



***Health Service Operation Management (Unit code: MOP552)***

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# **Executive summary**

In a day-to-day life we routinely deal with physical goods and services. but, were do these products or services come from? This is where operations management comes into play. Looking closely at the production of such goods, we are able to take a peek inside the production process. Operations management can be defined as the management of the entire process that transfers inputs into outputs. Outputs are said physical goods or services. Inputs can be material, manpower, and machines. For example, we take the metal as the material in the car industry, is supposed to be reshaped by a machine. This machine is operated by a machine operator. The metal thus becomes through the transformation process a finished component which is assembled on a car as the output of this process. A central aspect of the operations management is the improvement of the transformation processes which can be accomplished by concepts such as total quality management, Kanban or total productive maintenance.

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# **Introduction**

In this letter there will be a discussion about some quality improvement projects related to manufacturing business and also service providers. Advantages of a Just In Time method will be discussed with an example of the improvement of a queue and waiting hours for a pilgrim attraction spot. We will discuss the principles of the JIT and how there was benefit from applying it on both a service and a manufacturing field, showing some examples to solidify the theory behind the benefits of JIT and some other methods.

An example will be given using Shri Vitthal Rukmini Temple at Pandharpur and its queueing problems and also there will be example on the Boeing company where it improved the production timing and also the production quality.

# **Part A**

Just in time, is a set of techniques to increase productivity, improve quality and reduce the cost of operations. Just in time ensures that inputs into the production process only arrive when they are needed. Just in time is basically “What you want”, “when you want”, and “How much you want”.

Now speaking about the origins and history of just in time, it was invented by Taiichi Ohno of Toyota after the World War 2 and that was when the resources were very scarce in Japan. Also, there was very high unemployment and lack of abundant natural resources. After the second world was over, the president of Toyota said we should catch up with the American industry otherwise the automotive industry of Japan will not survive, and at that time one American car worker man produces approximately nine times as much as the Japanese worker man. After Taiichi examined the American industry, he found out that the American manufacturing make great use of economic order quantities. So, in order to survive they need to lean out their processes. They built smaller factories which focused on quick turning small amount of raw material into small number of physical products. Processing smaller patches allowed the manufacturers to reduce the financial risk while slowing the generating sustainable level of working capital. The just in time gained a worldwide prominence spread to united stated in late 1970’s and 1980’s and it showed that work is more efficient through implementing those ideas in production with just in time concept and took more that fifteen years in order to perfect the ideas and it was only introduced in the manufacturing industries at 1970’s. Some of the companies that has implemented Just In Time successfully are Toyota, Dell, Harley Davidson and Apple. For the Toyota company, its strategy is handled by the fact that the raw material is not brought to the production floor until an order has been made and received. For Dell company, they used the JIT by forcing the suppliers to carry inventory instead of them carrying it by themselves. There are a lot of other examples that can be given for the companies who implemented just in time. (Fiscus, 1987)

Just in time differs in many ways from the traditional way. Usually in traditional manufacturing we try to predict what the customer will want and will create a forecast against which will our quantity to be produced, and we will also try to produce those products in large batches as a belief is that we will make machines and the processes more efficient, especially in those machines that requires more time to setup. This will typically result in long lead time through out processes. This is why many people call this as a Just In Case manufacturing. Now what if the customer order something that is not in stock? They will either have to wait weeks or even month for the product to be manufactured or the work will be rushed through the system by the progress causing huge amount of disruption and could affect the quality of work as well. So as summary of comparison, we can say that traditional way sees the inventory as an important thing where as the JIT see it as a problem. Traditional has huge number of lo/batch sizes whereas JIT a small one. In traditional way it takes longer time to set up where in just in time it takes a short time. The lead time in traditional way is longer that Just In Time. We have a low flexibility in the traditional way where in Just In Time it is high. Traditional way is a push system but the JIT is a pull system. (Harrison, 2005)

## So, what does Just In Time do?

* Just In Time reduces waste and improves quality, waste could be anything that does not add value to the product but still has some cost.
* It exposes problems caused by variability, so if you remove the inventory, you will have a bigger picture of what are your problems.
* It achieves a streamline production by reducing also the inventory
* It reduces cost and/or increases profit
* Provides a faster response to the customer

