses:

In lean manufacturing, everything is very interdependent. Each part effectiveness relies on other parts’ performance.
  o Toyota: Due to some incoordination, the quality feedback impacted significantly in 2005 and raised some criticism.

In case market experiences unexpected demand instabilities as well as fluctuations due to demand in disasters or other unforeseen events. Furthermore, Just-in-time delivery leaves retailers and manufacturers with little inventory as the holiday season approaches.
  o Toyota: Produces most of its cars in US and Japan and has the lower market share in other parts of the world as well as in special events. (Ranked 4th)

5.3. Opportunities:

These points are inferred from [8, 14]:

  o Supplementary trust on Economics Chain and reducing marginal costs.
    o Toyota: Competes in a consolidated industry in that there are few but powerful companies competing with them. With contracting, buy/make strategies and negotiations, Toyota reduced many contract costs and inventory costs using JIT dynamic methods.

  o Competition among established companies using JIT (LP): In global market, reducing costs can flourish new target market.
    o Toyota: Toyota has succeeded in narrowing the sales gap between Ford and GM. Now Toyota holds 18.4% of the market share of passenger cars while Ford holds to 15.4% and GM is 19.3%.

  o Negotiating power of Buyers.
    o Toyota: In Toyota Co. Policy, when there are plenty of product out in the market, buyers can afford to be more precise and have higher standards for product quality. This is where Toyota’s technique of cost cutting is a competitive advantage.

5.4. Threats:

These points are inferred from [15]:

  o Labor strikes, stock outs, and port lockouts can rapidly interrupt an entire supply chain while lean manufacturing processes are in place.
    o Toyota: Stock out in 2008 caused 50,000 units to stop.

  o JIT as a dynamic flow responds poorly to force-major situations.
    o Toyota: Rising oil prices and energy costs made some Toyota Partners to void the supply chain which impacted Toyota sales trend in 2011.
➢ Economics obstacles: In the global market, companies are buying their parts using online exchange rate and international LC. Therefore, the financial market fluctuations affect significantly on sole lean production strategy.
   o Toyota: Shifts in the exchange rates affecting profits and cost of raw materials, reduced Toyota’s gross profit by %8 in India and Middle-east market.

6. LESSONS LEARNED

JIT and Lean production are inventory strategies used to improve the production and manufacturing process of our products. This means that through applying the JIT strategy we can get more profit out of the capital invested, and through applying the lean with it we will reduce the wastes in the production development (PD) process to its minimum. Hence when they are implemented properly, JIT inlaid with Lean will cause intense enhancements in a manufacturing company’s return on investment, efficacy and quality. Moreover, some people thought to change JIT name into Just On Time (JOT) as it is focusing on the execution of the product when needed neither sooner nor later with the benefit from Lean production perspective.

In addition to what we learned from JIT as producing the right quantity of the right parts in the right time, and from Lean production as reducing wastes in PD to allow engineers do more than what they want to do. We got the following lessons from JIT and lean production strategies:
   a. You can manage and control the surrounding, so don’t consider the systems as they are. b. Operative and functioning details are very substantial (Toyota Production System).
   c. It is very important to govern WIP.
   d. Making the production process flexible is essential.
   e. It is possible to make quality first.
   f. Continuous improvements are required, important, vital and necessary for competitive future prospect in the long run.

7. CHALLENGES AND DIFFICULTIES

One of the major challenges that make, JIT inlaid with the Lean perspective, difficult to implement is its relative complexity. The whole product lifecycle should be reconsidered and restructured from the intake of raw materials till the delivery of the final product. The supply-chain needs to be considering multiple suppliers that can provide the required materials with a short time delivery request, thus its preferred that the suppliers are located near the production site. Small companies that order small quantity orders might face troubles in meeting the minimum required orders. Hence need to be dealing with different types of contracts that might allow cutting or breaking large orders into several parts that will be received over a certain period or divide the large orders among several small organizations. All of the goods should avoid having defects or minimize it to the lowest limit possible in order to avoid shutdown due to low quality production. Workers need to understand the manufacturing system implemented and shift to the place where they are needed. This renovation in the production system due to following the JIT inlaid with Lean perspective strategy needs to be allocated with the right time and money portions on one hand, and provided by the committee of the management team and staff of the organization on the other hand. Add to this the risk of the system’s never gaining traction within the corporate culture. Toyota, the Japanese automobile industry, implemented JIT and Lean production strategies within a continuous improvement culture in order to avoid wastes and achieve a high quality management. This is very difficult to apply as a stand-alone process. Managers responsible for making and preparing orders have to acquaint themselves with alternative shipping methods such as less-than-truckload (LTL) carriers who consolidate loads and routes to fill a trailer. This may even require coordinating with other companies operating within the area, as in an industrial park. The management team has to emphasis the importance of applying and running a JIT with Lean perspective strategy for the organization’s staff in order to get great quality products and services.
8. CONCLUSION

Based on its experience and application history, JIT has proven that it is a useful tool to achieve huge production goals at the shortest time possible and with the maximal benefit ever. The result of this strategy includes a high quality product that is ready for the long term competitive market. Therefore, with good and precise production planning, suitable and appropriate outsourcing plans, and correct and reliable cost cutting analysis, organizations will apply and handle a perfect JIT concept as these points consist the key success factor for JIT implementation. In order to assure the success, JIT needs a full cooperation and participation of the organizational management members as well as the manufacturing team members. However, it is also important to fully appreciate the organization’s readiness and capability prior to the implementation of JIT in order to be successful and avoid early failure.

Lean is frequently linked to the manufacturing approach – it is considered as a group of tools and practices applied to the organization aiming to reduce the wastes and thus the costs of production. So it is recommended that lean production strategy should be used as in the Toyota’s case but with lean thinking – it is a part of the production value chain. Two levels of application for lean methodology: strategic and operational.

In order to achieve the customer value, it is important to differentiate between the lean thinking and lean production at the strategic and operational levels respectively. This distinction will bring you to the correct application of the lean strategy as a whole, so you will use the appropriate tools and practices to have the customer satisfaction value.

To conclude, we must completely benefit from the software used to facilitate and implement JIT and Lean methodologies in the production process. It is very important to know how much raw material we need to order and how many finished goods we need to deliver, and the software will help us schedule the production process. Furthermore, without doing changes in the organization’s production system, it is impossible to make a JIT system inlaid with the Lean perspective. Therefore, we should take drastic decisions to implement a Just-In-Time system which will reduce the production cost and increase the profit for the production of high quality products ready for a long run competition that will be produced at the right time with the lowest waste outcome due to the application of the Lean production strategy.

9. REFERENCES


IJOAR© 2013
http://www.ijoar.org
[10] Denny Hong-mo Ych “Impact of Just-in-Time” Retrieved from University of Toronto