

Analysis of Japanese OEM – Suppliers Relationships in United States

ZongSheng(Rex) Chen

Product Development/ Craftsmanship Engineer
Vuteq Canada Inc, Woodstock, Ontario, Canada
Tier 1 supplier – Toyota & GM

Abstract: Nowadays, some automakers often complain about the inefficiency/ unproductivity from their suppliers; however, those OEMs might have to think twice about their own policies & operation processes before framing suppliers as their scape goats. Any manufacturers can find the supply chain operations gain & lost from both U.S. and Japanese automakers, as well as their suppliers. During 1980s and 1990s, Japanese automakers had built strong manufacturing capabilities in U.S.; and their first-class manufacturing methodologies vastly turned out to be the most popular benchmarking quality standard within U.S. automotive industry. Those manufacturing guidelines were not just restricted in just-in-time (JIT) delivery of parts to the factory & lean manufacturing processes. Japanese automakers also equipped with their own lean manufacturing capabilities and realize that their success largely relied on the development of a local supplier base. The data base indicated those Japanese Automakers did share manufacturing management guidelines and technology with local U.S. suppliers. These guidelines and technologies also made similar factories became extremely competitive in Japan. Considering the entire continent's area and transportation system; it is almost impossible to achieve on-time products' delivery. Thus, many skeptics insist that lean manufacturing would never happen in North America legitimately; yet the Japanese automakers (In U.S. market) had proved them wrong. American automakers are beginning to follow the Japanese endeavors' leadership, revolutionizing into lean manufacturing and requiring their suppliers to provide on-time delivery.

Keywords: Lean manufacturing, Supplier & OEM relation, Quality, Efficiency, Large production, Integrated system, Inventory/Stock, JIT, Loading, Transportation, Couriers, etc.

I. INTRODUCTION

Why Japanese automakers' supply chains better than the U.S. ones? There are indeed several tips for the suppliers to be this successful nowadays:

- Japanese OEMs are willing to co-operate with their local U.S. suppliers to develop/ process lean manufacturing together.
- Japanese OEMs arrange & balance their production tasks well to avoid peak demand, which keeps suppliers' inventories in lower volume.
- Japanese OEMs have established a uniformed 'time window' system in which all parts must be received at the shipping department and ready to be delivered on call.
- Japanese OEMs apply a lean transportation system to handle mixed loading and small batch delivery. Sometimes a 'cross dock' is built to split large quantities of goods into smaller batches.
- Japanese OEMs encourage suppliers to ship the needed parts to the assembly plant on a specific time, even when the truck is not fully loaded.

For an effective automaker implementing a lean solution, it is critical that suppliers transform from traditional large-scale manufacturing systems into lean systems for both internally and logistics activities. In fact, it is not entirely true in this case. Automakers' logistics activities and internal management strategies — in other words, OEMs' own logistics activities and internal management strategies — may impact suppliers (the ability of suppliers to respond to lean systems at the right time and get the right parts at the right place) profoundly.

Although there has been too much propagation about JIT and lean manufacturing, it is still not quite clear for us to fully understand the concept and how to make them work effectively in real cases.

Two main principles govern the manufacturing side of TPS: *Just-In-Time* and *Jidoka*.

