BTO Give and Take

Overcoming challenges in the pursuit of flexibility

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In this era of mass customization, customers want what they want, when they want it, at a price they're willing to pay. Information overload and constant exposure to alternatives only heighten the demand. While it might be a good time to be a customer, it can be an extremely frustrating time to be a manufacturer—especially if you're used to rigid production schedules, forecast-based planning, and balanced order flow.

Many manufacturers recognize that build-to-order (BTO) manufacturing is one of the most effective responses to these challenging demand patterns. But despite this gradual acceptance among some industry leaders, creators of the 3DayCar concept at Cardiff and Bath Universities and the International Car Distribution Programme (both based in the United Kingdom) report that the industry as a whole is largely ambivalent. A few pilot projects may have been run—such as Toyota's five-day car at the Solara plant—but no one is close to establishing true BTO production.

Using their current build-to-stock approach, automotive manufacturers instead rely on dealers to order from preset stockkeeping units. The result is an enormous supply of automobiles on dealer lots, estimated to be worth more than $80 billion. Getting customers to buy those vehicles costs another $30–$50 billion in rebates and incentives. Clearly, there are some serious shortcomings associated with build-to-stock, and manufacturers must acknowledge these weaknesses and look to flexible scheduling approaches to offset demand-forecasting deficiencies.

Scheduling flexibility

MANY PRODUCTION SYSTEMS are based on sequenced flow: a smooth, balanced approach to scheduling and shop-floor control. But if sequencing is the way to go, why are many still saddled with excess inventory, slow response time, and little flexibility? Proper sequencing is no longer enough. Now, changing customer demands must be accommodated with scheduling flexibility and, thus, lower inventory levels throughout the supply chain.

Scheduling flexibility allows a manufacturer to change product mix and volumes quickly, correctly, and economically, as consumer needs change. To succeed, manufacturers must develop a scheduling sequence that maximizes the extent of change and degree of fluctuation in product variety—and that the system can accommodate while minimizing high-transition penalties or large changes in performance outcomes.

Without this flexibility, there will be more resequences due to unexpected quality problems, supplier delays, and changes to customer orders. Unless an operation's planning function can greatly reduce the planning cycle for the entire supply chain, the cost of manufacturing likely will increase due to escalating just-in-case inventory and capacity misallocations.

Complexity drives flexibility

BTO MANUFACTURING IS a daunting and complex undertaking. While original equipment manufacturers (OEMs) may want to be more responsive to customer requirements—producing any model, at any plant, at any volume level, at any time—the reality is that their manufacturing systems just aren't that flexible. Manufacturing a typical four-door sedan requires more than 2,000 components and subsystems. Add to the mix choices of color, interior components, materials, and other customizable elements, and the number of options is in the trillions.

Clearly, the endless permutations of customer orders make it very difficult to forecast demand. But even if demand could be determined, requirements would have to be communicated in real time throughout the OEM's network of vendors and suppliers. With logistics sourcing arrangements with tier 1 and tier 2 suppliers across the globe, the enormity of the communication challenges is astounding.

Additionally, OEMs rely on technology and planning and control systems, including material requirements planning and enterprise requirements planning, to communicate customer orders to vendors and suppliers. For example,

Toyota provides its vendors and suppliers with both a long-term forecast and monthly build requirements at each plant. Despite such arrangements, it still takes the automotive industry an average of 41 days to fill customer orders, even though it only takes two days of actual manufacturing time to produce a vehicle.

Because of this complexity, the current method for handling revised customer requirements, which means resequencing throughout the supply chain, is simply not to do it. Instead, OEMs rely on buffer inventories to ensure the assembly process is uninterrupted (see Figure 1).

For example, managers at the ZF Industries plant in Tuscaloosa, Alabama, still rely on a three-hour finished goods buffer of axles and differentials to meet daily requirements at a Mercedes-Benz plant only 25 minutes away. Inventory buffers like these are part of the reason why the North American automotive industry (when including dealer stocks) averages a decidedly nonworld-class, two to three inventory turns per year.

