

Is mass customization nearing its tipping point?

Two decades in, technical advances and 3 primary enablers drive the movement

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The term “mass customization” was first used by Stan Davis in his book *Future Perfect* and then described in great detail by Joseph Pine in his book *Mass Customization*. Since then, hundreds of articles have been written about the subject, but there have been significant changes in the concept and advances well beyond what was envisioned in the early 1990s. While scholarly research tends to lead trade publications in number, Figure 1 shows this is still a “hot topic” for both trade and academic audiences.

The world had one view of mass customization 20 years ago, but organizations have made great strides in moving customer involvement and control deep into all aspects of the supply chain from designing, sourcing, making, delivering, selling and returning. Customer choices have risen, along with increasing supply chain management challenges.

In some areas, offering choices has become complex and has had negative effects on markets and customers. In other areas, explosions in new technologies, personalization and automated production and delivery systems have increased the complexity of supply chains, making mass customization more demanding. Let’s look at the topic of mass customization as it was originally conceived, how it has evolved and the likely areas of continued growth in the future.

A supply chain manager’s nightmare

Mass customization has many faces and evokes many different emotions.

To the consumer, it can be a candy store, with an indescribable variety of goodies, or a haunted house with a bewildering maze of complex hallways and fearful choices. To the retailer, it can be a chance to dazzle customers with a never-ending assortment of goods and services or a hopeless struggle with an overwhelming number of SKUs, inventory mismatches and high forecasting uncertainties. To the manufacturer or

service provider, it can be a chance to display process flexibilities that will assure distinctive competencies or a nightmare of setups, changeovers, schedule pressures and small lots that result in unexplainable and unacceptable cost variances and uncertain lead-times.

Two decades ago, companies were developing techniques for identifying smaller and smaller market segments with their unique preferences in styles, tastes, sizes, packaging and functional features. Traditional manufacturing plants and supply chains were built primarily for cost efficiency and mass production, not for process flexibility and the agility to produce greater varieties of products in smaller lot sizes. The smaller lot sizes, more frequent shipments and accelerated pace of new product introductions resulted in increased supply chain complexity.

SKU proliferation was accompanied by high-pressure market forces to cut lead-times to market for new products and replenishment times for goods sold, all while reducing costs and managing ever-shortening product life cycles. Increasing granularity in the markets also required more detailed unit product forecasts with higher levels of uncertainty in supply and demand. Stock-outs and excess inventories abounded.

However, in spite of the supply chain challenges, customer choice proved to be of substantial corporate value and often led to measurable increases in sales revenue and profits.

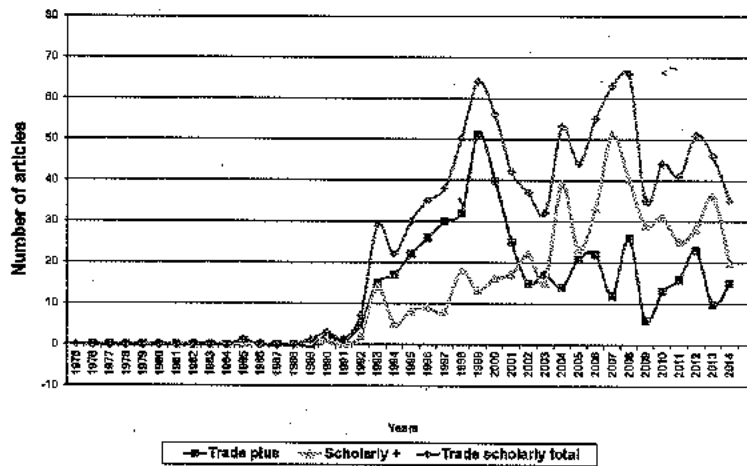
Back in 1997, James H. Gilmore and B. Joseph Pine II in their *Harvard Business Review* article "The Four Faces of Mass Customization" identified four successful approaches to customization prevalent at that time: collaborative, adaptive, cosmetic and transparent.

Collaborative customizers sought direct customer input to help them design and produce new products and product lines that met that market segment's particular desires. Adaptive customizers sought to create standard products that could be adapted or configured to meet

FIGURE 1

A mass of research

The number of articles, scholarly and otherwise, focusing on mass customization has exploded since the 1990s.



different customers' needs. Cosmetic customizers offered standard products but in different configurations, such as different sizes, shapes and color of packaging. Lastly, transparent customizers analyzed their customers' behaviors and needs and sold them customized products without letting the customers know their products had been customized.

The lure of mass customization is undeniable, but the dilemma always has been how to satisfy these seemingly contradictory objectives – customization versus standardization and ready inventory versus just-in-time creation and delivery to customers. Early definitions stressed the need to make large volumes of customized products at or near the cost of mass produced products and with relatively short response times. The key objectives were lower cost and reduced time.

What has changed?

If companies have been successful in implementing mass customization and it appeals to customers, why hasn't mass customization replaced mass production as the predominant approach to all manufacturing?