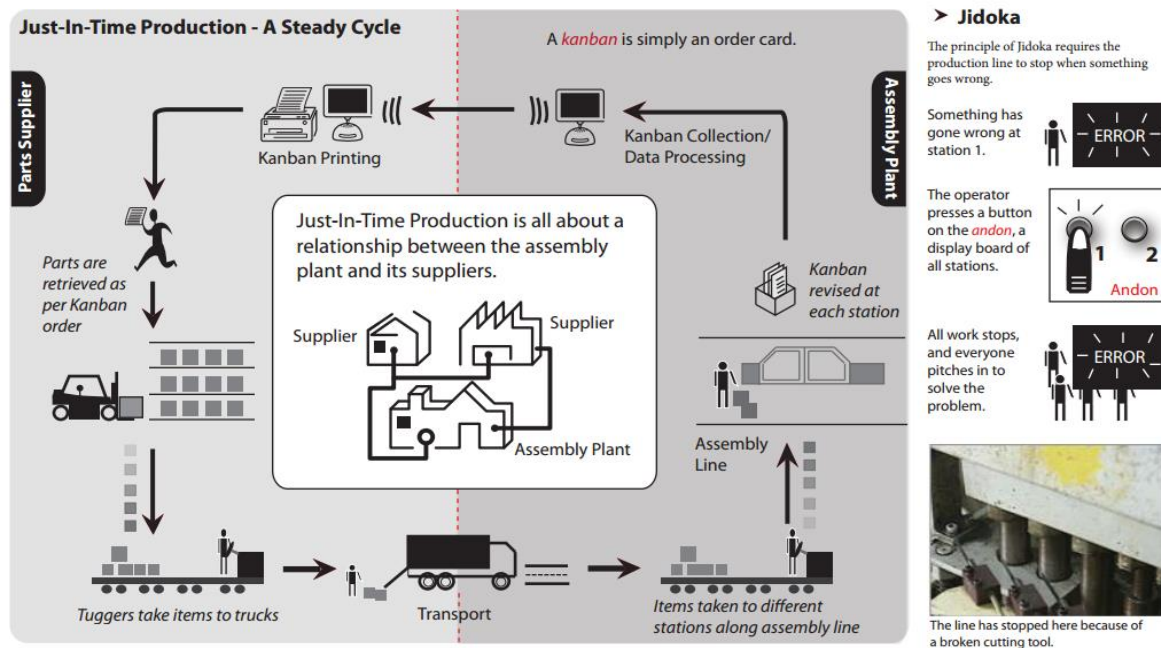


Figure 1: The system in practice. Adapted from cmuscm.blogspot.com. (2014, February 2nd).

Lean manufacturing is the core of the manufacturing industry, which focuses on delivering the highest quality products on time at the lowest cost. This is a production system and is also a focused value streams' system. The value stream includes all the steps required in the process of converting raw materials into products that customers need. Any steps in this process that failed the requirements would be considered a waste of resources. Indispensably, when value flows between customers and suppliers who are far away from each other, resources are wasted — products cannot simply to be transformed to value-added processes. The goal of lean supply chain management is therefore to be used to minimize this waste and allow products to flow with maximum efficiency. A key part of lean manufacturing is on-time delivery – getting the right parts to the right place at the right time.

The performance of US suppliers to the North American automotive industry demonstrates the impact of customers on supply chain management policies: US suppliers supply accessories/ parts to Japanese automakers is more efficiently compared than to US automakers. To compare the policies and guidelines between three U.S major automakers and Japanese factories; suppliers who offer similar products to both US and Japanese customers were being studied. There is difference between US automakers (Ford, General Motors and FCA) and Japanese automakers (Honda, Nissan, Toyota and others) among Suppliers – OEM relationships. In the following paragraphs will illustrate the secrets of Japanese manufacturers' successes operation tips and the way how American automakers operate. Although other automakers try to emulate lean manufacturing's guidelines and logistics, their implementation does not really meet Japanese standards.

II. MAIN PARAGRAPHS

A. To achieve lean manufacturing as a first goal:

Japanese automakers are more oriented on building a long-term business relationship compared with American counterparts. When Toyota, Honda, and Nissan established engines and assembly plants in the United States, they brought in their own Japanese suppliers — most of them had already mastered lean manufacturing and logistics; nevertheless,

under the pressure from the US government, Japanese automakers started looking for local suppliers who can meet their stringent cost, high quality and delivery standards. It seems easy to do yet it's hard to process. Japanese automakers were facing a considerable challenge about either of accepting suppliers' low performance or making investment by improving relationships with local US suppliers as well as teaching them on lean manufacturing. As a result, they decided to develop the relationships and guide those local US suppliers.

