Case Study: Toyota Motor Manufacturing

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# Abstract

This paper is an analysis of the case study made on Toyota Motor Manufacturing by Mishina and Takeda (1995). We, the authors of this paper, all contributed to one or more of the various sections. The paper will set up the context for the case study, explain what the Toyota Production System is, highlight some issues and solutions to minor problems faced, and provide innovative solutions to the major problem. Finally, these innovative solutions will be compared and contrasted to each other based upon what we have learned and researched during our time in the Operations Management course. Throughout the writing of this paper, we will be taking in a variety of sources, including our course textbook, to learn more about the case study. In the end, we hope that this knowledge culminates into a very well-developed paper.

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In the early 1980s, Toyota Motor Corporation (TMC) was facing a large amount of stress in Japan. The country was suffering from a huge trade imbalance and political pressures were rising. On top of that, resources were a bit scarce for TMC to continue to grow at the rate it was growing. Naturally, automakers at TMC started looking into a new investment - one that would involve planting a manufacturing facility in North America. If they were to do that, however, they wanted to make sure the same quality could be achieved for a very similar, low cost. In July of 1988, TMC opened up Toyota Motor Manufacturing, U.S.A. (Mishina, K., & Takeda, K., 1995). Toyota Motor Manufacturing, or TMM, immediately started serving 200,000 Camry sedans yearly.

## Toyota Production System

The Toyota Production System (TPS) evolved out of a desire to meet customers’ changing needs. This system is more of a way of “making things” than it is a strict rule book that is completely inflexible, and it is certainly a system that had not been seen yet in the United States. It was formed on several foundational goals: to provide “better cars for more people”, to eliminate waste in the production cycle, and to inspire efficiency in every facet of production (Toyota Motor Corporation, n.d.).

**Key Concepts**

Two key concepts that are vital in understanding the TPS involve the phrases “Just-in-Time” (JIT) and “Five Whys.” The TPS is considered a JIT system, which means it would “produce only what is needed, only how much is needed, and only when it is needed [emphasis added]” (Mishina, K., & Takeda, K., 1995). Any deviation from the true needs of production is considered waste under a JIT system. To be considered Just-in-Time, a sequential pull system was set up at TMM where parts could easily be made to order and arrive exactly when they were needed for the vehicle. Today, the term lean manufacturing system nearly means the same thing (Collier, D. A., & Evans, J. R. 2017). The “Five Whys” refers to the method that TMM would employ to uncover the root cause of an issue (Mishina, K., & Takeda, K., 1995). Essentially, this method involves asking the question “why?” several times until a level is reached where tangible action can be taken to fix something. It fits nicely with the TPS in that there is no time wasted through only guessing what the problem is.

**Terminology**

While assessing the Toyota Production System, we found a great deal of insightful terminology. The terminology all revolved around two key concepts: lean and six sigma. Six Sigma is focusing on reducing the defects on their vehicles within the manufacturing plants. Lean is improving the processes to be as swift and efficient as possible (Mishina, K., & Takeda, K., 1995).

The first term, jidoka, means automation. When applied to the Toyota Production System, it stands for executing processes with human-like intelligence. This can be applied to both machines and humans. Devices have fail-safe features that are supposed to catch errors, while humans have access to the ability to stop the production line when encountering defects. Applying the term at Toyota can result in a reduction of waste and prevent defective units from continuing onto the next stage. This is a Six Sigma-based term that Toyota thrives off.

The second term, heijunka, which translates to leveling in Japanese, focuses on keeping a company like Toyota competitive while reducing the waste that is found in processes. Heijunka is a lean concept that is process improvement focused (Friddle, n.d.).

The third term, andon, means lantern in Japanese. There are cords above the assembly line, and when an employee uses jidoka to spot an issue, they pull the andon cord to light up the sign above them in the work area. When this occurs, supervisors run over to find the problem at hand to have the workflow continue. This is a useful tool for supervisors so that they can be quickly alerted to a specific section where there are errors. Furthermore, allowing a supervisor to manage a significant area effectively. This is both a lean and six sigma term because it helps improve processes by reducing the waste of a supervisor kiosk and helping cut back on the number of defects.

The fourth term is kanban which translates to signboard in Japanese. Each batch on the assembly line has a kanban card which explains a great deal about the specific bunch like the part codes, batch size, address at which parts need to be delivered, amongst other information. This is a six sigma tool to help users reduce defects therefore also decreasing waste.

The fifth and final Toyota Production System term is kaizen, which is a combination of a few Japanese words. When combined, they mean changing something for the better. This is the most significant term as it is a summary of lean six sigma. This is a beautiful process because it is continuous improvement, allowing for things always to get better and create a stronger future.

These terms, specifically kaizen should not only apply to work but also our lives. I believe that when Toyota came up with these words to use for their business, they created a system (or tool) that can help in all areas and not exclusively work. If we apply the critical terminology of the Toyota Production System and lean six sigma to help reduce waste and increase efficiency to all areas of our lives, we will be unstoppable (Mishina, K., & Takeda, K., 1995).

## Issues

There are three main issues that our team worked to resolve. The first is an issue where screws were being cross-threaded. The second deals with the plastic hook on the back of the seats that would often break. The final and main issue revolves around the defects in the seats from KFS.

