The false promise of mass customization

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Build to order will be hugely expensive and challenging, and its benefits are uncertain. But there is a cheaper alternative.

For more than two decades, mass customization has been the future of manufacturing—and for some manufacturers it probably always will be. On the face of it, mass customization is a remarkably attractive proposition for consumers and producers alike. Consumers get a reasonably priced,
tailor-made product reflecting their personal selection of colors, features, functions, and styles. Producers, for their part, get to reduce their inventories and manufacturing-overhead costs, to eliminate waste in their supply chains, and to obtain more accurate information about demand. In short, a win-win proposition.

Two relatively recent developments have given the prospects for mass customization a boost: first, the success enjoyed by Dell Computer and other high-tech companies that build products to order and, second, the emergence of the Internet. Dell’s story is by now a familiar one. Over the phone or via the World Wide Web, customers select what they want from hundreds of different components to configure the computer of their choice, which Dell doesn’t begin to build until it has the money for it in hand. The company has become the envy of manufacturers of all stripes—from auto-makers to toothpaste formulators—that produce to forecast and are thus burdened with sizable finished-goods and components inventories and lagging cash flow.
The second development—the Internet—gives manufacturers a platform for taking orders from a mass audience for customized products, such as bicycles, clothes, cosmetics, shoes, and vitamins, at almost no cost. In the past, customization of this kind was handled by skilled but expensive salespeople closely interacting with customers.

But mass customization isn’t necessarily feasible for all goods. Assembling cars, for example, is more complex and difficult than building computers. Still, auto companies such as BMW, Ford Motor, and General Motors have high hopes for the build-to-order (BTO) approach, a variant of mass customization.¹ They are convinced that the costs they can wring from their business systems by switching to BTO are enormous, that the benefits to customers are numerous, and that the many difficult challenges they face in implementing BTO can be overcome.

Ford and GM have already launched experiments with full-fledged BTO for customers in a couple of cities. Other auto companies, in North America and Europe, have said in their public pronouncements that they will move to broad-based BTO systems in two to three years; privately, they have been heard to say that the change may take five or six.

Nonetheless, we remain doubtful about the benefits of BTO. The challenges of implementing it in the auto industry are daunting—particularly in North America—and it isn’t clear that the economics will work. Moving from a mass-manufacturing (or “push”) system of production, which automakers have continually refined over the years, to a BTO (or “pull”) system would require numerous operational and organizational changes throughout the auto industry value chain (Exhibit 1). Yet the payoff from all this activity is unclear. Luxury-car buyers seem eager to specify their preferences in great detail. But it is still too early to tell whether mainstream customers want their vehicles built to order, let alone how much they would be willing to pay for this.

Fortunately, automakers bent on a BTO future have a “virtual” alternative that could expand the customer’s choice without presenting the challenges posed by real BTO. Yet this alternative would still allow car companies to get much better information about demand than they have now.

¹Mass customization typically means selling highly individual products on a mass scale. Proponents of this approach liken it to a rebirth of craft production but on a larger scale. Build to order means that a product is built only in response to a customer order, but the product may or may not have to be customized. This is a subtle difference, but a critical one: auto industry executives typically consider the term “mass customization” misleading and refrain from using it.
they can ill afford. Focusing time and assets on the lower-cost virtual alternative is a better idea, notwithstanding the enthusiasm of the business press for BTO.

**The promise of BTO**

Broadly defined, BTO is already a reality: customers can place special orders for cars today. At the simplest level, customers (or sometimes dealers) can check the inventories of various lots within a given geographic area to see whether a car being sought already exists. Customers can also ask their dealers to order cars from the manufacturer. Most customers in the United States aren’t aware that they can order cars, and dealers generally don’t tell them—understandably, dealers would rather push inventory already aging on the lot. However, customers who want a special-order car may have to wait weeks or even months for delivery. In the United States, the auto industry
is geared to building, assembling, and delivering to stock—essentially through a batch method. Individual orders are worked into the system as time and inclination permit. Numerous surveys suggest that many buyers prefer to take what they can get rather than wait for the car of their dreams.

Consumer demand for custom-made cars is greater in Europe: about 19 percent of all cars sold there last year were special orders (compared with 7 percent in the United States), according to separate studies conducted recently by Goldman Sachs and by J. D. Power and Associates. A number of differences between Old World and New World markets explain the variance in these percentages. The lots of European dealers, for example, are typically smaller (often as a result of higher real-estate costs), so there are fewer vehicles on hand for buyers to select from—which prompts special ordering. BTO is more appealing to premium-car buyers, and some European markets, such as Germany, sell higher proportions of such cars.

Finally, though Europeans must wait just as long as people in the United States for ordered cars to be delivered—from six weeks to six months or more—rough data suggest that Europeans are more willing to wait for the right car than are US buyers, perhaps because Europeans are less impulsive in their purchasing habits and are more used to waiting.