More flexible and responsive

IN ORDER TO implement BTO, manufacturers must consider the elimination, or substantial reduction, of long frozen planning periods. Instead, flexible scheduling can be achieved by relying on shorter planning periods and using "time buckets." These fixed time periods allow OEMs to delay actual product differentiation until it's absolutely necessary. Toyota uses time buckets in order to handle detailed specification changes within 10 days of production and can even accommodate modifications on a daily basis.

Many manufacturers pride themselves on the ability to sequence workflow through their plants to reduce manufacturing cycle times and work in process inventory levels. Truly effective production, however, requires the flexibility that results from short cycle times, commonality, modular product design, an adaptable workforce, and slack capacity.

Nissan uses the term douki seisan, "sequenced and simultaneous," to describe the full scope of its highly productive Nissan Production Way manufacturing system. Despite its effectiveness—and even with a clearly stated goal to achieve rapid BTO capabilities—Nissan is a prime example of disciplined sequencing impeding the transition to BTO. The industry as a whole progresses at an even slower rate.

For the foreseeable future, manufacturers will continue to operate at roughly 85–95 percent build-to-stock, with slots available for configured orders. Customers will essentially reconfigure a car that was scheduled to be built anyway.

The anticipation is that this approach will allow the OEMs to project a fairly good forecast to suppliers leading up to the frozen period. Theoretically, a given supplier would not have to hold finished goods inventory if it could execute an order within that period. However, the diffi-

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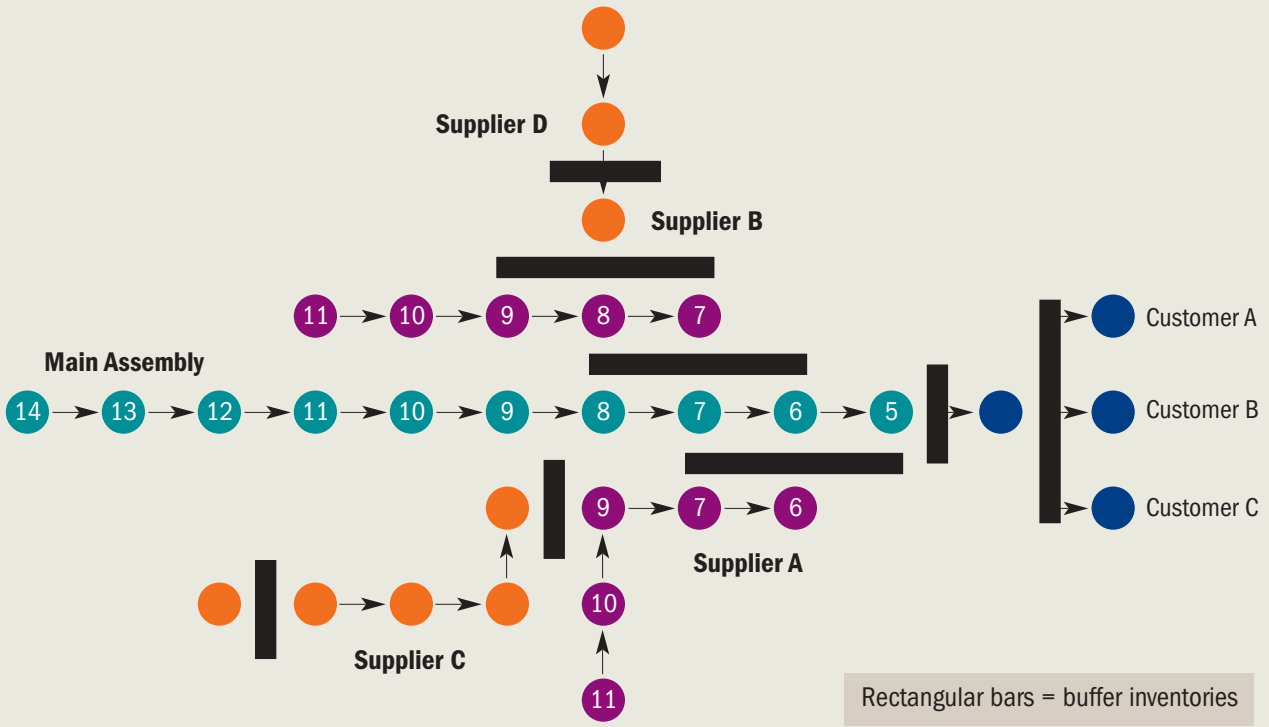
Figure 1: Buffer Inventory in Automotive Manufacturing



culty comes from the inherent inflexibility a long frozen period causes.

