Successful Build-to-Order Strategies

Start With the Customer

Build-to-order manufacturing has been hailed as a boon to both companies and customers. But to be effective, companies and their suppliers must first understand what customers want.

Matthias Holweg and Frits K. Pil

All companies wish they could produce exactly what customers want when they want it. The ability to be that precise would not only delight customers but reduce costs. The challenges, however, are formidable, and most companies settle for manufacturing standard products in bulk, guided by long-term forecasts. Unfortunately, demand rarely coincides with forecasts, and results fall short of expectations. Companies miss out on potential sales, or they end up burdened by inventory-holding costs and must entice customers with steep discounts or other incentives. Profits erode, and customers do not get what they really want.

In an attempt to offset their losses, companies end up creating island solutions, such as lean factories, believing that this will improve the entire value chain. The automobile industry, often considered an originator of best-practices models, is well known for such solutions. Auto manufacturers have used lean production to create more-efficient factories and improve productivity, but at the expense of the all-important customer perspective. To compensate for their poor understanding of customer needs, they produce larger volumes and more product variants, relying on their forecasts. Their focus then becomes how to get rid of stock and how to offset the cost to manage it. The more they continue on that path, the harder it is to produce the exact car the customer wants within the time the customer deems acceptable. (See "Why Push Strategies Ultimately Fail.") Indeed, a survey of prospective car buyers shows

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Why Push Strategies Ultimately Fail

Any company that supplies customized high-volume products — automobiles, furniture and electronics, for example — will be tempted to rely on strategies that push finished goods into the market because it needs revenue to offset bulk-production costs. The focus too often becomes simply how to make the shop floor more efficient, rather than how to optimize the whole system.

INVENTORY COSTS

While the factories smoothly turn out standard products, the savings from lean manufacturing plummet as companies rack up inventory-management and storage costs. The basis for the push strategy is customer-demand forecasting, which often results in inadequate supply, oversupply or worse, inadequate supply of desired products *plus* an oversupply of undesired variants.

For example, of the average 17 million vehicles sold in the United States each year, about 2 million new vehicles are held in inventory for 40 to 60 days. Conservatively, that means an annual interest cost of $2 billion, not to mention the cost of logistics, handling, storage and insurance. Investment-banking firm Goldman Sachs estimates that a BTO strategy would save companies $1,200 per vehicle in "phantom" costs, including price discounts and lost sales.*

The Destructive Cycles of Make-to-Forecast

In the first cycle, the company must rely on larger economies of scale to compensate for the use of push-based selling. In the second, the company loses sight of real customer requirements because it is selling too many products from stock.

ERODED PROFIT POTENTIAL

A push strategy also cuts into the profits a company can get by offering optional features. Take leather seats. A customer might be persuaded by discounts to purchase a car without them, even though she originally wanted them. Or she might buy a car with leather seats even though she did not want them, because the dealer has offered her a substantial discount to move the car out of inventory. Either way, the manufacturer — and to some degree, the customer — loses.

Research shows that 25% of customers in the United Kingdom do not get the vehicle they want. Of those, 53% receive discounts or incentives to accept the choice.†

Distributors of consumer goods have similar problems. The textile industry loses considerable revenue by clearing all remaining stock at the end of each season through sales campaigns and massive discounting. Although the market cycle is short, it is the manufacturers' inflexibility in dealing with a volatile setting that drives the strategy.

TWO DESTRUCTIVE CYCLES

Push strategies are part of a larger problem — reliance on making products to meet the forecast, which begins two vicious cycles. (See "The Destructive Cycles of Make-to-Forecast.") First, the company must increase volume to compensate for eroding profit margins, which means a further drain on resources. Second, even when the customer asks for a non-standard product, he must wait much longer than he would in a build-to-order environment because the custom product is competing for production resources. Customers generally do not want to wait that long and end up choosing something already made. The more products a company sells from stock, the more disconnected it becomes from real customer demand and the less likely its sales forecasts will match real customer requirements. As the cycle continues, the company finds itself building an ever larger proportion of products to forecast, and it becomes much harder to use the more profitable BTO strategies.

* Gary Lapidus, "Gentlemen, Start Your Search Engines" (New York: Goldman Sachs, 2000), 5.

