Sustainability in Environment
ISSN 2470-637X (Print) ISSN 2470-6388 (Online)
Vol. 6, No. 2, 2021
www.scholink.org/ojs/index.php/se

Original Paper

Supplier and Customer Relationships in Toyota Manufacturing USA: Proposal of Development of Advanced TPS for Global Production Strategy

Hirohisa Sakai[1*] & James Fikes[2]

[1] Toyota Motor Corporation, 1, Motomachi, Toyota-shi, Aichi-ken, 471-8573, Japan

[2] Toyota Motor Manufacturing, Texas, Inc., 1 Lone Star Pass, San Antonio, TX 78264, U.S.A.

[*] Hirohisa Sakai, Toyota Motor Corporation, 1, Motomachi, Toyota-shi, Aichi-ken, 471-8573, Japan

Received: April 17, 2021 Accepted: April 24, 2021 Online Published: May 6, 2021

doi:10.22158/se.v6n2p44 URL: http://dx.doi.org/10.22158/se.v6n2p44

Abstract

Toyota Motor Corporation has developed a process to enhance the supplier and customer relationships through their Tier 1 shipping process. The Tier 1 shipping entity is the supplier to the customer producing the completed product. In their system, quality gates are inserted into the process to act as the gates from order through shipment to ensure the correct material is ordered and shipped on the proper dates to sustain Just-in-Time delivery. This paper describes the Toyota Manufacturing USA process to fulfill customer orders and build a successful business relationship.

Keywords

Supplier and Customer Relationship, Quality Gate, 3-Point Check System, Tier 1

1. Introduction

Supplier and customer relationships have been present throughout history. For example, plants supply food to animals and animals are the supply of food to humans. The relationship between the plant, as the supplier of food, and the animals, as customers is fragile (Lin, Lee, & Ting, 2008). Poor quality production of food results in unhealthy animals, which leads to the death of the animal. Too little supply of food resulted in starvation and too much supply led to waste and rotten food. Not much has changed in supplier and customer relationships from the prehistoric era to now. Manufacturing Plants produce a supply to customers or consumers and the relationship between both is just as important (Taylor & Brunt, 2001).

The authors have developed the Advanced Toyota Production System (Amasaka & Sakai, 2008) and participated in an enhanced system to ensure high quality relationships between customers and suppliers by focusing enhanced communication and confirmation in Tier1 and Tier 2 supplier and customer relationships as shown in Figure 1. The objectives of this newly developed system are to (i) increase the trust of the customer in the supplier for sustained business relationships, (ii) improve the reliability of parts in the supply chain to ensure stable production with quality gates, and (iii) create clear change management communication between the supplier and customer to minimize risks.

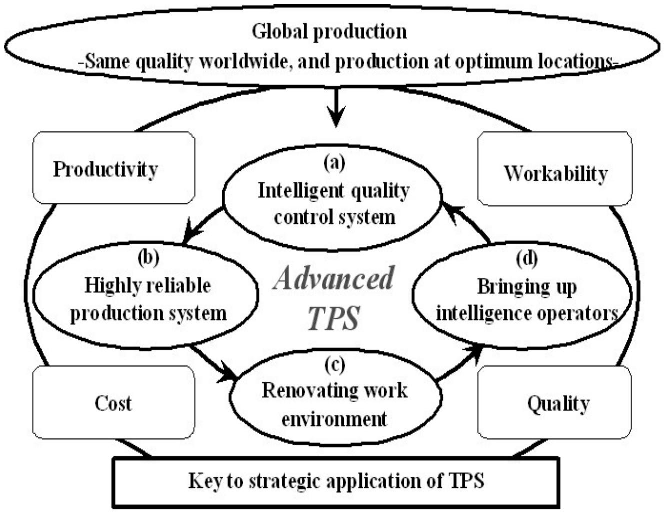

Figure 1. Advanced TPS Model

This article describes the features of this new supplier and customer relationship enhancement system. Firstly, in efforts to reform the traditional system, the supplier must communicate with the customer on a regular and frequent basis to discuss upcoming build schedules and change points. Secondly, in order to ensure customers, receive not only what they want but also the system includes a process for confirming the products shipped to the customer meet their normal build requirements that are ordered at the correct quantity per container, and are shipped accurately to customers facility.

