A Complete Guide to Just-in-Time Production

Inside Toyota's Mind

A COMPLETE GUIDE TO JUST-IN-TIME: INSIDE TOYOTA'S MIND

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Returning to the past

Sakichi Toyoda devised the automatic loom technology in 1926. He is regarded as the "Father of the Japanese Industrial Revolution" and has been dubbed the "King of Inventors." Sakichi established his own values, which later became the guiding principles of Toyota Motor Company (give to society, get your hands dirty, respect for people, put the customer first, etc.). One of his most influential innovations, the loom that could stop itself when there was a problem, exemplified his built-in quality. He referred to this as jidoka. Kiichiro Toyoda founded the automobile manufacturer Toyoda. Kiichiro is a mechanical engineer and the inventor of the "just-in-time" JIT idea. Later, Taiichi Ohno created a new manufacturing system that transformed just-in-time manufacturing from a concept to a practical system. The Ohno technique was based on continuous kaizen. Ohno is the proprietor of takt time and idea cellular manufacture. The two main pillars of Toyota

Production System TPS are Kiichiro Toyoda's just-in-time and Sakichi Toyoda's jidoka.

Is lean equal to JIT? Is lean or JIT an inventory reduction program?

Yes, people called it an inventory reduction program when they first heard of it. "Just in time" is one of the main pillars in the TPS. "Just in time" ideally means "one-piece flow." Inventory is the greatest waste in the process, and it hides many problems, such as quality problems, breakdown times, waiting waste, and more. Let's get back to history. Prior to the 1970 oil crisis, very few people in the world know what Toyota was up to. The fact that it emerged stronger than ever while many of its competitors were quite battered made people take notice. People went to Japan to find out how Toyota had done this. What people found was that Toyota was doing something called "just in time." In the West, this was interpreted as an inventory reduction program. As a result, it became known as the "just-in-time

inventory" program. Nobody really believed inventory could be taken out of the whole value stream. Therefore, "just in time" came to mean "go beat the heck out of your suppliers." The big three auto companies (Ford, General Motors, and Chrysler) had lots of power over their suppliers, and they became pretty expert at this tactic—to their eventual detriment. James P. Womack came forward with *Lean Thinking* in 1996 and helped many to see the whole value chain. He showed how waste clogs the system and how continuous improvement was needed to link all parts of the chain to customer demand. He explained his findings in plain English, but once again people didn't hear. Lean might be an element of the larger strategy, but it is most likely to be relegated to plant and manufacturing work. As a result, one company after another has tried lean and failed.

Is JIT zero inventory?

Many people believe that just-in-time inventory equals zero inventory. The ideal

situation is one-piece flow, which can only be achieved through the use of a manufacturing cell. The inventory buffer exists, but it is rarely used. The Andon system includes a buffer. There is a safeguard in place to protect your customer. There is a buffer to prevent the entire manufacturing line from being shut down to rectify a problem. There is a buffer in place to prevent the breakdown of a vital manufacturing process.

So, what is Just-in-Time?

Just-in-time production is a manufacturing system that produces and delivers only what is required, only when it is required, and only in the amount required. The Toyota Production System is built on two pillars: JIT and jidoka. JIT is based on heijunka and consists of three operating elements: the pull system, takt time, and continuous flow.

Before starting this book, I want to highlight that Toyota Production System is based on deep supplier relationship.

This is one of the most essential aspects in Toyota's success. I will briefly highlight collaboration and Toyota's basic principles. Few businesses recognize the value of collaborating with suppliers to improve their own processes and the value they deliver to their consumers. The approach will fail if you do not collaborate with your suppliers to truly reduce inventory holdings. If you are trying to reduce inventory and urge your supplier to supply smaller batch sizes more frequently, the procedure will fail. Many businesses have tried to shift the costs of inventory storage on their suppliers. There are no genuine savings in the entire value stream! You are transferring the cost to vendors, but no meaningful savings are realized. This is something that very few people comprehend. I recommend reading Harvard Business Review's Building Deep Supplier Relationships (Liker and Choi

2004). Building these types of relationships with suppliers is one of the most difficult aspects of TPS implementation, but it is also the most vital.