Automakers on both sides of the Atlantic are nevertheless united in their conviction that they could raise prices somewhat and reduce costs substantially if the majority of their customers bought special-order cars. Prices could be raised because customers would have difficulty comparison shopping, and they would be getting exactly what they wanted. At the same time, dealers and original-equipment manufacturers probably could cut back on the enormous discounts often required to “move the metal” from the back of the dealer’s lot. These sometimes amount to thousands of dollars a car.

But the far greater lure of BTO, for automakers, lies in the hope of lower supply chain costs. A true pull system would mean a massive reduction in finished goods (for both the manufacturers and the dealers) and in components inventories (for both the manufacturers and the suppliers). Industry analysts estimate that if customers bought a majority of cars built to order, the industry could capture as much as 70 percent of the capital lost or locked up in the present push system—lost when inventory becomes obsolete following a change in models, production processes, and assembly struc-
ures, or locked up in metal and components kept on the shelf to meet unan-
ticipated demand. By capturing this lost or locked-up capital and by reducing
discounts offered to move inventory, carmakers could realize total savings
(reckoned by capital spent) of $65 billion to $80 billion a year. Nissan
Motor, for one, has estimated that this could amount to a savings of up to
$3,600 a vehicle.

**Daunting challenges**

But making mass customization in the auto industry real, particularly in
North America, would require carmakers to deal with enormous changes—
in design, sourcing, manufacturing, marketing, and distribution.

**Management paradigms**

Mass customization would require manufacturers to rethink the way they
absorb fluctuations in production. OEMs such as Ford and GM, for exam-
ple, would have to idle their plants during periods of low demand, though
unionized labor would still have to be paid. For that and other reasons, just
breaking even requires most plants to run at no less than 80 percent of
capacity.

**Operational changes**

Achieving the strategic manufacturing flexibility required for mass custom-
ization would require many operational changes. Customers may like to
choose the color of their cars, for instance, but paint shops at car plants run
in batch mode to cut costs and to minimize the emissions and waste that are
generated every time paint guns receiving new colors are flushed.

Carmakers could achieve BTO by modularizing—that is, by fabricating indi-
vidual cars not from thousands of distinct parts but from mere dozens of
larger mix-and-match modules. But because carmakers might have to carry a
range of modules (some of which may vary slightly in color, choice of fabric,
or even an individual part), modules could involve greater inventory redund-
ancy and waste within the supply chain than do nonmodular components,
which can be configured exactly according to demand. In addition, modules
take up more floor space than do loose parts and are costlier to ship. At both
DaimlerChrysler’s Smart-car plant in France and Volkswagen’s Resende truck
plant in Brazil, modular supplies have introduced a range of productivity

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2 To cite just one example, in Europe more cars are shipped by truck than by rail. But the vaster distances
of the United States dictate the slow pace of rail shipment, which ties up inventory and discourages last-
minute order changes.
and quality problems. As one Smart-car executive put it, “We had to learn that what makes sense in theory has headaches in real life.”

The supply chain

BTO introduces even greater challenges upstream of the assembly plant, in the supply chain. Currently, the chain is designed to deliver, on time and to the right location, mass quantities of standard components, not to adjust the output mix according to individual orders (Exhibit 2). The latter approach would tend to require shorter supply links, yet the low-wage areas where many current suppliers are located happen to be a great distance from the carmakers’ assembly plants.

The role of dealers

Although most US states at present have franchise laws prohibiting manufacturers from selling directly to consumers, dealers are still likely to view BTO as a threat. Ironically, the dealers’ resistance is reinforced by the OEMs’ policy (especially in the United States) of providing free financing for the first 10 to 30 days of inventory on dealers’ lots. Dealers have told us that they actually value large stocks, up to a point. Said one, “A large number of cars on my lot shows I am healthy, open for business, and offering wide choice. Why should I trade that in for two demo cars in a dinky showroom?”

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**EXHIBIT 2**

A flexible factory still needs a supple supply chain

<table>
<thead>
<tr>
<th>Time estimate</th>
<th>Scheduling</th>
<th>Production</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>30–40 days</td>
<td>3–7 days</td>
<td>10–12 days</td>
<td></td>
</tr>
</tbody>
</table>

**Barriers**

- Production scheduling delays due to market allocation constraints and erratic availability of parts
- Limited number of confirmed orders from dealers
- Limited visibility of order data within supply chain
- Long lead time for suppliers (2–4 weeks or more)
- High inventory and overtime costs for OEM and supplier due to frequent scheduling changes

- Inflexible assembly operations
- Focus on minimizing downtime
- Time allowed for rework
- Plant shop issues, such as batch size, changeover of paint color
- Stock-keeping unit (SKU) complexity

- Issues of geographic dispersion
- Slow railroad transport and expensive road transport
- Limited OEM control over vehicle movement, dealer customization

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1 Original-equipment manufacturer.
2 Includes vehicle options such as sunroof, engine type, or transmission type.
Labor and the rest of the organization

Automakers would face numerous organizational challenges as well. Labor unions would oppose the external assembly of modules and managers throughout the OEM organization and the value chain would at least initially resist incentives that pull parts and cars through the system in response to customer demand instead of pushing them through supply and assembly plants to dealerships.