## Final One

Final One is the first part of the final assembly line where the seat sets delivered from KFS meet the car bodies from the assembly line. Here, a series of workers and team leaders unstrap the rear seats and set them into place while the front seats get loaded into place and installed with four bolts (Mishina, K., & Takeda, K., 1995). The main issue happens during the front seat installation, where team members can mess up and cross-thread, meaning they shot the bolt at an angle (Mishina, K., & Takeda, K., 1995). A consequence of this is that the seat is not secured in place and will have to be taken off the line into defect parking for fixing later. Another problem comes with the mishandling of hand tools. Occasionally, team members would damage the seat coverings with their hand tools, although this doesn’t happen as frequently (Mishina, K., & Takeda, K., 1995). There are several options for solving these problems, including having only team leaders handle the bolts, taking better care of handling tools, or re-tapping on the assembly line. The solution that was adopted was having the team leaders fix such a familiar problem on the assembly line with a re-tapping tool in thirty seconds (Mishina, K., & Takeda, K., 1995). This way, the assembly line doesn’t have to stop to do a fix and it doesn’t take much extra time to do.

## Final Two

Final Two is the second part of the final assembly line where the rear seats get installed and bolted down. The rear seat also includes a side bolster that has a special hook that attaches to the body of the car (Mishina, K., & Takeda, K., 1995). The main issue here is that the hook would sometimes break off during installation since it was made of plastic (Mishina, K., & Takeda, K., 1995). When Toyota decided on more variations in seats, the hook was changed from metal to plastic to compensate for the variations (Mishina, K., & Takeda, K., 1995). Some ideas for solving this problem would be swapping back to a metal hook, using double hooks instead of one, or doing a redesign of the rear side bolsters. The adopted solution was to spend $50,000 for a redesign of the rear seats and hook system (Mishina, K., & Takeda, K., 1995). In time, the benefit of high-quality car seats will pay out the investment to fix the hook.

**Seats Issue**

A large issue that Toyota was facing was with their seats. They were receiving seats from a separate company called KFS, or Kentucky Framed Seats. KFS had been handling seat production for Toyota and providing perfectly. The issue came when Toyota started introducing more and more variations of seats for their cars, depending on different areas of the world the car would be delivered to, and the different models made. This caused a surge in errors from KFS when delivering seats for Toyota. Whether it was material flaws, missing or incorrect parts, or even the whole seat as incorrect, seats started to cause problems for Toyota’s entire production line.

Most of these issues caused slows or even stops in Toyota’s production line, causing a backup of orders for different cars. This was going against what TPS was initially created for, and was creating more waste for the company. KFS was causing too many errors for Toyota to be able to function effectively and was causing a multitude of problems.

**Seats Process and Analysis**

**Solutions**

With the problem lying outside of the direct control of TMM, there are four courses of action that can be taken to deal with the problem.

## *Solution 1*

The first clear solution is to work with KFS to resolve the issue on their end or a least reduce its impact. This could be done a few ways, but the general idea is to work within the bounds of TMM and KFS’s relationship.

## *Solution 2*

The second solution would be to find a new arrangement with a different company. This is fairly straightforward. If KFS cannot provide the service that TMM needs, it may be advantageous to find a company that will.

*Solution 3*

The third solution would be to reduce the count of seat variations. Before the wagon model of the Camry entered production, the rate of defective seats was negligible. It may be possible later to add variations back in incrementally with influence from TMM and improvements KFS’s process.

*Solution 4*

The fourth solution would be to develop an in-house solution. This would solve the problem of seat quality being out of the control of TMM, have the quality of seats increased to the level that a TPS system provides, and maintain the benefits of the current arrangement with KFS.

# Final Solution

Our team decided that Solution 1 would be the best option for TMM to take. We thought it would be beneficial to keep the benefits that come with working with KFS including the just-in-time delivery, not having to manage and develop a system for assembling seats, and the low expense of solving the issue. Solution 2 would require too much change in the current process as well as finding another company with a reasonable cost, quality, and reliability is not guaranteed. Solution 3 seemed to be too much of a temporary solution to the problem. Sacrificing customization to maintain reliability does not solve the issue and limits future customizations when they need newer models. Finally, Solution 4 seemed like the next best option. It would solve the seat issue for good and bring the assembly of seats into the TPS system. However, the cost of expanding and developing an additional system to the plant seemed too high to justify these benefits. Because of these reasons, we decided that Solution 1 would be the best option.

Implementing Solution 1 could be done in two ways. The first would be to review KFS’s system and try to convince them to implement TPS principles to greatly increase its reliability. However, this change may be difficult and costly. In the more likely scenario, checks of some form would have to be added to the end of KFS’s system before the seats are shipped so defects can be caught before the seats are sent over. This could be done by Toyota employees at the KFS plant or through some other arrangement. Overall this would be effective, simple, and cost-effective to implement and it is the solution that we recommend.

**Conclusion**

The recommended solution of continuing to work with KFS to help them lessen the defects that have been appearing in the seats does not work against the principles of the Toyota Production System. In fact, the TPS thrives off of having suppliers who can deliver their parts Just-in-Time. KFS is a company that complied with that standard. The only standard they really violated is that they had defects in their seats, which contributed to waste. If we can find a way to aid them in minimizing the defective seat count to zero then TPS will be at its best. All in all, through this project our group has been given much more insight into TPS as well as understanding into what it looks like to go into a system, analyze it, and return with ideas of how it can be improved.

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