† S. Elias, "New Vehicle Buyer Behaviour: Quantifying the Key Stages and Activities in the Consumer Buying Process" (paper presented at 3DayCar Annual Conference, Cardiff, Wales, Dec. 11–12, 2000), www.cardiff.ac.uk/3daycar.

The more they rely on the forecast, the more they lose sight of real customer requirements, and the harder it is to handle a custom order when it does come along.

that they are willing to wait only two weeks for a custom vehicle, and few volume manufacturers are able to comply.[1]

The auto industry's "shop-floor myopia" is ironic because lean thinking holds that the best way to reduce waste in the overall system is to make products to customer order.[2] Island solutions not only fail to improve the big picture but often can conflict with the company's overall objectives. Consider the trade-off between full truckloads and delivery frequencies. The more often a company ships parts, the less likely it will have a full truckload, so it reduces deliveries to what it needs to keep trucks full — an island solution. But when demand fluctuates, which is inevitable, the company ends up with emergency shipments and costly airfreight. The entire value chain suffers from those additional costs.

A more effective approach for both sides is *build to order* (BTO), in which companies examine responsiveness holistically across the value chain. The emphasis at each stage is how to meet customer demands efficiently. BTO forces companies to look at the total cost of an optimization. It is an encompassing and customer-centric view that lets companies react quickly to demand changes, reduce inventory costs and decrease discounting.

But it's also tough to put into practice. Companies must do much more than alter information systems or product designs. BTO requires flexibility across the entire value chain — in process, product and volume. (See "The Three Dimensions of a Successful Build-to-Order Strategy.") Getting it right on all three dimensions is hard work. Many companies have attained product flexibility but have not addressed process and volume flexibility. Others have attained volume flexibility but at a cost to the process and sometimes to the product. BTO will not succeed without a synergy among the three aspects of the value chain — something many companies don't fully understand. With synergy, they can manufacture a variety of items in succession, as well as schedule, produce and deliver specific varying volumes of the items to customer order and within an acceptable time.

Take the optimization that weighs a full truckload against delivery frequency. In a BTO strategy, managers would first look at the problem in terms of value added: "Does the increased frequency provide enough value to customers that they will pay for it?" They then would address the question across the three flexibility dimensions: process (Does it make inventory redundant?); product (Does it mean we can bring customization closer to the customer?); and volume (Will it be in sync with production?). BTO thus encourages companies to explore all the facets of responsiveness.

The Three Dimensions of a Successful Build-to-Order Strategy

Process Flexibility

- Link customer requirements directly to production, so that decisions are based on real customer demand, rather than on demand forecasting.
- Integrate suppliers to make orders visible to all value-chain partners.
- Perpetuate sales data through the supply chain to avoid any time delays and enable a fast response to changes.

Product Flexibility

- Bring customization closer to the customer to avoid relying on stock of finished products.
- Manage product variety by understanding the cost and profit implications of choice.
- Make support structures more mutable to enable total responsiveness.

Volume Flexibility

- Reduce dependency on full capacity by negotiating with workers and suppliers.
- Diversify production plants to cope with volume variability.
- Use incentives to manage demand level and profits, rather than reactively discount excess stock.

Optimization across the entire value chain, rather than in select parts

Process Flexibility

Process flexibility relates to the speed at which the company can make decisions, alter schedules or amend existing orders to meet customer needs. It determines, for example, how quickly the company can translate information at the customer interface into organizational decisions and operating mandates. Because it cuts across all parts of the value chain, process flexibility requires the cooperation of suppliers and distributors. It is particularly difficult to attain if the supply-chain climate emphasizes short-term, cost-centered initiatives rather than collaborative efforts to enhance mutual gains. Companies cannot impose BTO. All players must come to trust that a BTO strategy will benefit everyone.

Link Customer Requirements Directly to Production Building products when the customer wants them is challenging, especially when a product has multiple variants. Many companies cannot respond quickly enough and fear they will lose out to manufacturers that have faster service. As a safeguard, they turn to demand forecasting and thus stockpile a range of products, hoping to find a customer.

The more they rely on forecasts, the more they lose sight of real customer requirements, and the harder it is to handle a custom order when it does come along. A study of six typical European automobile manufacturers revealed an average 41-day lead time to deliver a custom-order car. The average manufacturer spent 34 days processing the order and assigning it a production slot. It took only two days to build and assemble the vehicle.[3] (See "Days To Fulfill a Custom-Automobile Order.")

