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# Framework for Customization of Order Processing In Indian Automobile Industry

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**ABSTRACT**
This paper deals with the present state map of a leading Indian car manufacturer which makes automobile in almost all segments. The present state map shows a very traditional view of order processing. This car manufacturer has over eighty percent of its supplier as in-house manufacturer. The paper suggests a future state map for this manufacturer especially in the luxury car segment. Suggestions have been made to draw a parallel with DaimlerChrysler which has its majority of its supplier components outsourced from its supplier. With growth of Indian economy and standard of living the paper suggests a shift in the methodology of order process in luxury car sector of this Indian manufacturer.

**Keywords -** Built to Stock (BTS), Built to Order (BTO), Just in Time (JIT), Just In Sequence (JIS), DaimlerChrysler Supply System (DCSS)

## I. Introduction

With increasing product and process complexity and with advent of globalization leading to cross company assessment and optimization of standard and thus sales and production operation are becoming more important. Analyzing all these changes a proposal could be made that continuous logistic in form of supply chain management with the help of new ideas will help companies create new benchmark and increase competitive advantage in automotive industry (Graf et al., 2000). The industry needs to confront these complexities and changes by taking aid of Supply Chain Collaboration. The changing scenario in customer's demand and the changing market the companies are trying to beat the competition through flexibility and efficiency in the supply chain making it as holistic approach unlike previously followed self-centered approach (Bischoff et al., 2004). The three most critical challenges that the automotive industry encounters:

**a)** Complexity in customer's demand and specification
**b)** Increase in transfer of value added to the supplier
**c)** A prolonged globalization of company through market capture and cost advantage through site transfer

As the market has number of big names in term of automotive industry and with new knowledge about technology, buyers are motivated to favour those companies that provide them with something that has feasible price, quality and is easily available. Not to forget that these factors go along all the stages of customer supplier relationship in process chain as well. The high cost pressure and complexity in demand leads to multi-tiered supplier network (Schmidt et al., 2003). Earlier when the chain use to stretch to a little now is divided into numerous supplier and is sufficient enough to analyse the procurement of process chain as far as the first supplier.

## II. Customer Orientation and Product Complexity

For vehicle manufacturing companies the business model can either be BTO (Build to Order) or BTS (Build to Stock). Each has a different level of customer orientation and cost optimization. BTS is usually a trend followed by large manufacturer producing in volume whereas companies like Mercedes, B.M.W, and DaimlerChrysler follow the BTO philosophy. BTO makes greatest demand in logistic in terms of reliability, adaptability and flexibility. The BTO scenario works something like this customer orders his customized car at DaimlerChrysler. The wide variety of available alternatives provide customer with advantage to configure their own individual vehicle. But this also leads to high level of process complexity and time critical procedure for company. The variant provides so much option that statistically speaking DaimlerChrysler has only 2 out of 500,000 vehicles identical. For a C class sedan the company provides 80 options, 14 exterior colours, 5 interior colours and 3 different seat cover. If a customer selects 15 options

on an average, there will be 6.635 trillion theoretically possible variants just for single model of Mercedes C class.

When looking at BTS among the company with volume manufacturing capacity like Maruti we find the variants are less. The aim of such company is to meet the demand and thus it facilitates lesser option for customer. Alto for example comes in category of Lx, Lxi, Vx, Vxi. The other variants that it has are 6 prominent colours and facility for handicapped driver. The rest traits are merged under the category (Lx, Lxi etc.) of car customer is buying. The customer thus has 48 ways of buying the car. Therefore it has lower complexity of process and enough time to produce large number of cars.

The task of Logistic department is to manage the information and material flow in customer ordering process and along the value added chains in such a way that shortest delivery time can be achieved with consideration of capacity restriction and possible use of flexibility (Straube et al., 2004).

## III. Location Transfers and Globalization

Main reasons for location transfers of assembly plants of the OEMs abroad can include:

- Market proximity in the high-volume or new, developing markets
- Low manufacturing costs as a result of the labor cost level
- Greater availability of trained plant specialists
- Deregulated working time conditions
- Greater flexibility in meeting time-critical customer requests
- State subsidies for industrial locations
- Waiving of import duty and tax restrictions (local content regulations).

To remain competitive and have the ability to guarantee the OEM the required supply security and flexibility, "responsive follow-up" is essential for many suppliers, particularly if other local companies are also in direct competition. Apart from this, suppliers naturally also have reasons similar to OEMs for transferring their manufacturing locations abroad. The main reason here is labour cost advantage which enables the suppliers to meet the target prices of the OEMs.