Japanese manufacturers had established close relationships with a small number of suppliers and integrated these suppliers with factory production systems and JIT delivery systems through extensive information exchange. Japanese automakers' investment in supplier's relationship was very worth it. In the same supplier factories, the production lines that supply parts to Japanese automakers are leaner than the lines supply their American competitors. Japanese automakers focus more on maintaining low inventory levels, maintaining production levels and quality integration.

(1) Maintain low inventory levels

The key to be successful in lean manufacturing is maintaining low inventory levels. Ideally, the time interval between the customer's assembly request and the supplier's production of the parts is quite short. In the case of traditional high-volume production, suppliers organize production according to their own production schedules regardless of customers. Thus, sometimes the supplier's inventory is stored for several weeks, and the products are not available for customers. In small batch production case, the product flows quickly between suppliers and customers. Small batch production capacity clearly means lower inventory costs, but there are other more important benefits. Suppliers can respond promptly according to changes from customer demand. They can quickly identify any defects in the product and therefore fewer potential defective parts that were required to be picked or reworked. There would be fewer people perform inefficient activities, such as moving large quantities of inventory from one place to the factory, so the final productivity will be improved.

Even though the same suppliers that manufacture and ship similar products for both Japanese and US customers, they still maintain a lower inventory level for Japanese OEMs. The inventory turnover rate which defines the ratio of annual sales to average inventory; then for suppliers who serve the Japanese automotive manufacturers the ratio could reach 40 and the inventory turnover rate for US OEMs maintained below 26. The suppliers also maintained lower product (WIP) inventory, ending on-truck inventory for their Japanese customers. It shown the significant differences between Japanese and US's OEM customers. Among Japanese automakers, Toyota has the least inventory, and it is recognized as the first lean manufacturing company equipped with TPS (Toyota production system). Other companies like Chrysler was leading the US automotive industry on initializing supply accessories to assembly plants and invested in JIT systems. Additionally, Ford's 'on the wheel' products were the highest.

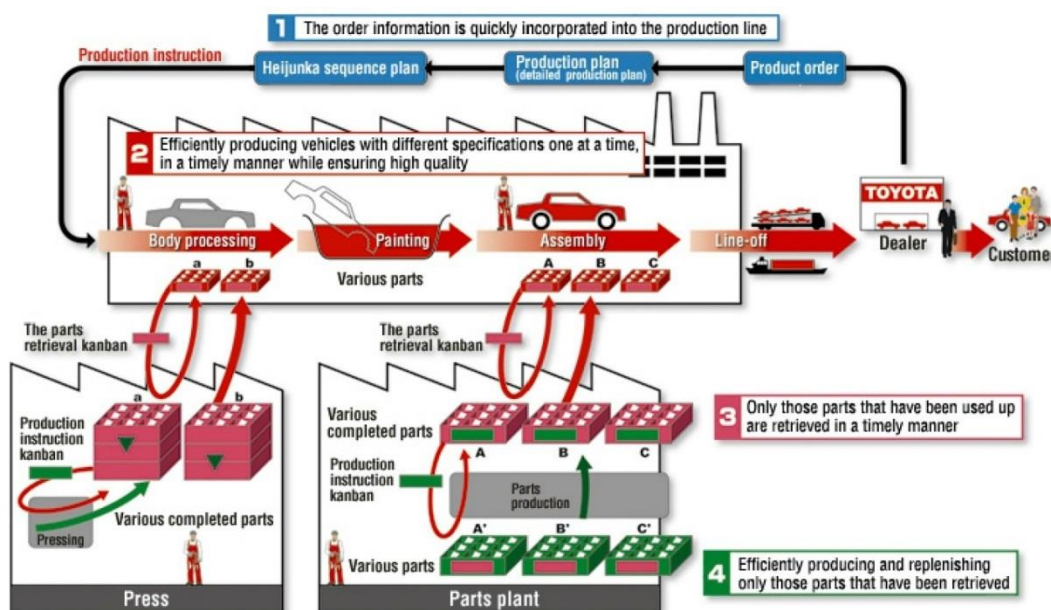


Figure 2: Illustration of the Toyota Production System. Adapted from www.toyota-global.com. (2018).