The delays result primarily because the original production forecast rarely coincides with actual customer orders. The manufacturers use an order bank to fit the customer orders into the forecasts so that they can build the vehicle-production schedule. The bank introduces a 10-day delay in the process — a typical example of how forecasting push competes with customer pull.

Predictably, few people bother ordering a custom car. Indeed, only 33% of cars in the United Kingdom and as little as 5% in the United States are built to order.

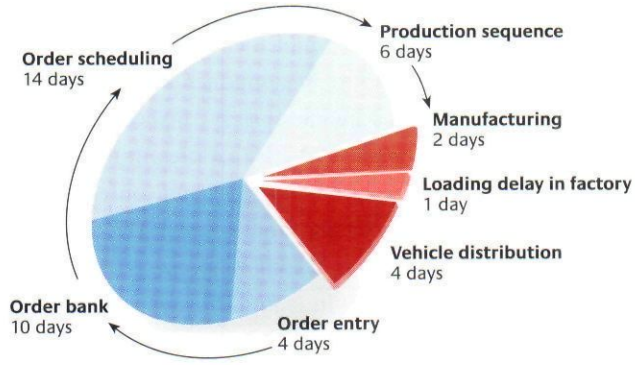
Contrast that with the electronics industry, in which some manufacturers have no need to stockpile any finished products. Dell Computer Corp., for example, can transfer a customer order to the factory within 24 hours of receiving it and typically can ship the order within a few days. The company uses an assemble-to-order strategy to link its customer information to production control and its production control to assembly operations. (See "Dell's Assemble-to-Order Value Chain.") Dell draws from an inventory of components at a local warehouse, so it can assemble any order as long as the components are available. The inventory is also a buffer against long supply lead times — say, for components that must come from Asia.

A variety of value chains in other industries have adopted the assemble-to-order approach.[4] Optician chains such as Vision Express in the United Kingdom will assemble a requested frame and custom lenses within hours — a process that takes some chains as much as two weeks.

Assemble-to-order works well in relatively simple environments and with products that have few components but many variants. Frequent use of the same components will most likely translate into stable demand in the supply chain. Lower-volume and slower-moving components, however, pose a risk. Using the assemble-to-order model in fast-moving markets, such as

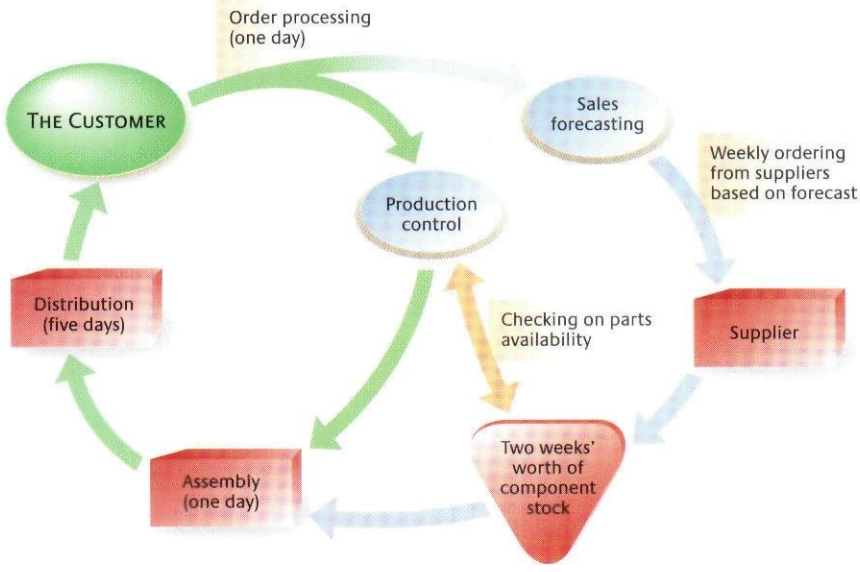
Days To Fulfill a Custom-Automobile Order

It takes on average 41 days to fill an order, but only two are spent actually building the vehicle, according to a survey of six European car makers.



Dell's Assemble-to-Order Value Chain

Dell directly links customer information to production control and from there to assembly operations. Consequently, the assembly plant receives a new set of orders every few hours and can build the computers within a day. Dell assembles orders using inventory from an on-site warehouse; it simultaneously replenishes components using demand forecasting.



electronics, risks stock becoming obsolete more quickly and parts depreciating faster. Indeed, other electronics companies, such as Compaq Computer Corp., have found it difficult to replicate Dell's delivery speed.