In many cases, this leads to a fragmentation of the production process: The labour-intensive production stages of part production are transferred abroad and, due to the time-critical and cost-critical delivery process, the variant-forming final assembly of the modules remains in the same country at the original location or is even re-established at an industrial park of the OEM. The resultant complexity of production and procurement structures and the increasing requirements in terms of logistics are later discussed in the paper. The increased presence of global supply relationships with the widening span of value adding up and downstream also necessitates a realignment of the logistics service providers, who increasingly have to operate globally and rely on Internet-based management and information systems.

## IV. Logistical BTO Business Process Model of a Premium Vehicle Manufacturer

Earlier the core processes of product development, production planning, customer ordering and material procurement were analysed individually and optimized functionally within their own departmental boundaries. The innovative idea is to link the three core process via interfaces. Customer visits the firm and orders his product with required characteristic. It is necessary for the manufacturer to have ability to meet any future requirements of a built to order business process in a competitive environment more effectively (Graf et al., 2004). The customer's order is processed and is divided into two parts of material procurement process and product development process. The basis of the cost and price conditions and therefore also of the market success is formed to large extent in the product development process. The new product is developed and supported logistically by project and production breakpoint control as well as product documentation. Project control introduces and new type of change or scopes in a timely fashion. The breakpoint control sets the date for the first use of the new part. In preproduction series phase all parts of vehicle are documented in order to forecast the required number and notify the supplier. The logistics also needs to develop the delivery concept from the supplier through the assembly lines, the planning containers and the storage.

The process chain of supplier to provision of the material in body shop, paint shop and assembly shop is represented by material procurement process. The demanding targets in customer ordering process and product development can be attained by aligning the procurement process. When the customer specific vehicle is scheduled for production, it is important to pass the information to supplier quickly to provide him with sufficient time for delivery of parts to assembly shop. This is usually carried out by standardize procurement chain process in a streamlined and economically efficient process. In this respect Just-in-Sequence (JIS) delivery parts and Just-in-Time (JIT) delivery of vehicle and stock processing is certainly the most sophisticated methods of supplying BTO vehicle production with parts of wide variety of variants (Graf et al., 2004). The use of Electronic Data Interchange (EDI) to send the requirements to supplier plays vital role. In form of annual, monthly and daily production program the details are updated and are transferred to supplier. The supplier thus meets the deadlines of company as per required.

## V. Customer Order-Managed Program Planning and Order Processing

The purpose of customer ordering process is to prepare a balanced sales and production sequence and to manage the customer order so that production and material procurement capacity are utilized optimally. The order is taken on a weekly and date specific basis in line with the order planning and precisely scheduled keeping mind available production capacity of plant and concern supplier. Usually the part requirement is calculated for nine months with the program and order data along with part and structure data of part list. Customer orders are then assigned to production days. Targets are adhered to customer deadline keeping in mind the even distribution of models and option on assembly line. Among all the combination the best possible sequence is worked on day shifts. Factory utilization, production capacity and human resource are vital factor. To determine optimum sequence a program is developed considering large number sequence and investigating them in terms of target function. In this way quality level is decided for each sequence and one with highest quality is selected as final product sequence (Graf et al., 2004). Usually a chain process is followed in customer order processing involving customer visiting the firm and placing order after choosing various variants.

The in line sequencing principle as it is known can explain what actually happens in the production. The order after scheduling is finalized in terms of content, sequence and deadline and is then in "Frozen Zone" where it cannot be changed. After this the supplier receives this binding target order assignment. The OEM can achieve adherence to in line sequencing in the assembly shop by keeping the number of variants in body shop and paint shop low enough to restore originally planned sequence using sorter. In this process bodies are managed on a variant specific basis up to sorter and the specific customer's order in not assigned to body again until assembly call up. The desired in line sequence quality (= sequence quality + deadline quality) determines the size of the sorter and is established using special IT based simulation program. The in line sequencing principle also enable JIS delivery from remote locations as the supplier can schedule produce and deliver the final order sequence promptly. The sequence rule is usually based on first cum first serve basis i.e. the processing is done on basis of inventory state or lead time. If the parts are on hand they are dispatched immediately to the assembly station. For the parts that would take a week time they are kept in sequence and a queue is formed to which the latter parts are kept on adding. When the call from OEM is received the first in queue is dispatched. In case of a tie the parts are dispatched arbitrarily.