Although the US automakers are still falling behind their Japanese rivals, they are moving forward continuously. E.g. they are shifting vastly from past weekly deliveries to the direction of daily delivery on reducing inventory. A case in point is Ford Motors. Despite of them being high on 'on the wheel' product, they have been actively turning to a more frequent, small-volume delivery as part of Ford's production system.

You may think that lowering the inventory may issue the risk of failing on delivery to the customer or shutting down the assembly line, and it could turn out to be more expensive on shipping costs due to the use of dispatched trucks or even air flights. Despite running less inventory, Japanese manufacturers did not pay a high cost for shipping. In fact, Japanese manufacturers' emergency shipping costs are lower than the cost of US automakers.

Thinking about the myriad benefits of reducing the inventory of Toyota's US suppliers. When Toyota began ordering leather cushions from GST for Lexus models, Toyota found that GST couldn't kept up with their demands. They often failed on shipping cushions to the Toyota plant and needed to switch from original planned sea transportation to air. Although GST paid for the urgent delivery costs, Toyota was unsatisfied with the supplier's final completion. Then they sent out a group of Toyota production system experts to GST to cooperate with everyone in the factory, from the CEO to the general, they had successfully implemented the Kanban system, so a standard process for die cut the leather & stock had been developed.

The CEO of GST believed that the reduction in inventory would result in an increase in the number of unshipped shipments. But to his surprise, the inventory fell from 112,000 leathers to less than 40,000 like a miracle, the emergency air transportation freight dropped literally to zero. At the mean time, quality defects were almost eliminated, the productivity is doubled, and the delay time deliveries have dropped from 242 to 2 per year. This supplier has done it so well in two years without spending any extra cost.

(2) Maintain certain production level

The other successful tips of performing lean manufacturing also depends on an appropriate scheduled level of large production progress, in other words, the production of different products must be evenly distributed to minimize the uncertainty of upstream operations and suppliers. Toyota defines an appropriate level of large production in assembly process as a uniform distribution of volume and specification, then suppliers could proceed at a smooth, stable flow state from demands. An uneven production schedule (such as shifting from a large production of coupe to large production of four-door car) will dramatically increase the demands from suppliers. To handle high peaks' condition, suppliers are being forced to maintain high inventory levels to ensure themselves are prepared for unexpected requirements from OEM. Thus, by providing suppliers with a predictable schedule (with a stable ordering & regular demand) is especially important for a lean logistics system which only has a small inventory and must overcome unexpected condition within demand. Japanese manufacturers outperform their American competitors in this regard. Their orderings are more stable, reflecting the fact that their general assembly plant's progress is stable. Honda, Nissan, and Toyota are also standing out among their Japanese counterparts. Toyota is particularly sensitive to horizontal levels of production, which is the core principle of Toyota's production system. Automakers believe that customers who cannot keep their own schedules evenly distributed have no right to utilize a J.I.T system. Customers who are not producing in a certain level are only imposing their chaotic systems on their suppliers, and the suppliers would pay for all the high inventory costs, as well as higher shipping costs associated with all related drawbacks and emergency shipments.

Like butterfly effect, a small change in the customer's factory schedule can lead to greater imbalances to the tier 1 suppliers, and even more to tier 2, tier 3's suppliers. In short, maintaining a uniform production schedule will have stronger impact on tier 2 and tier 3 suppliers' orders. The schedule of Japanese automakers and US automakers have affected the ability of suppliers to maintain a level of production: the same tier 1 supplier maintains a higher level of production for Japanese manufacturers than to US automakers. As a result, when tier 1 suppliers can produce stably; their secondary suppliers will have a better result on cutting inventory and shipping on time.