Many manufacturing plants have parts they build and send to other suppliers for sequencing or sub-assembly in a Tier 1 and Tier 2 relationship as shown in Figure 2. Tier 1 suppliers support sending products to the Original Equipment Manufacturer (OEM) to be used in making the final product sold to consumers. Tier 2 supplied products are made by a manufacturer who sells and ships to a Tier 1 supplier for sub-assembly or sequencing into the production line.

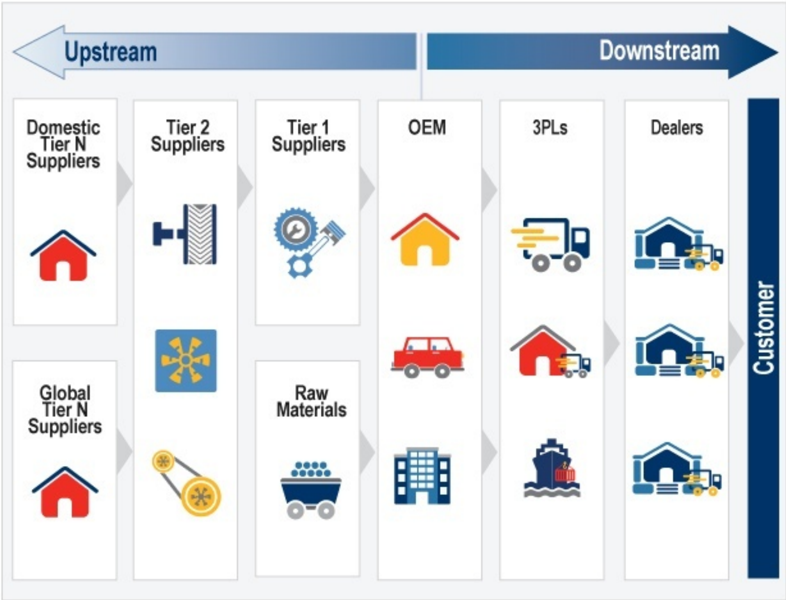

Figure 2. Sequencing or Sub-Assembly between Tier1 and Tier 2

2. Current Condition and Problems of the Traditional Supplier and Customer Relationship in the Manufacturing Environments

Suppliers and customers in the manufacturing environment are continually in a partnership throughout their products lifespan. Traditionally the customer provides the requirement and orders products from their supplier based on market demand and market fluctuations. Manufacturing OEMs, who are the customer to the Tier 1 supplier, usually have many products they are ordering from multiple Tier 1 suppliers, but they have little resources to ensure that every part was ordered for their final production needs. It is possible for the customer to order products from a supplier who does not make the product or orders an obsolete product (Badea & Burdus, 2009). In the traditional supplier-customer relationship, suppliers are not expected to confirm the validity of an order or communicate the potential problem to the customer. The consequences of inaction by the supplier can lead to unnecessary production stoppages at the customer’s facility or incorrect part installation leading to a product recall (Womack & Jones, 1994).

In order to solve these problems, customers in today’s manufacturing environment rely on higher levels of inventory to absorb incorrect orders. Using the higher inventory amounts as a buffer causes a multitude of inefficiencies at the customer. High inventory is a form or waste, and it contributes to other forms of waste such as excessive movement, scrap due to shelf life, overproduction, and difficulties managing First in and First out (FIFO). FIFO is an inventory management technique which requires the usage and depletion of the products entering the inventory first (the first product entering inventory is the first product out of inventory) (Ohno, 1988).

One of the causes of this condition is the lack of communication between the supplier and the customer in working pro-actively to prevent the initial problem from occurring (Potthast & Baumgarten, 2009).

Customers are in the habit of working to control what is in their current operations and not working as a partner with their supplier to prevent the shipment based on an ordering mistake proactively.

A method to improve the supply chain quality and consistency is based on clearly defining a communication and supplier work confirmation method between the supplier and the customer that embraces both the wants and needs of the customer in effort to support final production and high quality.