Integrate Suppliers Complex industries such as auto manufacturing will find it harder to implement an assemble-to-order approach. Dell manages 15 to 50 components per computer; an auto manufacturer must schedule at least 2,000 components per final product. Dell assembles systems that present no more than 100,000 different combinations to order, and only a few products account for much of the overall volume. Vehicles, in contrast, are assembled in billions of combinations — some of which require fundamental changes in manufacturing operations (left-hand drive as opposed to right-hand drive, for example).

For complex industries, component buffers are not an option. Instead, companies must closely tie their suppliers' production schedules to the assembly schedule of the custom products. When suppliers are geographically distant, lead time can seriously constrain the manufacturer, so the variants from suppliers must be limited. Companies then can introduce small buffers to accommodate lead times and variable volumes.

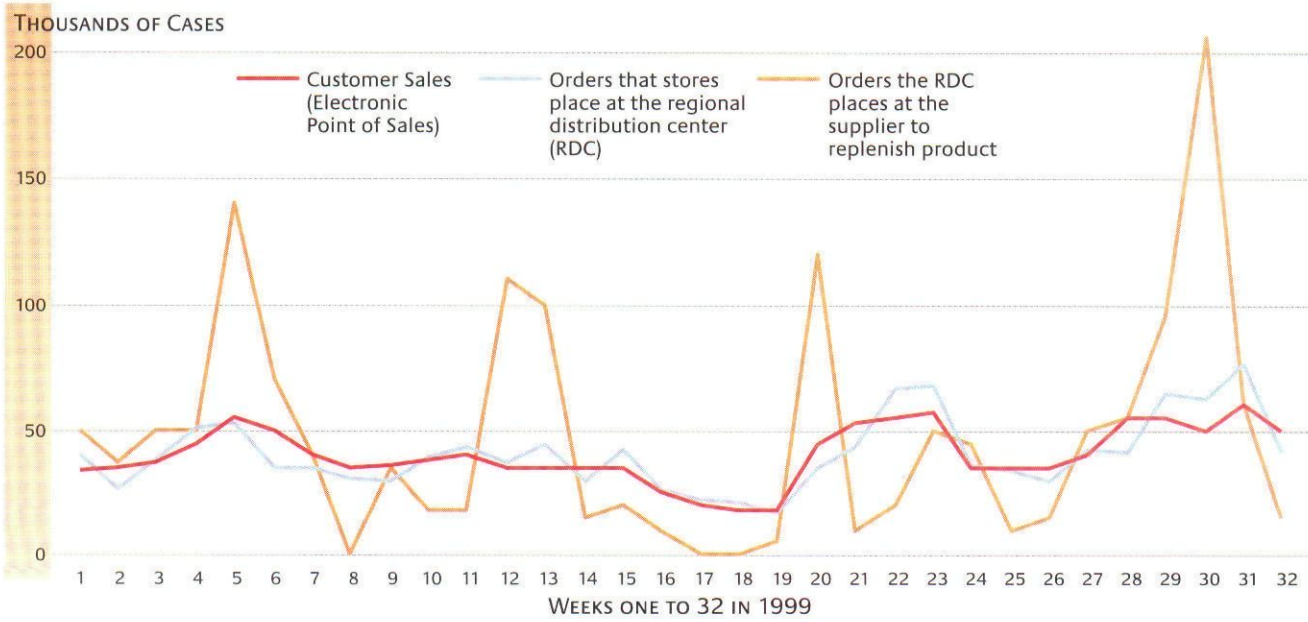
Perpetuate Sales Data Through the Supply Chain Ironically, most swings in customer demand do not come from the customer. They are artificially created as orders move along the value chain. Consider a soft-drink six-pack, which is a high-volume product in the grocery value chain. Suppose all the stores in the chain record sales from 18,000 to 60,000 cases, which they pass to the regional distribution center that replenishes the product. The center cannot supply the exact number, because it can supply only full palettes of cans, so it adjusts the order accordingly. At this point, the demand distortion is minimal. (See "The Extent of Artificial Demand Distortion.") However, the retailer then manually adjusts the order flow to get the supplier's volume discounts and to allow for planned promotions. This time the distortion is more dramatic. When the order finally arrives at the company that supplies the distribution center, per-week orders range from no cases to 205,000 cases. This bullwhip or whiplash effect — so named because the distortion gets larger with each link in the ordering process — is still prevalent in value chains across all industries, although it has been a concern since the 1950s.[5]

The supplier sees the final order, believes demand is highly variable, and buffers his operations with inventory. Thus, an island solution — creating inventory to stabilize production volumes — ends up hurting the rest of the value chain, ultimately translating into additional cost for the customer.