In terms of filling trucks, Japanese OEMs exerted less pressure on their suppliers than what U.S. OEMs did. In addition, if the truck is not fully filled, there is less than 8% of Japanese customers' suppliers are fined. On the contrast, there is more than 33% of U.S. customers' suppliers are fined. On the contrary to Toyota's suppliers, Ford's suppliers are under pressure on filling trucks' load. Ford ranks low on lean inventory, especially its high level of inventories, which can be explained by the company's shipping policy. Ford wants to use all the truck space to reduce transportation costs, so the company requires suppliers to fill the trucks based on the minimum weight requirements. Ford usually pays for shipping costs, but

suppliers that do not meet the minimum weight target needed to pay for shipping themselves. Ford's policy encourages suppliers to fully filled the trucks regardless of whether Ford needs the parts or not. This guideline contradicts the core lean manufacturing fundamentals of delivering the right parts to the right place at the right time.

(3) Quality integration (Heijunka of production)

Suppliers deliver almost the same quality final products for U.S. & Japanese's suppliers, but when they ship to US OEMs, the cost of internal scrap rate and parts' rework is much higher than in Japan. This is because the quality measuring methods on suppliers which is adopted by Japanese manufacturers are - prevention-based & during process control; while US manufacturers prefer to apply post quality inspections.

Adopting a 'prevention-based, process-controlled' quality strategy is another requirement for effective lean manufacturing. Instead of relying on formal inspections to detect defects after quality problems (resulting in costly repair costs and waste of maintenance shop floor space), workers can stop production lines at any time.

In a word, suppliers are more willing to improve quality when supplying Japanese manufacturers, and only for post-test quality when supplying US customers.