3. Ideas for an Enhanced Communication Method

Communication between both the supplier and customer must be established in the manufacturing environment to prevent product shortages or overages (Weber, Current, & Desai, 1998). Using this concept to support a more reliable communication model, this article proposes three important points to assure high quality and effective communication in the business relationship which includes:

(1) Frequent and structured communication meetings lead by supplier to discuss abnormalities in the order or shipments

(2) Operation schedule and volume comparisons between supplier and customer

(3) Product change point reviews and discussions

Figure 3 shows the ideal flow of communication for common supplier and customer related actions and the corresponding actions that are required from the receiver of the information. The supplier takes the lead on providing feedback to the customer for abnormalities in the order and shipment dates, changes to the product, or product build locations.

The objectives of the enhanced communication method are to (i) increase the trust of the customer in the supplier for sustained business relationships, (ii) improve the reliability of parts in the supply chain to ensure stable production with quality gates, and (iii) create clear change management communication between the supplier and customer to minimize risks.

To fulfill these objectives, it is required that the supplier lead the communication during on a consistent and frequent basis with an agenda of activities to be discussed. The agenda should be prepared and distributed prior to each meeting with requested action items for each party to be prepared to speak to prior to the meeting. Post meeting activities should include a summary of the meeting and action items (with responsibility/due dates) distributed to all participants. Proper meeting preparation and leadership will avoid communication problems such as (Teo & Dale, 1997):

(1) Poor attendance or attendee engagement

(2) Overly lengthy meetings

(3) Incomplete action items

Part changes are inevitable in a high-quality mind-set environment (Liker, 2004). Product end customers return their items to the store due to defects and those defects are reported to the manufacturer. The manufacturer and designers work together to make changes that will positively impact the product to ensure the defect is not going to re-occur (Ohno, 1988).

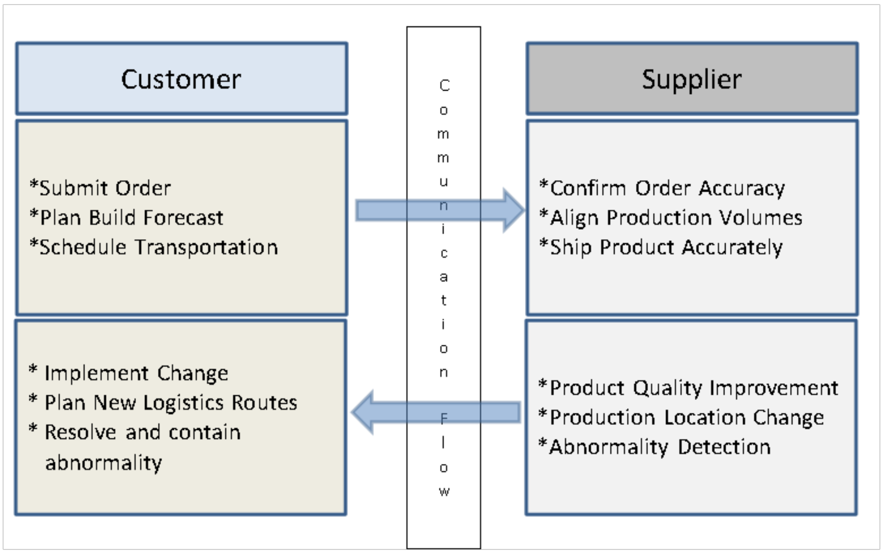

Figure 3. Communication Flow between Customer and Supplier

4. Methodology to Enhance Supplier Production Order to Shipment Confirmation

As customers place orders, few suppliers check to ensure the customer is ordering what is needed to support the customer's production needs (Feng, Fan, & Yanzhi, 2011). To progress to a higher level of customer service and build a reliable supply chain, suppliers need to commit to ensuring their customer's orders meet the minimum requirements of production. Quality gates implemented throughout the supply chain can support the needs of the customer and act as stopping points for the supplier to confirm customer needs are met before proceeding to the next process. To address these needs, the authors of this article have proposed an order confirmation system which includes three quality gates: Frequent and structured communication meetings lead by supplier to discuss abnormalities in the order or shipments:

(1) Confirmation of order accuracy

(2) Maximization of logistics space

(3) Product shipment confirmation (3-Point Check System)

Figure 4 shows the supplier order to shipment confirmation system. It is reliant upon the supplier taking the responsibility to ensure the customer has ordered properly and communicating when there is a problem. The system's mission is to (i) foster confidence in the supplier's capabilities to identify problems and (ii) prevent incorrect shipment of product reaching the customer.