Demand distortion also disconnects the value chain from the customer and inhibits the company's ability to respond quickly. To keep the integrity of customer sales numbers, companies should rethink their contracts and pricing structure, perhaps

The Extent of Artificial Demand Distortion

Over 32 weeks, grocery stores in a study recorded weekly soft-drink sales of 18,000 to 60,000 cases, but by the time the supplier got the order, the range had been distorted to 0 to 205,000 cases.



basing volume discounts on annual consumption rather than on individual orders.

There are several initiatives under way to maintain customer-sales data through the supply chain. The grocery sector's efficient-consumer-response (ECR) initiative has successfully linked actual electronic-point-of-sales (EPOS) data with distribution centers and is beginning to have links to suppliers, too. Stock is turning over faster and being replenished more quickly.

The more recent Collaborative Planning, Forecasting and Replenishment (CPFR) emphasizes collaboration among trading partners.[6] The partners agree to develop a market-specific plan based on sound management principles. All sides agree to take responsibility for the process and the plan, which describes what is going to be sold, how it will be merchandised and promoted, in what marketplace and during what time frame. If one partner wants to change anything about the plan, the others must agree.

Product Flexibility

Product flexibility relates to how well the company adapts a product to the customer's specification and how much it is able to delay or reduce the degree of product tailoring. Textile manufacturers dye clothes at the last minute to satisfy fads. Cereal producers such as General Mills are experimenting with having customers choose their own cereal ingredients, which would then be mixed, boxed and delivered to their door.[7] Mass customization, postponement and late configuration are all routes to product flexibility.

Bring Customization Closer to the Customer Customizing late in the process lets companies respond faster to individual orders and stabilize production schedules. Consider, for example, how Hewlett-Packard handled the assembling of printers for different countries. By building a standard printer and postponing the addition of country-specific power leads and manuals, it obtained a leap in product flexibility at little extra cost.[8]

In consumer durables, such as furniture, late configuration is not always possible, however. And with vehicles, it even can be wasteful. Components such as mud flaps, alarms and stereo systems can be configured at the point of sale, but adding leather seats and air conditioning at that time would compromise product quality and raise product-liability issues. It would also require additional component inventory at the dealerships, with all the associated logistics, inventory-holding costs and obsolescence risks.

Customers cite only body style, engine, exterior color and type of radio as critical to the car purchase decision. Yet companies are spending a fortune to enable variation in options that customers don't deem critical.

In other words, customization is not a substitute for responsive production. It cannot be done to correct a basic configuration.

Manage Product Variety A Mercedes E-class has 3.9 trillion variants; a Honda Accord has only 408.[9] Is the Accord restricting customer choice? We found that customers cite only body style, engine, exterior color and type of radio as critical to the purchase decision. Yet companies are spending a fortune to enable variation in options customers don't deem critical. For many vehicles, 0.1% of specification accounts for 50% of sales. Moreover, in many instances, the number of possible specifications is more than 1 million times the number of vehicles the company will actually build. Hence it's important to determine what variations truly enhance customer-perceived value.

The level of product variety does not seem to affect total responsiveness in a predictable way. Japanese auto manufacturers in Europe find it almost impossible to build to customer order, despite having relatively few variants of individual models; companies such as Volvo and Mercedes build a large proportion of their production to order despite many product variants.

Make Support Structures More Mutable Volvo designs its support structures for key products and employs parts sharing, which simplifies scheduling and material logistics and enables greater economies of scale. The approach reduces the need to increase volume to cover development cost. Product variety doesn't necessarily mean complexity. But sharing just any set of parts is risky because it may reduce a product's unique look and feel. A better approach is to have key products share support structures for purposes of customization.

In the automobile industry, producers use a unique wire harness to connect a combination of electrical components that the customer has selected or the marketing department has forecast a demand for. But manufacturers must bundle the

components a certain way because the harnesses can accept components only in certain combinations. That reduces their ability to offer the exact product the customer wants.