## There are five principles for JIT manufacturing:

* Total Quality management, JIT will not survive if there no strong emphasis on Total Quality Management, Quality must always have a higher priority over cost. Because in our market today, quality is no longer an order vendor.
* Production management, the principle of production management is important to sustain the quality in the process. JIT uses the pull system as opposed to the push system. This allows the demand to set the tone for the production. This is also important for the system to be flexible which means that the production inventory must be able to change according to demands from day to day. In production management stand point, designing for testability is essential for process to achieve a zero-defect product.
* Supplier management, main focus of supplier management is to establish a long-term relationship with the suppliers, and by doing this you can grow with your suppliers. Just In Time consider inventory to be wasteful so therefore it is eliminated. When inventory is eliminated, parts will be delivered exactly when they are needed, where they are needed and the exact quantity needed which will hundred precent defect free.
* Inventory management, the main emphasis of Just In Time manufacturing is the goal of zero inventory and to achieve this, you must eliminate safety stock. Reduction in working process will reduce the number of defects in the event of problem. Just In Time is not inventory control system, it is a philosophy for continuous improvement of quality that put emphasis on prevention rather than correction. Reduction of inventory will also open up more spaces in your factory.
* Human resource management, so to be successful in Just In Time manufacturing, quality this is an essential need to manage. You need company wide involvement across all the department, motivation is needed from managerial stand point to maintain continuous improvement. Problem solving skills are needed to maintain the speed of line in the event of halt. High employee interaction is essential for employees to work together to change the process for better. (Finkel, 1991)

## There are several benefits from using Just In Time concept.

* Reduced inventory
* Improved quality
* Lower costs
* Reduce space requirements
* Reduce lead times
* Increased productivity
* Greater flexibility
* Reduced scrap and rework
* Better relationship with suppliers
* Simplified scheduling and control activities
* Increased capacity
* Increased equipment utilization
* Better use of human resources
* More product variety
* Reduced need for indirect labour

To apply the JIT methodology at the Shri Vitthal Rukmini Temple at Pandharpur, they had to look into several variables such as forecasting number of pilgrims visiting per hour and respective service times, diving the pilgrims into groups of two: Gents, and ladies and then subdivided into young and old. Also, they looked into the arrival pattern where the daily average was 25 thousand while at weekends or holidays its was raised up to 50 thousand. The pilgrims forecasting was based on working days, weekends, and pilgrimage period. Also, they looked at the time spent in front of Deity which differs from a pilgrim to another. They also looked at the waiting times and the queue length. (Shima, 1988)

Referring to the article related to Darshan temple, the main problem was the queuing time for the visitors of this temple. There was two different waiting hours for this temple, during pilgrimage period and the regular days. The waiting hours for the regular days was from 1 hour up to 5 hours. During pilgrimage period the waiting hour was increased to 24 hours of waiting. The problem was that they couldn’t fix the problem by a physical redecoration or adding additional queues since there was only one deity. Not only JIT was focussing on decreasing the waiting time, but also by pointing out the reason why the people are waiting. This way, the customer satisfaction will increase since the waiting time will decrease plus they know why they are waiting and what is the expected time of waiting. The three input variables where during pilgrimage, during weekdays and during weekends.

The benefits of the JIT method on Shri Vitthal Rukmini Temple at Pandharpur was not obvious at the beginning when the system was introduced since most of the pilgrims were from rural areas and only 500 slots were opened, but later on the booking per hours will increase. After getting the ticket and booking the time for the darshan and after some verifications, the pilgrims were allowed to enter the queue of darshan and the expected time to reach darshan was 15 mins whereas for the individuals who did not register through JIT it was around 8 hours of waiting. Also, this gave the pilgrims the ability to book their tickets back after visiting darshan since they knew the exact time needed to finish this pilgrim. Another benefit was that the donation collection has increased during this year comparing to the last pilgrimage since there was more entries to the online site and donations were made easily. (Chandera Subhash & Rambabu Kodali,1997)

# **Part B**

## **Q1**

The corporate strategy of Boeing encompasses vertical integration, Diversification, Corporate diversification, Strategic alliances, Merger and acquisitions, and international strategy.

We will explain few of them in regards to the question number 1, Boeing participates in a number of stages of the commercial aircraft supply chain, its integration strategy is driven by whether it drives competitiveness in future aircraft designs, value creation for its customers and acceptable risk to exert greater control over intellectual property, and to avoid delays and cost overruns. The Boeing has entered a joint venture with Adiant, making triple 777X’s wings itself and avionics units. The plan is to further integrate into various other various components of the aircraft such as engine pylons, doors and windows, forward and nose fuselage section, fuel management and so on. Boeing has also set up a nacelle and pylon Center of Excellence in South Carolina.