The first quality gate is order accuracy confirmation, which is critical in ensuring the customer's order is going to meet the build demand of the consumer of their products. To confirm the order is correct, suppliers should (i) confirm the products the customer has ordered are products the supplier produces, (ii) the quantity ordered matches the lot quantities the supplier builds, and (iii) the shipments dates the customer are requesting are within the suppliers planned operation dates. By ensuring these three items, suppliers can meet the customer's requests or will be able to identify and communicate any discrepancies.

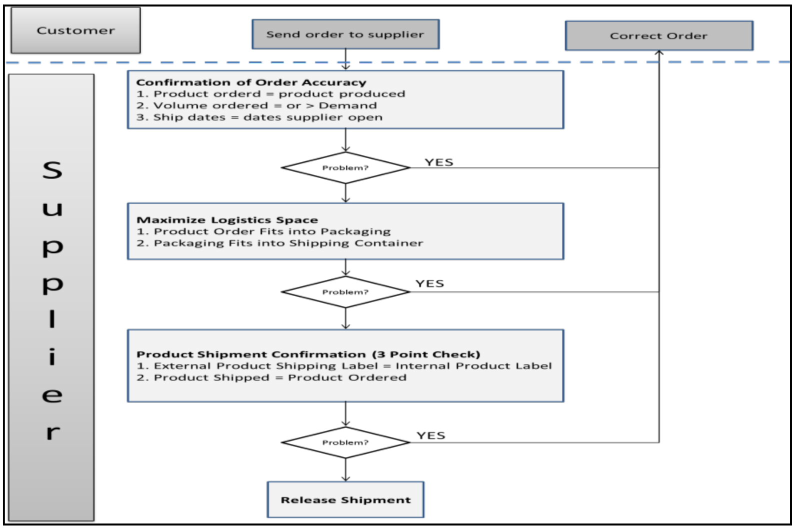

Figure 4. Supplier Order to Shipment Confirmation System

Secondly, once the order has been confirmed as valid, the supplier should calculate the logistics space required to ship matches the space available in the transportation method. Logistics can be a high cost of operations and cost per unit in manufacturing environments (Liker, 2004). Each product has a specified packaging requirement and space that it will take up in a vehicle. The supplier should ensure the product order will fit into the designated space. If the logistics space is not maximized, the supplier should communicate other options for the customer to use to maximize the space and reduce the costs of logistics.

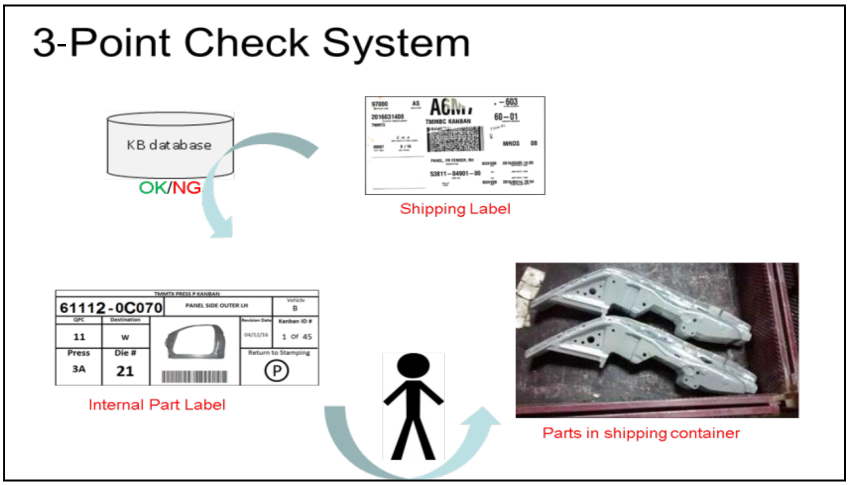

Figure 5. 3-Point Check System which Ensures the Shipping Corrected Parts

The final quality gate is product shipment confirmation, which involves 3-Point Check System as shown in Figure 5. When the product is packaged placed in storage at the supplier, it is likely that the product can be placed in the incorrect location or be labeled incorrectly. The 3-Point Check System is designed to prevent the incorrect shipment of product to the customer by (i) ensuring the customer shipping label matches the supplier internal product label, (ii) the customer shipping label matches the product to be shipped, and (iii) the supplier internal product label matches the product to be shipped.