Volvo is better at customizing because it uses a mutable wire harness that can handle any combination of electrical components. The mutable harness lets Volvo customers alter the electrical options through their dealer up to four hours before the vehicle is actually built, thus bringing customization closer to the customer. And because customization occurs late in the process, Volvo can avoid the cost of distributing and stocking large numbers of variants.

Volume Flexibility

Volume flexibility is a company's ability to respond to overall changes in demand by altering production volume. Some products are obviously seasonal. Demand for lawnmowers and convertibles is higher in the summer, and Ducati, the famous Italian motorcycle maker, experiences sales swings of 5-to-1 over a year. Demand for automobiles of all types fluctuates substantially during a year. To ensure that their plants are not idle during lulls, companies must be able to shift capacity utilization at minimal cost.

Capacity is a major concern to most companies considering BTO. They fear plants will be underutilized, especially when demand falls below optimum supply levels. But any production system will fail if demand drops, whether the company stockpiles products or builds to order. The focus should be on the ability to manage short-term variability in demand. A company either can make the factory more responsive or can manage the demand flow.

Our data suggest that the second option makes more sense, partly because of high fixed costs associated with most production operations. For example, running an automobile assembly plant at 50% capacity for a year costs an average 73% of full-capacity operating costs. The cost is even higher with short-term capacity changes — 50% capacity for one week would generate more than 80% of full-capacity operating costs.

Also, suppliers have volume rigidities. Without an agreed-on plan with suppliers to promote volume flexibility, companies are not likely to find plant-level improvements useful.

Reduce Dependency on Full Capacity One path to volume flexibility is to reduce annual labor costs, the largest proportion of operating cost. The company sets up an hours bank, in which workers agree to a total number of hours per year, but are flexible as to when they work those hours (within negotiated limits). If they work more hours during high-demand periods, instead of receiving overtime pay, they work fewer hours than "normal" when demand is less critical. The strategy reduces the impact of demand swings on labor costs and eliminates the need for costly overtime or untrained temporary workers, who may compromise quality.

Another approach is to shift capacity across plants. BMW, for example, can shift a group of trained workers to multiple plants in Germany to meet shifts in demand.

Diversify Production Plants In the diversification strategy, companies use large, efficient, but less flexible plants to satisfy the base demand, and smaller, potentially higher cost, but more flexible plants to meet low-volume demand and provide additional capacity if demand changes.

The steel industry — one of the most inflexible industries — offers an interesting example of diversification. The work follows a sequence of three main processes: first, using pressure and heat to partially fuse iron ore, coke and limestone (sintering); second, making iron in the blast furnace; third, making steel by reducing the iron's oxygen content. The steel is then cast and rolled into sheets, beams or wire. The rigid processes severely restrict the industry's ability to respond to demand swings.

To address that, key industry players have started to use mini-mills. These handle smaller, specialized orders, while the large mills deal with large orders. Mini-mills melt down scrap steel; they have no sintering plant or blast furnace. They would not be able to meet all the demand for steel nor could they make all the varieties. They exist to help the larger mills cope with demand swings and variety. The auto and textile industries have a similar approach.[10]

Use Incentives To Manage Demand and Profit The use of incentives and differentiated pricing to manage demand — and ultimately to maximize revenue — is common in service sectors. Pricing is

An hours bank reduces the impact of demand swings on labor costs and eliminates the need for costly overtime or untrained temporary workers, who may compromise quality.

Push vs. Pull Strategies

PUSH ← → PULL

	Make-to-Forecast (MTF)	Locate-to-Order (LTO)	Amend-to-Order	Hybrid Build-to-Order	True Build-to-Order (BTO)
Goals	■ Produce standard products from long-term-demand forecasts ■ Manage stock reactively to allow for efficient production	■ Use MTF, but increase stock visibility (through the Internet, for example) to enhance customer choice	■ Provide custom orders when specifications of product in system can be easily amended	■ Rely on forecasting for high-volume, stable products, and build low-volume products to order	■ Build products only after the customer orders them ■ Make customer needs visible to all parts of the value chain
Benefits	■ Efficient production ■ Local optimization of factory operations	■ Higher chance of finding right product in stock ■ Inexpensive to implement	■ Higher degree of custom-built vehicles in production	■ Stable base production ■ Relatively short order-to-delivery times on average ■ Less inventory ■ Less discounting	■ No stock apart from showroom and demonstrators ■ No discounting
Weaknesses	■ High levels of finished stock in market ■ MTF requires alternative product specifications and discounting to sell aging stock ■ Customer orders compete with forecast for capacity ■ MTF loses sight of real customer demand	■ High stock levels remain ■ Discounting still required ■ Custom orders still compete with forecast for capacity ■ Extra cost to transfer product to location close to customer	■ Customer orders built only when they fit ■ Unsold orders are built anyway ■ High temptation to revert to MTF if demand drops	■ Stock is still in market ■ Still requires discounting to cope with forecast error ■ Danger of reverting to pure MTF when demand shifts	■ System is sensitive to short-term demand fluctuations, so will not work without proactive demand management ■ Active revenue management required to maximize profit