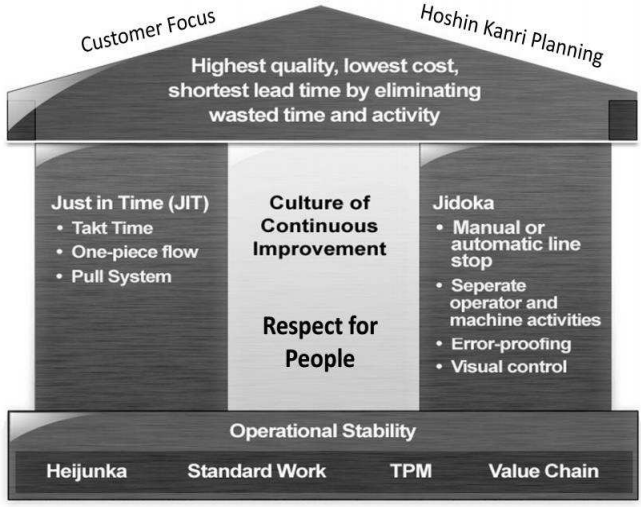

Figure 1.1 The House of the TPS

Chapter 1

Introducing the Core Values of Toyota

Toyota's management and leadership structure is built around five basic values. If you go to any of Toyota's websites, you'll see something like this in the values section: "We believe we are capable of and will achieve great things. We are a business driven by creativity, experimentation, humility, respect, and innovation. And we believe that it is people, our people, who will go above and beyond to ensure that Toyota is everything it claims to be today and in the future. It all comes down to honesty."

Toyota has five core values: challenge, kaizen, go and see, respect for people, and teamwork. They strive to build mutual trust between employees, customers, and suppliers. These core values are aligned very well with the company's vision and goals.

Challenge

All workers (from the senior leader to the floor worker) must be regularly challenged to continuously improve themselves and the process. The challenge comes from a definition of the gap between the current state and the ideal state. There should be a very clear direction of where the company wants to go. Challenge is about giving a clear direction and defining success in terms of progress or improvement goals. It's not telling people what to do. Challenge is about leading people to agree on a clear description of the problem, the criteria for an acceptable solution, and the expected pace of progress (Balle and Balle 2010).

Kaizen

Kaizen refers to the practice of continuous improvement. Everybody in the company should practice continuous improvement and problem solving. Problem solving is the driver of continuous improvement. The rule is that no process is perfect. By continuously

improving the process using the Deming[1] cycle (PDCA), you are moving toward perfection and ensuring the process doesn't slip back. Kaizen is about improving operations and striving for innovation and evolution (Liker and Trachilis 2015).

Go and See

This is a management technique, and it is considered the foundation of lean practice. Go and see (or gemba) is about leading from the front by seeing the actual situations and meeting with people one by one to learn, challenge, and support.

[1] The concept of the PDCA cycle was originally developed by Walter Shewhart, the pioneering statistician who developed statistical process control in the Bell Laboratories in the United States in the 1930s. It is often referred to as the "Shewhart cycle." It was taken up and promoted very effectively from the 1950s on by the famous quality management authority W. Edwards Deming and is consequently known by many as the "Deming Wheel."

Respect for People

This includes your employees, suppliers, and customers. Respect for your people means developing their skills, teaching them how to problem solve, committing to their safety, and protecting their work. Teaching people problem solving is one of the main requirements for lean success. It is about developing staff autonomy so workers can analyze and solve their own problems. This often means challenging them to correctly visualize problems and seek root causes before jumping to the first obvious solution. This requires day-in, day-out hands-on coaching. Most importantly, this means giving people space to think for themselves, and it means respecting their ideas. Respect for people also means putting customers first and listening to their needs.

Respect for people is not just a slogan. Respect for people should constitute the main basis of any management decision. When the management board chooses to hire external experts rather than developing their

regular employees, is this not contrary to respect for people—one of the main pillars of the Toyota Production System? When management creates a continuous improvement department, hires the improvement consultants, and relegates the improvement to them, does this really serve the goals of changing culture and developing people? Can such a parallel team be effective implementing change and making improvement? They naturally have little experience with the company's culture and a lack of knowledge about the situations at the gemba.

What usually happens when the outsourcing consultant leaves after the work is done? All knowledge is gone! The regular employees have no experience managing the improved processes or continuously improving them in order to face future challenges. They have not been trained on the culture of continuous improvement and have not been contributors in the transformation process. All powerful lean tools should be used by the company's

leaders and factory managers who have the capability, power, and responsibility to effect changes. Improvements should be made by people who are directly managing the day-to-day work—not a parallel team. The leaders who manage the day-to-day work are responsible for coaching people who do the work. Together those people should operate, develop, and continually improve their processes.

Companies that travel the consultant route should make sure they use the temporary personnel to share lean expertise and knowledge with the rest of their workforces (Soliman 2015). A company should ask itself the following questions: Do these consultants train employees properly and use the appropriate method to help stimulate their thinking, change bad habits, and form new habits? Are they acting as real mentors? Are they using the right behaviors for coaching, or are they just teaching people some tools and techniques? I have seen consultants teach employees their own

thoughts and ways of doing things—not what those employees really need to improve their daily work and change bad habits.