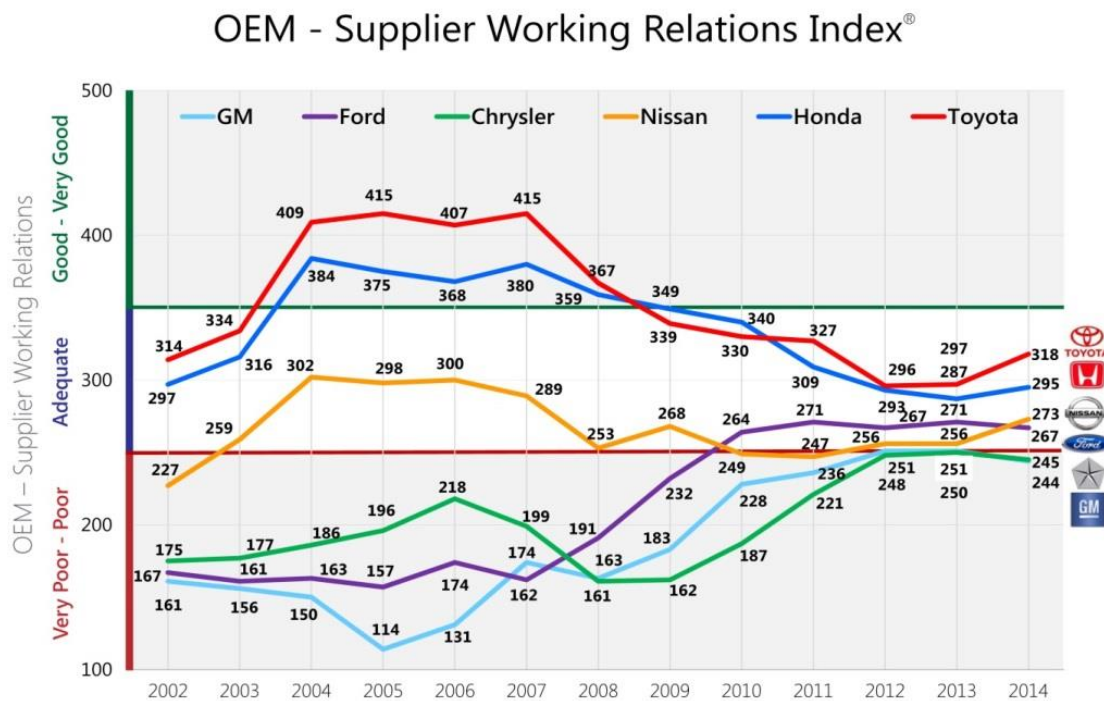


Figure 3: Illustration of the OEM - Supplier Working Relations Index. Adapted from <https://detroit.cbslocal.com>. (2014 May).

B. To achieve on-time transportation and delivery:

Lean manufacturing could minimize the inventory and reduce waste, but it will rely heavily on the shipment of a high-frequency pace & small-batch of parts in an orderly, timely, and low-cost manner. They also performed pretty well in JIT logistics which is just as good as excelled in lean manufacturing. Overall, in addition to the number of times that the truck can be fully loaded, suppliers who supply Japanese manufacturers have achieved higher ratings in all aspects of logistics performance than those supplied by US OEMs. Suppliers in the US factory have a truck load of 68%, while Japanese suppliers have a load of only 47%. The difference in customer policy is the reason: US customers punish suppliers for not carrying the fully loaded products in each shipment, while Japanese customers expect suppliers to ship the necessary accessories only when they are needed.

When it comes to delivery and transportation systems, so who is doing it right? The Japanese OEMs have developed sophisticated collaborative relationships with major carriers and have imposed stringent delivery requirements to compensate for long-haul shipping costs in U.S. through the use of innovative delivery methods and efficient loading methods such as mixed product loading.

(1) Develop closer relationship between carriers & suppliers

First of all, building a closer relationship with transport carriers is just as important as with the relatively small component suppliers, and it is also critical to the efficient operation of automotive manufacturers' lean manufacturing and delivery systems. By focusing on a small selection of carriers, called "core carriers," lean manufacturers get tangible and reliable service in a side-by-side, tightly arranged delivery, shipping tracking, and effective communication.

For most of the automobile manufactures, several core carriers transport the main products. The Japanese OEMs are taking more advantage of major carriers than American automakers: Japan uses an average of 1.4 transportation companies, compared with US automakers for using 4.3 transportation companies. In addition, the carrier's delivery service for Japanese manufacturers accounts for up to 92% of their own total shipments, while the highest proportion among US automakers is 75%.

When looking at individual car manufacturers, it's clear that there is a huge difference. For instance, the comparison between Toyota and GM's is surprisingly varied: Toyota uses only one carrier, while GM uses seven carriers. It is not an unexpected result that GM has a delay through delivery and slower unloading speed than Toyota. With so many potential core carriers, how can GM integrate their own working schedule system into their carrier to provide GM the highest priority and achieve the ideal delivery? The lesson is obvious: if a car manufacturer outsources the transportation business to the lowest bidder, the result will be a low freight rate, but not necessarily a high-quality service. In a lean enterprise, there is no large inventory reserve insurance, and reliable transportation services are critical. Develop relationships with carriers and require continuous and punctual transport services as the highest priority.

(2) Customers can motivate suppliers to meet these conditions by improving their own operations and shipping activities by establishing stringent delivery conditions e.g. with specific frequency, delivery period, and effective loading and unloading process.

For Japanese OEM manufacturers, one of the most essential keys to success is to require more frequent shipments from their suppliers. The fact that suppliers are rarely shipped the products which indicates that customers receive and hold large quantities of inventory, which increases inventory storage costs and takes up valuable space to mask quality issues. Suppliers who are serving Japanese manufacturers are also more efficient in daily shipments than serving to US manufactures: suppliers supply 3.6 times a day for Japanese manufacturers, and 2.4 for the US's three automotive giants. Ford's suppliers who ship an average of 1.1 shipments per day. On a stark contrast, Toyota's suppliers surpass all other car manufacturers, which deliver 5.0 times a day.