5. Example: The Enhanced Communication System in TMMTX

As a supplier to four OEM Manufacturers and four Tier 1 customers, Toyota Motor Manufacturing, Texas, Inc. (TMMTX) has implemented the enhanced communication system in 2008 between its company and their external customers. Their efforts resulted in zero late part implementations since 2008 and zero part shortages caused by operating hour misalignment (TMMTX Production Planning Key Performance Indicators). The TMMTX example of the enhanced communication system ensures customers are aware of the upcoming changes to the parts supplied to their customers, and upcoming events/production plans.

As a supplier, TMMTX is responsible to communicate these changes to the OEM and Tier 1 customers. The communication tool TMMTX uses is called an Engineering Change Summary Sheet (ECS) as shown in Figure 6. Once product design changes are released from Toyota, TMMTX summarizes the change and meets with the OEM and Tier 1 customer of their parts to confirm the changes are understood and timing for implementation is identified. This summary sheet benefits both parties by acting as a catalyst for conversation leading to a common understanding.

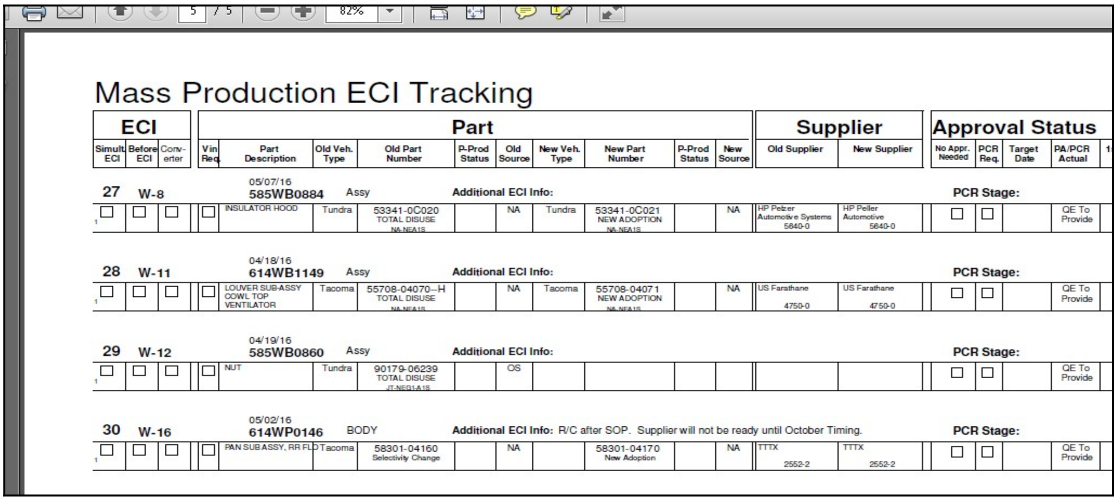

Figure 6. Engineering Change Summary Sheet (ECS)

TMMTX is a unique manufacturing facility because of it houses Tier 1 customers on the TMMTX campus. These customers are considered Tier 1 because they sub-assemble parts sent by TMMTX to their facilities and then ship the parts back to TMMTX for final sub-assembly. Therefore, these customers are considered On-Site Suppliers (Surrounding Suppliers) also. This close proximity allows for lower logistics costs between the supplier and the customer, it helps TMMTX better control product quality, and reduce overall inventory of product. Enhanced communication is more important because of the close proximity and the immediate impacts of errors in the supply chain. TMMTX is the first facility in Toyota Motors USA with On-Site Suppliers sharing the same campus.