Respect for people also includes protecting their jobs. When a company decides to start the improvement process by eliminating wasted motions on the shop floor, this often leads to the removal of workers from a line or cell. Those workers should be placed on other jobs. This way, fewer workers have to be hired in the future. Toyota's Production System provides things to do for any extra regular employees. This could include working in kaizen teams to improve standardized work, improving downtimes, identifying the root causes of quality problems, developing countermeasures, problem solving, and finding better ways to move materials.

Generally, a company that wants to build a good lean culture should avoid connecting kaizen work to the layoff process. Some

companies have realized this, and they tend to transfer the extra labor from one line to another or use those workers elsewhere in the company to avoid layoffs.

Teamwork

Teamwork is not a matter of people getting along. It's about people solving difficult problems together (Balle and Balle 2010). People don't need to be friends. They just have to be able to agree to workable compromises. No teamwork means no problem solving. Teamwork means cooperation across functions. For example, production and logistics need to work together to solve customer delivery problems and set up a proper pull system.

Teamwork extends to both customers and suppliers—and not only within the company (Balle and Balle 2010). Managers should encourage teamwork and clarify enough issues that their employees can work together. For example, if an employee can't see the problems in the complete value

stream, he or she won't work with the supplier to solve the inventory problems or work with the customer to solve the irregular ordering issue and level the production.

Toyota works with its suppliers to improve the complete value stream (Liker 2003). Toyota cars contain hundreds of different parts that are not made by Toyota itself but by its suppliers. This means any improvement within Toyota only affects a specific portion of the entire assembly process. In order for Toyota to be able to ensure perfect quality and reliability in its cars, it has to work deeply with the suppliers. Toyota's Production System is built on deep supplier relations, and this is an excellent example of teamwork (Liker and Choi 2004). Few companies realize the importance of working with suppliers to improve processes. The following is a small example. If you are not working with your suppliers to truly reduce the cost of inventory holding, the process will fail. If

you are trying to reduce inventory and ask your supplier to deliver smaller batch sizes more frequently, and your supplier is not ready, the process will fail. I have seen many companies try to shift the cost of holding the inventory to their suppliers. This does not result in real savings in the complete value stream.

Another example of teamwork is working with your customers to improve quality. The customer is the principal judge of quality. Collecting customer feedback and letting customers contribute in the process of fixing quality issues is important. Toyota's recent recalls relied on dealers and service centers to play big roles in collecting the important data. This let Toyota know what changes needed to be made on its factory floors. That data was based on customer feedback and comments.

Generally, people learn better when working in teams. Psychological experiments prove that individual development is facilitated

best through teamwork (Balle and Balle 2010). Managers should work to get people with different outlooks to solve problems together. There is no problem solving in a lean environment without teamwork and cooperation.

Mutual Trust

You build mutual trust with your people by solving their problems. In lean management, you work with people to solve every problem. This way, you end up developing different kinds of relationships with them, which is when mutual trust starts building. Unlike management by objectives, people are used to deliver the results.

You also build trust with your suppliers by supporting them, improving their processes, and working with them as partners (Liker 2003). You build trust with your customers by committing to quality, safety, and reliability and producing a defect-free product. You also need to deliver products

on time with no delays or shortages and provide value in your service.

In the traditional working environment, a lack of trust between the laborers at the operational level and the top managers often exists. Managers treat laborers like machines and overburden them in order to achieve corporate goals. The rule is to extract the maximum for the lowest fee. In turn, laborers try to preserve their jobs with tricks that keep them working with their preferred methods, which constrains improvement.

Gemba walks help maintain good relations and a foundation of trust between top management and frontline workers. During these walks, leaders should watch their working environments to see if anything negatively affects employee safety. They should make sure operators are not performing unsafe acts, and they should monitor working environments for problems that prevent laborers from doing their jobs smoothly. This could include a lack of

available tools, no spare parts, delays in transporting necessary materials, and unsafe equipment in the working areas (Ahmed 2014).

Leaders also should be committed to workplace cleaning and organization. (For example, they might look into 5S[2] organization.) A clean, safe, and comfortable environment lets laborers know that everyone in the company is committed to employee safety and satisfaction. These good attitudes permeate throughout the organization. Instead of just being things to accomplish, targets become ways to drive improvements, make processes safer and easier, and increase employee productivity.

[2] 5S is a Japanese technique used to organize the workplace and maintain its cleanliness. 5S stands for sort, set in order, shine, standardize, and sustain. It is one of the important tools in eliminating wasted motion in the workplace and improving ergonomics.

This book is not intended to present Toyota's leadership. The primary focus of this book is on the technical aspects of the Toyota Production System, particularly Just-in-Time, which is one of TPS's two fundamental pillars.

To understand JIT, the heijunka (leveling) technique, which is the cornerstone of JIT, will be presented. The three primary operational elements (pull, continuous flow, and takt time) will also be discussed.