In order to avoid confusions and traffic jams at the delivery/receiving deck, lean customers also require suppliers to remove the goods at a specific time interval. A lean company that manufactures aluminum troughs implements a rigorous time window to ship finished products. They have also developed a very rigorous system that avoids finished products as inventory which based on delivery time; and they also apply the standardized time constraints & methods toward loading and unloading finished products. The company delivers goods in an orderly manner throughout the day, ensuring a consistent workflow through shifts. As a result, 10 out of 12 terminals that were always packed were closed completely. The two remaining docks were used evenly during a day and delays were barely happened on both terminals.

(3) Make up for long distance transportation challenges

The entire area of the North America continent throws down a geographic challenge for lean car manufacturers. In Japan's Toyota City, Toyota is well-known of their JIT method. Toyota City which has a unique geographical environment is located in a rural place right at the outside of Nagoya city. It's pretty much only plain in here, so the suppliers serve Toyota and build parts factory around Toyota's assembly plant accordingly. The supplier will receive the signal of demand on the needed parts just a few hours before the actual assembly line's requirements, and will be able to produce & transport the necessary parts to Toyota multi-times a day in an exact amount.

This type of approach would not be effective when the supplier is hundreds of kilometers away from the assembly plant and it would take hours to deliver those parts. So, these Japanese manufacturers have found a way to make up for the geographical distance encountered in the United States. Milk run delivering method is the solution for them which involves multiple stoppings at several different suppliers and assembly plants. If a factory can provide enough equipment for an assembly plant by fulfilling a truck multiple times a day, traditional point-to-point delivery might work just fine under lean manufacturing; but if that's not the case, it's preferable to have a milk run setup.

In the NA's automotive industry, Toyota has become a leader in the cross-dock technology. The cross dock accepts the entire vehicle needed product and loaded in a warehouse, meanwhile reassembles all kinds of goods then mixes the them into different trucks. The automotive industry has established a partnership called 'trans freight' or 'transshipment' and teaches companies how to use the Toyota Production System to manage cross docks. Fully loaded delivery or routine delivery from each supplier to the cross dock. The cross dock then reassembles the inventory into a mixed batch and delivers the exact amount of raw materials to Toyota's general assembly plant. Raw materials flow through the facility, and the temporary storage rarely takes more than a few hours.

(4) Adopt an effective loading/ conveyance method

In a traditional manufacturing, spending a little extra time on loading and unloading trucks can result in an additional labor costs, but those extra labor costs are always negligible. On the contrast, in lean manufacturing, loading and unloading time is critical because there is no buffer for inventory storage on the assembly line. The inventory placed on the truck would take an additional half an hour to be unloaded, which indicates that the assembly line might need to wait for parts coming. Japanese manufacturers have significantly less loading time than American automakers.

Let's get to fundamentals and agree that it takes less time for side loading trucks to unload the cargo, but only trucks that supply side-mounted equipment are used by Toyota's carrier. In tail-loading trucks, there is only tiny space for moving parts around, and workers have to move the parts and accessories from the tail end before loading and unloading parts close to the cab. Side-loaded trucks provide plenty of space for access to the entire truck's accessories. In addition, workers can choose to determine the order of unloading. At the same time as unloading, the parts are sent to a similar storage location in the assembly shop. However, side-loading requires a lot of initial investment and cooperation from suppliers. If the supplier has already established a shipping dock for the tail-loading truck, then this method will not work.