In recent years, research suggests several reservations about the universal

appeal of mass customization. Many operations professionals say "it would be nice," but the ability to design and build mass customized products is still elusive. Marketing professionals remain attracted to the concepts of one-to-one marketing and customer relationship management, but recent findings challenge the assumed universal appeal of mass customized products. And overall, management is finding that mass customization is just not a viable alternative to mass production due to its inability to achieve mass market levels of efficiency.

While there are numerous examples of the successful use of mass customization, it appears that it has not yet adequately confronted the need to make a customized product at low cost and with a short response time. Customers want customized products, but a recent study of online shoppers found that price and waiting time are still the most important criteria in purchase decisions. One of the ongoing attempts at mass customization has been increasing the number or variety of product choices.

The effects of product proliferation

Many early successes in mass customization resulted from methods such as

early customer input, modular designs, postponement in manufacturing and assembly, and customer involvement in the final choice or configuration.

For example, in 1988 Whirlpool patented the first dishwasher with interchangeable front panels of different colors that customers could change themselves. In 1996, Dell.com was launched and subsequently mastered postponement and customer involvement in final computer assembly and software configuration. Many companies have used adaptive customization to redesign manufacturing processes to postpone final mixing of product ingredients, packaging and labeling to maximize responsiveness to market and retailer choice.

Most consumer product manufacturers have even become agile in meeting different retail packaging specifications. For example, Wal-Mart and Walgreens often specify very different packaging, sizes and quantities per package for the same products in their respective stores. This is a form of cosmetic customization aimed at better fitting perceived market desires in those retail settings.

All of these production changes have encouraged and conditioned retailers and consumers to expect choice, involvement and responsiveness to preferences. On a recent visit to a local grocery store of average size, we observed more than 400 choices of salad dressing, more than 230 choices of toothpaste and more than 200 choices of barbeque sauces. Granted, there were not 400 different flavors. Many of the choices were different sizes, shapes, packaging or minor ingredient variations such as fat, sugar or sodium content.

However, they were all different SKUs. Two decades ago, most households would stock only one or two salad dressings in the refrigerator and have one or two tubes of toothpaste shared by family members. Now most families have at least as many salad dressings at home as their favorite restaurant, and each family member has his or her own

personal tube of toothpaste. How many choices are enough? How many different products are consumers willing to purchase and stock for themselves? Have we reached the tipping point when supply chains and consumers say we have too many choices and we need to return to a simpler life?

In many of these product areas, choices and inventory levels most likely will be more customized to local market tastes. A great current example of this type of collaborative customizing is Lay's "Do us a flavor" campaign to identify new flavors for potato chips. The first campaign was so successful that the company is running it again. Any consumer can create new flavors and design their own packages. The public is invited to vote on submissions. They can see what is most popular in different states, what preferences their Facebook friends have voted on, and even what's trending based on the Google-powered daily Flavorcast.

We lost count of the more than 3,000 possible new flavors posted earlier this year on www.dousaflavor.com.

Choice saturation is occurring in some areas, and there is evidence that expansions of some product offerings have produced negative effects. Barry Schwartz, in his 2004 book *The Paradox of Choice* and other studies, noted that the more retirement investment options a company offers its employees, the fewer employees subscribe. Because of the perceived complexity of the choice and fear of making a bad decision, employees make no choice at all. Consequently, companies lose sales, and the employees often forfeit the matching contributions of their employers.

In the medical field, more and more patients are given choices of treatments and told that they need to make the decision. Out of fear and lack of understanding there are often detrimental health delays because of failure to choose a plan. When choices are complex and the pros and cons of each path can't be understood clearly, consumers and busi-

nesses sometimes postpone or elect not to make purchase decisions, even if there are negative effects.

Mass personalization -- where are we headed?

Kevin O'Marah of SCM World noted in early 2015 that customer preferences may be changing.

He reports the results of a survey of supply chain and operations executives who were asked to offer perspectives on the future of manufacturing. He describes the key takeaway as "manufacturing is entering a new phase of customization-oriented production that is less concerned with productivity and efficiency and more focused on agility and responsiveness."

This suggests taking the concept of mass customization even further, to mass personalization where every individual can choose the type and level of customization desired. While mass customization shifted the emphasis from mass markets to niche markets, mass personalization goes even further -- to markets of one. This shifts the focus from how a manufacturer can customize to a focus on making what the customer wants. It also raises the question of how to find out what the customer wants. Over the last four years, researchers have increasingly emphasized the need for companies to adopt a customer-centric perspective in their mass customization programs.

Developments such as e-commerce, mobility, social media and omnichannel retailing have contributed to a big increase in the number of SKUs, variety of fulfillment modes and range of options expected by the modern shopper. These comments from manufacturers lead us to the question of where we are headed. What are the factors that are helping or constraining manufacturing in its pursuit of mass customization? At least two trends appear relevant: New and disruptive process technologies, and new and disruptive management programs.

New and disruptive process technologies: The computer and all of its related technologies, such as the Internet, mobile devices and social media, have revolutionized the business environment. Companies are challenged to keep pace or fail.