Beyond shortening the frozen period, another obvious way to improve flexibility is to reduce dependence on order sequencing. Rather than sequencing orders, sequence time. For example, an airplane with 100 seats that is scheduled to leave every morning is sequencing time. The ticket agent doesn't know who will be in the seats, but tries to make sure they are all filled. Even if they're not, the plane still takes off, empty seats and all.

Challenges

AS AUTOMOTIVE MANUFACTURERS contemplate the shift to BTO, many important topics must be considered.

- **Ambivalence.** BTO goes against local optimization at the factory level. With the advent of Just-in-Time, manufacturers have focused on local optimization for the last 15–20 years. In many ways, we are in a state of efficient mass production, whereby lean factories are coupled with mass production supply and distribution strategies. Henry Ford's legacy lives on despite the best efforts of Taiichi Ohno.
- **Hidden financial consequences.** Many customers will not pay full price if the product isn't exactly what they want. Likewise, there are significant costs associated with influencing customer demand through price discounts and rebates.
- **Benefits of faster lead times.** What will customers pay for a 14-day lead time? Is there a distinct market advantage? If they see no difference between 14 and 40 days, then why not maintain a slightly larger frozen period and try to get suppliers to build-to-firm-orders? Or should suppliers absorb the cost of holding higher inventory levels?
- **Managing the supply chain.** Does effectively controlling the BTO supply chain depend on the density of supply bases around the plants? Nissan has one of the most compact local supply bases in North America, for example. Of all its suppliers, 65 percent are within a two-hour radius and 88 percent are within an eight-hour radius. Thus, a majority can likely support BTO within the frozen period, if it's long enough. Extensive frozen periods are problematic, however, when the customer wants changes and still expects a vehicle in two weeks.
- **Failing to address synchronization of processes.** It's true that customers may not want to pay a premium for cars furnished in 14 days; however, they are equally unwilling to pay full price for cars already on the lot if they're not exactly what they were looking for. Flexible, responsive BTO processes that successfully deal with resequencing orders likely will result in more profits through lower operating costs and better use of assets. The challenge for manufacturers lies in the inherent tradeoff between productivity and responsiveness.

Taking the leap

ONCE MANUFACTURERS COMMIT to BTO, the following must be accomplished. The first step is to get performance measures in sync. Serving customer relationships through fast and reliable deliveries, lower operating costs, and increased flexibility is paramount. But market share, capacity utilization, and labor productivity are still the key industry performance measures. Plant managers continue to be rewarded for taking two minutes off assembly time when what they should be rewarded for is taking 30 days off finished vehicle inventory by adding two minutes to the assembly time to make the plant more flexible.

Next, an organizational and operational understanding must be developed. While sequencing is often approached as an operational issue (making sure the mechanics of sequencing processes are implemented), scheduling flexibility is a bigger challenge organizationally. The ability to remain focused and responsive and keep processes cost effective gets to the core of how an organization enables the tactics necessary to be sequenced and flexible. Frequent schedule changes can be demoralizing to suppliers unless there's a clear understanding of why they occur and a system to manage changes without too much disruption.

Finally, it is necessary to establish a well-connected supply chain. It can be a challenge to keep everyone informed, in real time, of the details of each and every change. To solve this dilemma, companies habitually focus on real-time communication support, often achieved through information technology. However, before placing emphasis on technology to manage the information that drives the flexible supply chain, the supply chain must be organized around the collective benefits that faster response, lower costs, better quality, and greater flexibility will bring. Remember, sequencing is operational, flexibility is organizational. Coordinate and come together before applying tactical tools.

In order to meet constantly changing customer demand, automotive manufacturers are taking small steps toward BTO. They have a lot of work ahead of them, and frequent resequencing is a major challenge. However, it's both possible and necessary to overcome in order to achieve true scheduling flexibility in the final leap to BTO. ◆

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