Using sequential loading can also increase the working efficiency. Large products customized made for different vehicles are transported to the assembly plant in the exact order as required by the car being built on the assembly line. Instead of looking for seats elsewhere through the downstream production line, the assembly line workers only need to go to one place and pick up the next one in order. This allows workers to concentrate on assembling cars rather than looking for an accessory elsewhere in the plant, and it also reduces the chances of choosing the wrong individual parts for a particular car. Rather than their American automakers, most of Japanese automakers prefer to use sequential loading method.



Figure 4: Loading and unloading goods: How to get it right in your warehouse. Adapted from UNICARRIERS. (2017 May 22).

An efficient truck transport system separates the truck driver and loading clerks, which increases loading efficiency. Transfreight uses Toyota's Freight Verification Management system (FVM) for unloading and reloading. Workers use a handheld device to scan incoming pallets for entry, after which they apply a new barcode to give it a unique designation on site. The device also shows the planned loads versus what has been unloaded; if they do not match, the system will automatically be locked and the manager must be consulted. The high volume and efficient throughput are part of managing the Heijunka of production, and maintaining the most efficient truck routes to Toyota's general assembly plant.

III. CONCLUSION

By the strong comparisons of suppliers with production lines who are serving both US automakers and Japanese manufacturers: it clearly reveals that of OEMs production and logistics systems would take great effect on suppliers' lean manufacturing capabilities. In regarding to supply chain management, the three giant US automotive makers have widely adopted lean manufacturing and JIT logistics solutions; however, they can still get benefits from continuously improvements (Kaizen). The same suppliers have better lean operations and logistics when serving to their Japanese customers. Especially for the suppliers who are serving Toyota are the leanest among all.

"Vehicle model by model, we have shared suppliers across plants. Managing a mass of packaging assets across locations allows more flexibility rather than doing so at a plant level" – **Brian Bold, logistics control manager, Toyota**

The great benefits from building a valuable lean chain is gradually being adopted, and even Toyota is focusing on Kaizen activities and constantly improving the system. As more fast pace tasks required by OEMs, customers are expecting delivery as fast as computing, performance and quality will become even more crucial. The core lesson of lean manufacturing is that speed up does not indicate increasing extra costs and reducing qualities. Shortening the time line could actually improve the quality and reduce costs. But for those OEMs, they cannot just expect to achieve these benefits by implementing lean manufacturing standards straightly to their own suppliers. Building a lean supply chain with proper communications and exchange of different ideas among all partners associated with the value chain which is the most essential task for any automotive customers.

REFERENCES

- [1] Jeff Gilbert, "Why do suppliers prefer working with Japanese car companies?" Retrieved from <https://detroit.cbslocal.com/2014/05/12/why-do-supplies-prefer-working-with-japanese-car-companies/>, May. 2014.
- [2] Automotive Times, "Japanese Automakers Overtake U.S. Rivals In Supplier Relations Rankings?" Retrieved from <http://www.automotivetimes.com/japanese-automakers-overtake-u-s-rivals-in-supplier-relations-rankings/>, May. 2014.
- [3] Jeffrey K. Liker and Thomas Y. Choi, "Building Deep Supplier Relationships. Research Gate". Harvard Business Review 82(12). December. 2004.
- [4] Shayon Sanyal, "Supply Chain Management_ Understanding Toyota's Production System (TPS)?" Retrieved from http://cmuscm.blogspot.com/2014/02/understanding-toyotas-production-system_2.html, February. 2014.
- [5] MIE solutions, "4 Ways to Automate and Improve Your Buyer/Supplier Relationship" Retrieved from White Paper on the Future of Cataloging - MIE Solutions. August. 2008.
- [6] Invoicera, "Top 10 Challenges faced in Buyer Supplier Relationship Management" Retrieved from <https://www.invoicera.com/blog/top-10-challenges-faced-in-buyer-supplier-relationship-management/>. June. 2018
- [7] Christopher Ludwig, "Toyota's total supply chain vision" Retrieved from <https://automotivelogistics.media/interview/total-supply-chain-vision>, July. 2013.