6. Example: The supplier Production Order to Shipment Confirmation System in TABC

TABC (formerly known as Toyota Auto Body California) checks their customers' orders to ensure the parts ordered are most current, the quantity will support their customers' production requirements, and the parts shipped from TABC's shipping dock match the customer order. This practice has allowed TABC to be one of the best Toyota suppliers in terms of order accuracy and on-time delivery (Amasaka, & Sakai, 2010). TABC has a total of 16 different manufacturing customers in the United States and is considered a Tier 2 and Tier 1 supplier for these customers. Their ability to validate orders and confirm outbound shipments allows for a positive relationship with their customer base.

As TABC receives orders from their customers in the form of an electronic data interchange format EDI862 which is processed through an order validation file. EDI862 is a standard order format used between manufacturing companies and is considered an industrial standard for communicating order releases, advanced shipping notices, and invoices (Liker & Hoseus, 2008). The order validation file is an excel tool programmed by TABC to validate the parts ordered are current, the quantity per container is accurate, and the volumes ordered match or exceed the production requirements. Once the EDI862 file is dumped into the validation tool, a small window appears to notify the TABC Export Planning Specialist the order is valid or not. Figure 7 shows an example of a quality gate checkpoint within the validation tool. Quality gates or self-quality checks at TABC are referred to as Jikotei Kanketsu (JKK) check points, which is defined as built in quality with ownership and this principle is in built into Toyota standardized work procedures (Liker & Hoseus, 2008).

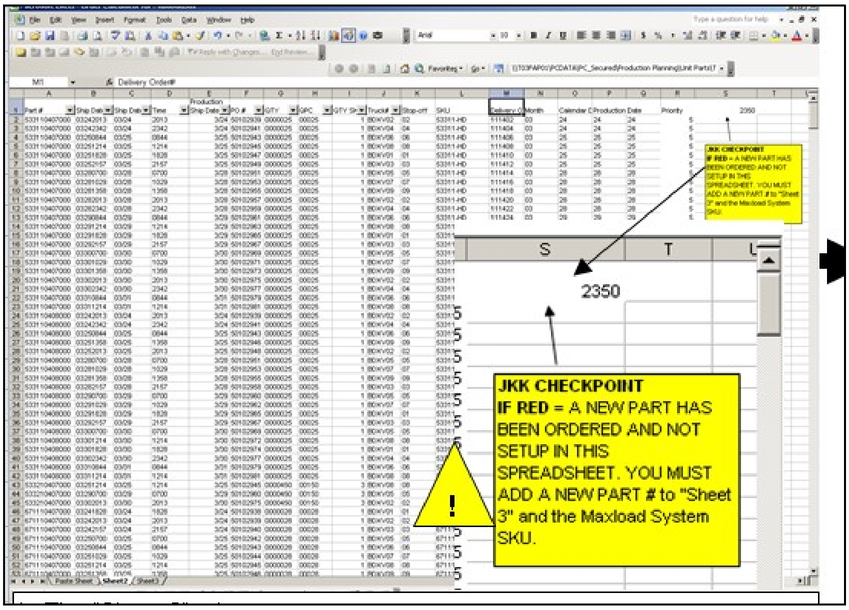

Figure 7. TABC Inc. Validation Tool

In addition to validating customer orders, TABC does three points check of the parts before shipping to their customers and confirms the maximization of the load using a load diagramming tool as shown in Figure 8. The TABC three points check involves the shipping team member scanning an internal part label (Kanban) into a database, then scanning the shipping label. The database will validate the part numbers match and will send an audible signal to the shipping team member if there is a match or mismatch. Once the system validates that the shipping labels are the same, the team member must do a visual check of the parts and compare the picture of the part on the internal label, matches the part in the shipping container as shown in Figure 8.