related to delivery speed. To fly to New York tomorrow, an air passenger will most likely be charged full price. Booking a month in advance garners a better price; standby on the day of departure can be cheaper still.

British Airways expects to gain an extra 3% to 7% in revenue by continually altering its product offering and pricing, and some of its competitors believe they can achieve a 10% increase.[11]

But such time-based revenue management often is overlooked in manufacturing. The automotive industry, for one, seems to have it backward: The customer who buys an in-stock vehicle is most likely to get a discount (despite the cost the company bears to store the vehicle), but the person who orders a custom vehicle has to wait several weeks *and* pay full price.

In BTO, a company manages demand proactively — instead of reactively — to clear out stock. The customer chooses when the car is built. A company that receives orders early can anticipate long-term needs and therefore can manage and smooth capacity utilization in both the assembly process and the supply chain. That saves cost, which means customers pay less the longer they are willing to wait.

Making the Transition

Giving up building to forecast and instead building to customer order is not a trivial transition. It is hard enough to change the underlying legacy information systems. To change managerial mind-sets, cultures, reporting structures and power bases is daunting. Managers must view holistically the organization and its relationships with consumers and suppliers. Everyone must collaborate to make the value chain more flexible.

It is tempting to find shortcuts to a total transition. Many shortcuts seem to offer a cost-effective and reasonable compro-

mise, but most retain some element of a push strategy and end up negating the potential benefits of the BTO transition. (See "Push vs. Pull Strategies.") A slick variant of the push strategy that is receiving attention is virtual BTO, or locate-to-order, in which automobile customers search inventory online from all the company's dealers to locate the desired model. But the cost to ship the vehicle to the dealer nearest the customer can add several hundred dollars, depending on the location of the desired car. Moreover, customers using the Internet are not connected to the value chain, and that's what counts. They still have only two options: Choose from stock or wait more than a month for the company to build the car. Online order entry is certainly a viable element of a total BTO system. For total BTO, however, the underlying manufacturing process must be aligned in a way that optimizes all elements.

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Companies favor compromises partly because they don't cost much. But true BTO doesn't have to be cost prohibitive. A company might begin by updating its IT systems. BMW, for example, spent $55 million on its new European online-ordering systems at the core of its "10-day-car" BTO initiative. Not a lot of money, considering that General Motors has an annual IT budget of $3.5 billion. Hewlett-Packard achieved product flexibility at little extra cost.

Important First Steps Whatever managers decide to spend, they shouldn't proceed with a BTO transition without thoroughly understanding the key aspects of customer demand. It's important to ask what variety the customer really wants (as opposed to what the marketing department wants). Also, what order-to-delivery (OTD) times does the customer expect?

Once companies understand demand, they can begin to work on changing processes — both internally and throughout the value chain: making demand information visible to all players; bringing stock levels and delivery frequencies in line with upstream capabilities and the overall responsiveness goals; using inventory only to demonstrate products at the customer end and to buffer long inventory lead times, with the goal of eventually reducing inventory; making order lead times as short as possible.

Only after integrating information flow, examining response time and exploring systemwide cost implications can companies truly understand responsiveness across the value chain. From that point, three strategies are possible.

Offer BTO for Existing Products. Offering BTO for existing products is a strategy with considerable risk. The company could experience a drastic drop in demand as customers used to buying from existing stock adapt to the idea of choosing custom products. Production volume may decrease in response, triggering a drop in capacity utilization. The strategy does, however, get the quickest results, particularly in fast-moving markets. It is most suitable for environments in which fixed costs are low and response speed is more important than production cost.