Boeing factory is the most productive airplane factory in the world, they can build the 737 plane and all its configurations for customers globally. To build 42 planes a month, they need a pretty sophisticated and huge production line. It takes nine days for a plane to do a loop on the production line. Boeing has built more than nine thousand 737 since launching the single aisle jet in the mid 1960’s and each one starts like a hollow tube in Wichita Kansas and sent to the Boeing factory by train. The days 1 through 3 is all about the internals of the plane. First engineers install the plumbing’s, electrics and insulations. On the fourth day, the hollow tube becomes a plane. The wings along with the vertical fin or tail will be aligned to the plane through laser guidance. The landing gear is also fitted during that station. Day 5 will the horizontal stabilizer install and start of the functional tests. Engineers will put the wires in for flight control and finish the internal floor boards. They start building the interiors up, the galleys and the bathrooms. On day six the plane becomes alive and large-scale tests are now possible. The check the landing gear if it is retracting properly. Day 7 is the day when the plane weight is set on its own wheels and the engines are fixed along with their own network of wires, cables and tubes. All through the building process, everything is checked and rechecked reaching day 8 which is a critical test for the flight control surfaces, the flaps, and the flight deck itself. The plane should near to the end of the production line. Day 9 will be the final inspection for the customer before it is released out of the factory. The next stop will be the Renton field for ground tests of the engines and other systems and then its first flight.

This type of production line, where in each station you have a ready part which needs to be assembled only gives the advantage of better-quality control and focus on the quality measures to ensure the best outcome and for a quicker production. (Bowers, 1993)

## **Q2**

Boeing adopts Lean principles such as Just In Time ordering, Point of use delivery and internal kitting to streamline its production processes. The supplier is producing and delivering the components needed by Boeing using the Just In Time techniques. The inventory of Boeing company depends on the orders. Not every plane is made the same, each plane has its own specifications according to the customers requests. From 1916 until 1963, the Boeing company was purchasing parts and fabricating the aircrafts from start to finish. On 1940 to 1945, the company started to outsource the engine products. Later the outsourcing was limited to US and some surrounding countries but on 1970, they start their global outsourcing and they commenced a global strategic partnership. The Boeing company is being supplied with parts from over 3500 suppliers. The parts are being supplied from Japan, France, U.S, Italy, Canada, Australia, and Korea and much more. Each country manufacture and supply several parts of the Boeing plane. The Boeing factory is more like an assembly area where the parts come in just at the time they are needed to be. Whenever there is an order, according to the order, they make the order from the suppliers. There will be an integrated system between the Boeing company and its suppliers called consumption-based ordering. This technique allows the Boeing company to share its data about the inventory levels with the suppliers and this gives the suppliers an aggregated data of the demand and order at there discretion and it is usually only when the Boeings inventory level falls below threshold. As we said in the beginning of the assignment, the Boeing doesn’t keep a big amount of inventory in their warehouse. They only have enough quantity to be used in each station in the production line lasts for a day or two. Since the parts of an airplane are huge, keeping a large quantity will disrupt the space management thus decreasing productivity.

In the inventory world, we need to look at three main phases. Raw material and component, Work in progress, and the finished goods. All of the three above take space and cost. It is important for any business to manage the number of stocks that they hold, partly because holding stocks has costs. Cost of storing, managing, and securing it. Also, there is the risk of the stock becoming obsolete. The overall objective of stock control is to maintain stock so that the total cost of holding stock is minimized. Also, to minimize wastes as much as possible which helps in achieving streamlined highly efficient system that provides low cost/ high quality products to support customer needs. By saying wastes, it means anything that does not add value for example inventory waiting, Excess motion, Reworks, Returned goods. ("Lean Techniques Help Boeing Production Take Flight", 2021)

So, by managing the inventory the Boeing company can not only deliver more planes in a month, but can also deliver them at a lower cost since this inventory management is decreasing a lot of costs and it is improving the cashflow which is also an important aspect of the production.