Information technology

Most players are saddled with IT systems designed to support mass production. These systems include demand management, manufacturing resource planning (MRP), enterprise resource planning (ERP), manufacturing execution, and supply chain systems, some of which are still running in overnight batch mode. Adopting BTO might require companies to update and integrate their dozens of diverse systems.

Will consumers buy it?

Assuming that BTO can be implemented, will it appeal to consumers? Automakers point to growing evidence that their customers would welcome a BTO option. Last year, a survey by J. D. Power and Associates revealed that 17 percent of North American car buyers would purchase a build-to-order vehicle the next time they bought a car—if they didn't have to pay more and got what they had ordered in eight weeks or less.

The true depth and extent of customer demand for a build-to-order vehicle is still largely unknown. Carmakers cannot gauge the receptiveness of buyers of mass-market cars in either Europe or North America. Specifically, carmakers haven’t identified the incremental factors, such as time to delivery, that prompt customers to switch from one option to another or prevent them from doing so. Is it two weeks? Five days? Will customers accept delivery times that could vary? In addition, some customers have said in surveys that they place greater value on the dealer’s ability to help them understand whether one option or another will enhance or undercut a vehicle’s resale value than they do on expanded choice.

BTO won’t become a reality until the industry has a better understanding of what it is about BTO that customers value. Is it getting their specifications met? If so, how much delay will customers tolerate to achieve that? Also, are some segments of the market willing to pay extra for BTO and, if so, how much? Would they pay an extra $100 for red paint so that they did not
have to settle for white, say? And to what extent do the answers to these questions depend on not only consumer segments but also geography and vehicle models?

**A virtual alternative**

In view of these mysteries and obstacles, it is fortunate that an alternative path for OEMs exists. Indeed, some are already pursuing it—admittedly, in a quiet way, given the "political correctness" of the pure BTO model. They are finding that the alternative offers many of the benefits of a true BTO system while lacking its operational and organizational drawbacks. The alternative does so by connecting customers, either over the Internet or in a dealer’s showroom, to the vast, albeit far-flung, array of cars already in existence, including vehicles on dealers’ lots, in transit, on the assembly line, and scheduled for production. In this way, customers are likely to find a vehicle with the color and the options they most want. Automakers would not have to build to order; rather, they would enhance the customer’s ability to locate (a term coined by Forrester Research).

Customers shouldn’t care whether the car they purchased was built expressly for them or found for them somewhere in the supply chain, as long as it had the features they wanted and they got it in a reasonable amount of time. (Certainly, Dell’s customers don’t know whether their PCs were actually made for them or pulled from an order queue.) For automakers, this is a low-cost solution that is easier to implement than BTO yet likely to provide high customer satisfaction. Just as important, this approach offers automakers access to customer data and insight into customer preferences—for features, options, colors, and so on—equal to what real BTO promises.

But a virtual BTO system means trade-offs for consumers as well as for automakers. It might offer a more limited selection of options than true BTO, take longer to deliver the right vehicle to the customer, and force carmakers to charge more for some options. That is because neither the three distinct stages of batch auto manufacturing (stamp and weld, paint, and assemble) nor a manufacturer’s scheduling processes would change significantly when it adopted the virtual BTO model. If the customer ordered an option, such as a certain style of sunroof, that was installed during an upstream manufacturing stage and wasn’t already part of a vehicle in inventory or production, the automaker would have to interrupt the production
flow. And the OEMs themselves, under a virtual system, wouldn’t immediately gain any of the massive operational benefits promised by a true and realized pull model.

Ford and GM, among other companies, are experimenting with virtual BTO programs. Ford launched its on-line virtual BTO offering, FordDirect.com, in California in December 2000 and plans to roll it out nationwide by the end of 2001. Through FordDirect, California customers can search for Ford vehicles in dealer inventories; in time, Ford says, it will provide information about vehicles en route to dealers and on the production line. More than three-quarters of all Ford dealers in the state are participating in the joint venture, 80 percent of which was allocated to the dealers to get around regulations blocking OEM ownership of retail outlets.

GM in turn launched an enhanced version of its GMBuyPower.com Web site recently for Minneapolis customers and has plans to roll out the program nationwide by the end of 2001. GMBuyPower.com allows customers to research and locate existing cars with the features they desire or to get cars by special order. GM is also considering hooking up with dealers in a joint venture called AutoCentric, which would link a “locate/build-to-order” application to a Web retailer such as Autobytel.com. GM might even permit customers to use the Web to order vehicles made by competing carmakers.

In truth, changes that the auto industry must make to implement BTO are needed in any case. Automakers should take inefficiencies out of their supply chain systems and e-enable manufacturing and distribution systems to become more flexible and responsive. Such moves in themselves would shorten the feedback loop between demand and delivery.

But making the complete attainment of true BTO the goal when the changes required are mammoth and the returns so uncertain is another matter entirely. The auto industry has a history of disappointing returns from its investments in massive change initiatives, such as implementing ERP systems and placing hordes of robots in its plants. Should it neglect the safer, easier alternative—the virtual BTO option—the industry could be disappointed once again.