Introduce BTO for New Products. Introducing BTO for new products is a strategy with appeal for manufacturers who position their products in the upper market segments. "Custom" then becomes a marketing tool to support brand image. BTO benefits accrue only to the new product, however.

Combine BTO With Forecasting. In the hybrid approach, companies make stable high-volume product specifications to forecast and build specifications to order less frequently. Hybrid BTO works well for standard products that are customized. A car company would use a consolidated central-stock or a distribution center rather than hold stock at the dealer. That not only would decrease dealer inventory, but also would stimulate a cultural change. Dealers would order all products — whether they came from the distribution center or were built to order. Nothing would sit in inventory. By gradually reducing the number of high-volume variants held in central stock, a company would increase its build-to-order products until ultimately it built all products to order.

However, managers should not become complacent after partially reducing reliance on inventory. In the hybrid approach, they would still be carrying finished-product stock. If forecasts were wrong, inventory could build up, increasing pressure to revert to a push approach.

In the United Kingdom, several auto manufacturers have begun to implement the hybrid strategy. Peugeot supplies all

dealerships from only four distribution centers. The dealers hold no stock, but Peugeot guarantees next-day delivery from the centers. Initially, many dealers disliked the approach. Once they discovered that products were indeed available on request and that the delivery system worked, they gradually accepted the system.

Most U.S. dealers are equally cautious, believing that large inventories and associated product choices entice customers. Yet 74% of U.S. consumers stated in a survey that they would rather wait for the vehicle with the options they really want than settle for one from the dealer's lot. And 62% were even willing to wait to get the color they want. However, most said they would wait no more than three weeks after ordering.[12]

Who Will Be First?

Although the move to BTO is not easy, considerable gains are possible. Eliminating the waste of overproduction and inventory at the most expensive point in the value chain offers opportunities for tremendous savings. Greater market sensitivity and reaction speed not only enable customization, but also improve unit profitability. The most significant benefit of BTO, however, may be that the company reconnects with its customers, obtaining the insights needed to enhance the responsiveness of the entire organization.

The electronics industry seems closest to realizing BTO. Dell has shown how BTO provides significant competitive advantage — not only in faster product delivery, but also in shorter time to market. The industry as a whole has attained both product and volume flexibility, and it has demonstrated process flexibility at the front end with strategies such as assemble-to-order. But even Dell needs to do more. Certainly, its order-fulfillment model is efficient, and its assemble-to-order approach is closer to BTO than other companies' approaches. It has completed that all-important first step — understand customer demand — but it has not yet addressed all its processes. It still maintains extensive component inventory at the factory — inventory it replenishes using forecasting.

But regardless of who gets there first, the point is that BTO is too valuable to remain a wish. With a solid plan, dogged perseverance and good communication, most companies can reconnect the customer to the entire value chain and end their reliance on forecasting.

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5. For more on the bullwhip effect, see H.L. Lee, V. Padmanabhan and S. Whang, "Information Distortion in a Supply Chain: The Bullwhip Effect," Management Science 43 (1997): 546-558; and J.W. Forrester, "Industrial Dynamics — A Major Breakthrough for Decision Makers," Harvard Business Review 36 (July-August 1958): 37-66.

6. For more on the Collaborative Planning, Forecasting and Replenishment Committee of the Voluntary Interindustry Commerce Standards, see www.cpfr.org.

7. See www.mycereal.com.

8. E. Feitzinger and H.L. Lee, "Mass Customization at Hewlett-Packard: The Power of Postponement," Harvard Business Review 75 (January-February 1997): 116-122; and J. Pine, "Mass Customization: The New Frontier in Business Competition" (Boston: Harvard Business School Press, 1993).

9. The data is for the 1999 models offered in the United Kingdom. For more detail, see M. Holweg and A. Greenwood, "Product Variety, Life Cycles and Rates of Innovation," World Automotive Manufacturing (April 2001): 12-16.

10. In the auto industry, swing plants handle demand variation, and they are typically in countries that have generous policies toward subsidizing worker salaries when plants are not operational. In the textile industry, plants near the customer base (generally higher-wage locales) manage deviations from demand forecasts.

11. That is not unrealistic. A typical European short-haul flight has nine major pricing categories, which can yield more than 100 ticket prices for the same flight. Thus, two people on the same flight are very likely to pay a different price for the same service.

12. "Gartner Survey," www.gartner.com.

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