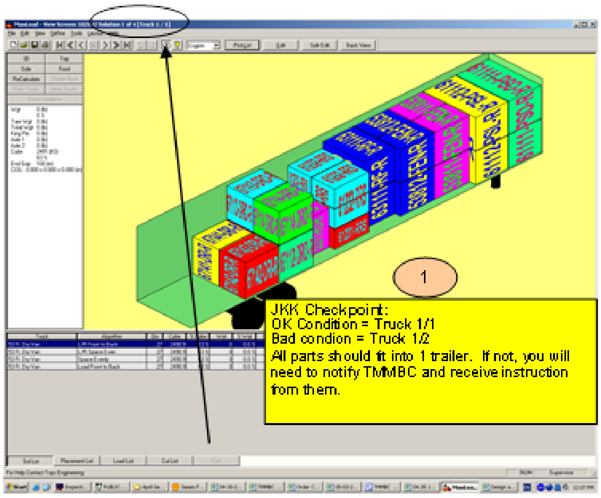

Figure 8. Confirmation for Maximization of Logistics

In summary, the TABC system for managing their customer orders supports a healthy partnership and relationship with their customers. Customers can feel comfortable TABC is going to validate and communicate any issues to the order for quick resolution. Also, TABC supports their customers by validating the parts shipped match the order by utilizing the 3-point check system. These steps have been successful in making TABC a leading Tier 1 and Tier 2 supplier in Toyota Manufacturing USA. Their reliability was a reason Tesla Motors Inc. sourced parts from TABC to support their Model X and Model S builds in Fremont, California (Feng, Fan, & Yanzhi, 2011).

7. Conclusion

Supporting positive relationships between Tier 1 and Tier 2 customers has proven successful for Toyota Manufacturing USA. Communication which occurs on a regular basis between the supplier and customer to align schedules and plan for additions has prevented unnecessary production loss and delayed new part production. By validating customer orders and ensuring proper parts ship has supported new business and high shipment accuracy. In conclusion, other businesses can gain from the Toyota Motors Manufacturing USA practices.

References

Amasaka, K., & Sakai, H. (2010). Evolution of TPS Fundamentals utilizing New JIT Strategy: Proposal and Validity of Advanced TPS at Toyota, *Journal of Advanced Manufacturing Systems*, *9*(2), 85-99. https://doi.org/10.1142/S0219686710001831

Badea, F., & Burdus, E. (2009). Contributions on the Lean Management in the current evolution of a company, *Economia. Seria Management*, *12*(1), 168-179.

Feng, B., Fan, Z-P., & Yanzhi, L. (2011). A decision method for supplier selection in multi-service outsourcing, *International Journal of Production Economics*, *132*(2), 240-250. https://doi.org/10.1016/j.ijpe.2011.04.014

Liker, J. K. (2004). The Toyota Way: Fourteen Management Principles from the World's Greatest Manufacturer. *McGraw-Hill*. New York.

Liker, J. K., & Hoseus M. (2008). Toyota Culture: The Heart and Soul of the Toyota Way. *McGraw-Hill*. New York.

Lin, Y-H., Lee, P-C., & Ting, H-I. (2008). Dynamic multi-attribute decision making model with grey number evaluations. *Expert Systems with Applications*, *35*, 1638-1644. https://doi.org/10.1016/j.eswa.2007.08.064

Morgan, J., & Liker, J. K. (2006). The Toyota Product Development System: Integrating People, Process and Technology. *Productivity Press*. New York.

Ohno, T. (1988). Toyota Production System: Beyond Large-Scale Production, *Productivity Press*. Portland, USA.

Potthast, J-M., & Baumgarten, S. (2009). Applying sourcing logistics in the automotive industry, *International Transport Journal*, *71*(1), 45-46.

Sakai, H., & Amasaka, K. (2008). Demonstrative Verification Study for the Next Generation Production Model: Application of the Advanced Toyota Production System. *Journal of Advanced Manufacturing Systems*, *7*(2), 195-219. https://doi.org/10.1142/S0219686708001577

Taylor, D. H., & Brunt T. D. (2001). Manufacturing Operations and Supply Chain Management: The Lean Approach. *Thomson Learning*.

Teo, W. F., & Dale, B. G. (1997). Self-assessment: Methods, management and process. *Proceedings of the Institution of Mechanical Engineers*, *211*(5), 365-375. https://doi.org/10.1243/0954405971516347

Weber, C. A., Current, J. R., & Desai, A. (1998). Non-cooperative negotiation strategies for vendor selection, *European Journal of Operational Research*, *108*, 208-223. https://doi.org/10.1016/S0377-2217(97)00131-8

Womack, J. P., & Jones, D. T. (1994), From Lean Production to the Lean Enterprise. *Harvard Business Review, March-April*, 93-103.