## VI. Process Oriented Material Procurement

### a. Standard System in the Automobile Industry:

Having standardized process the procedure in development, production and sale can be organized better. Also the resources can be used optimally and deployed efficiently. At DaimlerChrysler, the standard systems have been introduced on basis of BTO business process (Alicke K et al., 2004). The Mercedes Benz Development System (MDS) stipulates the standard of entire production development system, starting from product planning to production initiation phase. Global Ordering (GO) is applied throughout customer ordering process as it describes the sales and marketing process from customer order to delivery (Putzlocher et al., 2004). Objective of standardization in material procurement is to develop a common global supply system that serves as guideline for logistic planning. The DaimlerChrysler Supply System (DCSS) makes the complexity and diversification links of logistic process internal and external transparent. DCSS further defines the links with upstream and downstream such as Development, Purchasing, Production, Sales and with cross company value added chain of the supplier. The DCSS has subsystem like Production Programming and Scheduling (PPS), Launch and Change Management (LCM), Production Material Control (PMC), Material Handling and Engineering (MHE). The Mercedes Benz Production System (MPS) describes the layout of production organization and methods at the plant (Thomas et al., 2003). The proper standard of tool, processes and production equipment ensures to error free production and high quality while lightening upon the efforts of the employees. MPS consists of several subsystem like Work structure and group work, Standardization, Quality and robust processes, Just-in-Time, Continuous improvement process.

## VII. Standard Delivery Forms

The three basic delivery forms that is followed for BTO business model are:

7.1. Just-in-Time
7.2. Just-in-Sequence
7.3. Single stage inventory system

### 7.1. Just-in-Time

Just-in-Time is a ware house free process and uses decentralized buffer store and characterized by continuous material flow. The goods are distributed in containers that have same item number and colour variants. The supplier is in line with the daily "call ups" OEM and delivers the parts in required quantity and required level of quality. The characteristic of continuous delivery and production process is the reduction of material in hand (Graf et al., 2004). Another objective is to operate the process with the minimal handling costs. There are two concepts through which the parts are delivered. The first being the one where supplier produces directly into provided

trailer. The trailer through the shortest route reaches the customer's premise. The parts are unloaded and buffer store for short period in the assembly building before being assembled. Another alternative is the Warehouse on Wheels or WOW concept where the assembly house is supplied directly from demountable platform or trailer that is used as rolling buffer store. The JIT is suitable for parts having low variance and high transport volume. With a JIT delivery the physical area of "supplier-OEM" interface no additional part handling is required at the consumption point. To ensure this standardize container in the process chain. Use of reusable containers for material and disposal will cut down cost as well as make significant contribution to environmental protection.

### 7.2. Just-in-Sequence:

It is a warehouse free process characterized by the delivery of parts, modules and systems in line with the assembly sequence of the OEM (Alicke et al., 2004). It is preferred in heavy supply with large volume of part transfer. To coordinate the in house sub process with the final assembly shop in optimal manner, the OEM sends the precise order sequence to supplier at the earliest possible stage in form of control impulse. To delay the complexity arising due to variance and high volume the supplier first produces the standardized, non-order specific basic modules that are completed in final processing stages to form the order specific final modules. The three different types of JIS will be discussed. Tin the first kind supplier produces the final modules on the basis of date specific customer specifications of the OEM. The final orders are then buffer stored on premise of the service provider and once the receipt of sequence impulses they are put into required delivery sequence. The second kind is one with further reduced handling system, in which the parts to be delivered are already produced at supplier's premise in a production synchronous manner, meaning no additional sorting is required after the final sequence (Graf et al., 2004). In the third kind or the industrial park concept the module and system suppliers are located in the immediate vicinity of the customer. Parts are produced in flexible, organizationally independent factories that are linked to the assembly shop of customer via integrated transport systems.

### 7.3. Single Stage Inventory Chain:

For the parts that can only be produced in batches or have low forecast certainty, the best option is delivery in form of single stage inventory chain. There is only one warehouse between supplier and customer, the supplier logistic center (Graf et al., 2003, Kienle et al., 2004). Ideally, the parts are loaded directly onto the available trailers at the supplier after the final production setup. Storage at the warehouse is carried out for the supplier with the material remaining the property of supplier until it is removed by the OEM (Dangelmaier et al., 2001). After withdrawals from the assembly shop the materials from the warehouse are distributed to point where they will be used. The daily call ups can be dropped and management is carried out in the basis of the forecast gross requirement, agreed minimum or maximum ranges and the continuously transmitted inventory data. As the inventory and management control is now totally in the hands of the supplier and he is informed about the inventory changes his main advantages is the optimization of product batch lots. In addition to the cost savings the advantage for the OEM is high level of supply security, because short term withdrawals are possible since the storage is so close to assembly line (Graf et al., 2004).