## **Q3**

Boeing is one of the companies like so allot of companies which always looks for ways of improvement and customer satisfaction. It is true that the threat of new entrance is very low because of the need for high amount of technology and cost to enter, but still there is the airbus company which is only biggest competitor of the Boeing and therefore the satisfaction of the customer and a great quality product is a must. Boeing has extended global supply chain comprising 5400 factories and over 500000 people aboard which show us how Boeing has very strong buy strategy instead of making power components by themselves. As we mentioned earlier that all parts are coming from all over the world but they have multiple sources for each part for example, the engines are made from GE (USA) or Rolls-Royce (UK). But this is not the main strategy of the Boeing to over come delays in manufacturing. The main strategy is the JIT where after the order is made from the customer, they make the order for the parts. The aircrafts manufacturing is in a production line, stations where on each station a part is assembled. The way the order is made supplies the station with parts just in time when the aircraft is on that section of the production line, this is called time phasing. The problem in this time phasing inventory is that if ever the part delivered is damaged or its missing, it will cause a production delay. In this case the Boeing company has an alternative method to go around the problem. The part that is missing or damaged will be assigned as a priority according to its importance. For example, the missing part is tail which usually it is assembled in the beginning of the line, but this tail part can be also assembled when they reach the end just before the end and will not disrupt the movement of the line. This will not have critical priority, but on the other hand for example there is a problem in the electrical cables, this cannot be done in the end of the line, maybe it could be postponed to the next station. This will be tagged as a critical item and assigned to the expediters to do the efforts to replace the part in the best way possible. As soon as the part is delivered, the part will be assembled. But sometimes the suppliers are unable to deliver the parts in the timeframe that will not seriously disrupt the production, then the company will use its own machine shop that can manufacture the part themselves and continue the assembly of the aircraft. ("A Look at Boeing’s Outsourcing Strategy", 2021)

## **Q4**

The Boeing has been working on improving the quality of its product while also cutting time to deliver. It is a big challenge when you want deliver or manufacture a product quicker and keep the same level of quality in the product. Also, at the same time you need to consider the costs of the labour and other costs that could be raised in compensation for the decreased production time. The development of the 757 struggled with a time-consuming bottleneck and the reason was behind the plane’s heavy seats. They had to lift up the seats to its doorway and inside for installation. The seats were lifted by overhead crane then unloaded and rolled into the cabin. The used wheels to roll the seat near to the plane so they needed to dismantle the wheels and then instal them which roughly took about 12 hours. The team was so dedicated and tried to look for a way to cut hours out this long process without compromising the cost. They looked into the Ferris wheels, sky lifts and automated roofing carriers but none was good for the bill. Then the idea of a hay loader came up to mind and they looked into the possibility of it carrying the wheels or a similar machine to do so. They managed to find a rancher who could develop a viable machine that met their expectations with a safety guard also. This new hay loader was put into production and cut an astonishing 10 hours off seat installation. Another problem also to mention was that the wheel was getting punctured by the ubiquitous metal fasteners that littered the floor as they rolled down. They tried many methods trying to eliminate this cost until they came up with an idea of developing covers for the wheels which saved up to 250000$ per year per aircraft. All these were problems that were not only costly by time consuming also. One of the plans for the Boeing production to get faster and to cut days of production from 5 to 3 was to do all the customizations and differentiation at the end of the production line. This makes the line of production standardized for longer period of time and keep the customization at the end of the line which decrease the variances in amount of time taken by the special customization. Always when you are producing something in specific way and pattern, when repeating it you will get quicker and more accurate unless there is a distraction which cause a slow down in your routine standard procedure or work. Also, there is another project of reducing the inventory of the plane. The 747 jumbo jet has about 6 million parts including 3 million rivets. The plan is to make the supplier to do the assembling of some of the parts and deliver as kits to the Boeing company. In this way, the parts are no longer taking time to assemble like before and also cut costs of carrying of the inventory. Another strategy the Boeing is looking into is to first decrease the number of suppliers they are working with but make sure to have better links and cooperation with fewer suppliers. In this way there will be less damaged parts or missing parts thus decreasing the time for replacement. ("How to roll out a successful lean manufacturing strategy | Lean Manufacturing | Manufacturing Global", 2021)

# **Conclusion**

In the world of business, everything is tied together. The more you find ways to cut the costs the more you will benefit. Inventory management is one of the most important aspects of any manufacturing business or businesses that require stocks and inventory. By managing and controlling the inventory we are not just managing the amount of the inventory we have, we are controlling and enhancing the cash flow, improving the services by eliminating the unnecessary unavailable items which could strongly affect your customers, reputation, and your credibility. Managing the services also is very important also to avoid frustrations and eventually decrease in productivity and work efficiency. There are lots of methods to improve and manage the services and inventory but the innovation and thinking out of the box is an important aspect of management.

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