## VIII. Case Study:

The paper studies a certain Indian automobile manufacturing company. It was established in February 1981, though its actual production commenced in 1983 with its first model which at the time was the only modern car available in India, its only competitors the Hindustan Ambassador and Premier Padmini were both around 25 years out of date at that point. Through 2004, this company has produced over 5 Million vehicles. The company exports more than 50,000 cars annually and has domestic sales of 730,000 cars annually. Its manufacturing facilities are located at two facilities Gurgaon and Manesar in Haryana, south of Delhi. The Gurgaon facility has an installed capacity of 900,000 units per annum. The Manesar facilities, launched in February 2007 comprise a vehicle assembly plant with a capacity of 550,000 units per year and a Diesel Engine plant with an annual capacity of 100,000 engines and transmissions. Manesar and Gurgaon facilities have a combined capability to produce over 1,450,000 units annually.

### 8.1 Production process:

The company is a Build-to-Stock dealer as it manufactures large volume of car throughout the country. Its production process is based on Dealer Management System (DMS) that enables the smooth flow of supply chain. Every outlet spread throughout the country takes customer order and gives a variant code for the each order. This code is unique and is then forwarded to the production plant at Manesar (Haryana) or Gurgaon depending upon the type of vehicle. This online information flow is facilitated by DMS. The DMS has dual task, one is that of order flow and second is an overall information system. DMS has details of employee, his performance, duration of job etc. When the stock is not present at the outlet or when the demand is high, the authorized outlets has the system of advance booking of the vehicles. In this money is taken as collateral for the orders forwarded. Usually orders are confirmed for the customer who pays definite fraction of vehicle's price. Once the orders are forwarded at the plant the production starts. The company does all major spare

parts and body production through in-house production. Since it is BTS defined production the rate of production is high and the company claims to produce one car every 8 seconds. The delivery is made zone wise and usually takes three days to reach the outlet. The trucks are dispatched in groups of 4 to 5. This is to cover all the outlets at once in a certain zone.

**8.2 Shortcomings:**

The company has a fixed production line and routine that involves in Build-to-Stock production. The in-house production and less number of variants makes it ineffective in production of luxury cars where customer demands for abundant variant for his car. Further the lack of flexibility in the production prevents the company to progress towards other option in car manufacturing. The company's adherence to its followed practice can lead to bottlenecks when trying for change. Such complexities can be dealt through the production process discussed for DaimlerChrysler. It will help in creating new business opportunities for Build-to-Stock type companies to step into Build-to-Order genre.

## IX. Conclusion

Comprehensive process-oriented logistics will become increasingly important in the future. In addition to product innovations, time-to-market and time-to-customer will become crucial competition factorsThe only companies that will be able to hold their own against the competition are those that can make use of the opportunities presented by the new technologies for their own benefit and implement them quickly. The innovative concepts previously described offer some future-oriented solutions that clearly focus on the customer and illustrate the importance of supply chain collaboration. However, the customer's desire for shorter and shorter delivery times with 100% adherence to the agreed deadline means that synchronization between OEM and customer in a globally available online ordering system becomes absolutely necessary. Upon enquiry by a customer about his individually configured vehicle, a check is first made in the order system as to when the order can be scheduled at the assembly plant, taking into account capacity restrictions. When this date, the earliest possible from the viewpoint of the plant, is determined, the check of material availability along the critical supply chains is carried out. The earliest possible or requested delivery date is then reported back to the customer who made the enquiry. When the customer finally places his order, then the production slot previously reserved is firmly booked for him. Using the SCM tools, the information on required parts is forwarded online to all linked suppliers. In this way, the day when individual parts or variants are required is firmly fixed at an early stage through all tiers of the supplier network. Flexibility management ensures the build-feasibility of all the orders and so stabilizes the planned sequence. Adherence to this principle of inline sequencing (Perlenkette) is the backbone and "pace-maker" that ensures reliable scheduling throughout the process. Finally the SCM tools have the capability in their core function of monitoring the whole process to detect and prevent bottlenecks in capacity or in inventory.

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