Initially, organizations thought of this technology as a means of just reducing costs. However, managers are now finding that the development of these new technologies can be directed toward customization.

O'Marah recently reported how companies considered the following technologies as disruptive and important for their companies: Big data analytics, digital supply chain, Internet of things, cloud computing, advanced robotics and 3-D printing. O'Marah concluded that "fast increasing rates of investment in advanced robotics, additive manufacturing and advanced digital simulation of manufacturing processes all lend themselves to shorter production runs and more unit-level customization." The movement toward increased automation may also be a means of increasing the ability to mass customize.

New and disruptive management programs: During the lifetime of mass customization, other management programs have been more directly concerned with reducing costs (lean production) or more directly satisfying the customer's demand for fast response (omnichannel retailing).

In the *Journal of Intelligent Manufacturing* in 2012, Brandon Stump and Fazleena Badurdeen explored the potential of using lean manufacturing with mass customization and found the two approaches were somewhat compatible, especially when the customizing occurred late in the manufacturing cycle, or what they called low-level mass customization. As the degree of customization increases and customer involvement occurs earlier in the design and fabrication stages, the direct application of lean principles to maintain flow and low levels of inventory becomes more difficult.

Omnichannel retailers have been concerned primarily with providing the customer with a convenient way of shopping and eventually buying a product, then receiving that product in the fastest way possible. Omnichannel retailing itself is a form of mass customization in that the customer can specify the method of delivery. As retailers move to online selling, it creates a greater opportunity for mass customization, which is not possible in a make-to-stock environment.

Three emerging primary enablers

We are already seeing great advances in mass customization and even mass personalization, and there are three major enablers.

The first enabler is the ability to link, through technology, a vast collection of input and customer involvement directly into the production process so that customers are designing, producing and making distribution decisions for personalized products. An example is Shutterfly, where the customer interface allows customers to design personalized products, signal production and choose distribution or delivery methods.

The second major enabler is mass standardization of production processes that facilitate mass customization and personalization by the customer. The example of Lay's ability to gather personalized input from individual customers on a global scale to design products and packaging and gather marketing insights from thousands of others and then use standardized mass production systems to deliver products to micro-markets are all the results of the first two enablers.

Alibaba and Amazon are the biggest examples of using a standardized retail platform, scalable to almost any size, which facilitates interconnectivity of essentially all sellers and all buyers on the Internet. The availability of product and service reviews on these and many other websites provides consumers, sell-

ers and manufacturers with increasingly valuable information to support design, supply chain and purchase decisions. Internet site-to-store and store-to-store sharing of inventory information has greatly expanded the ability of many retail chains to meet customers' personalized choices rapidly.

The third enabler is the ability to create lot sizes of one or single-flow processes local to the customer and simple enough for the customer to operate in a personalized way.

One example that offers high variety is the Coca-Cola "freestyle" soda machine, which allows customers to make any of more than 100 different soft drinks, even mixing them to suit their individual tastes. Many retailers, both Web and store based, now use websites, apps, kiosks and store clerk inputs to involve customers in design and production of personalized products, such as cards, picture books, memorabilia, clothing, cakes and gifts.

The rapid advance of affordable 3-D printers in consumer markets may be a signal that we are on the verge of even greater changes in personalized consumer involvement in design and production of goods.

Current developments in customization

Probably the ultimate example of standardization that leads to mass customization and personalization is Apple's i-device technology and Google's Android technology. These platforms and operating systems are standard, but they enable global interconnectivity of businesses and individuals and mass customization or personalization through the creation of personalized applications that can be developed and marketed by almost anyone, including middle-school students.

At Apple's 2014 World Wide Developer's Conference, the company announced that the iOS app store had reached 1.2 million apps, a 33 percent growth in one year. Google is estimated

From cease and desist to go ahead and print

While increasing advances in 3-D printing make it easier for manufacturers to mass customize products, the emergence of fan art presents a challenge to makers of popular products.

Hasbro, for example, has in the past forced creators of unlicensed figurines and videos based on its My Little Pony franchise to stop, according to Law360, a website devoted to legal news and analysis. But recently, the toy giant partnered with 3D Systems and Shapeways to allow the controlled sale of such products.

Chris Ryan and Michael Mongaramvila wrote that artists must submit uploaded designs for review, agree to the terms of service and consent to the SuperFanArt artist agreement. The initial popularity of SuperFanArt has led Hasbro and Shapeways to extend the opportunity for other prominent lines, including Transformers, Monopoly, Scrabble, G.I. Joe and Dungeons & Dragons, the writers reported.

As an example, for a product that sells for \$30, Shapeways would get \$20, the artist would get \$6.50 and Hasbro would get \$3.50.

to have roughly the same number of Android apps available. These standard, mass produced IOS and Android devices can be configured to personal needs so simply that elementary school-age children can choose, download and install apps.

More significant, though, are the disruptive changes emerging in many areas of life and business, including the replacement of products and services with a variety of mobile devices. In banking, we have gone from having to walk in, to drive through, to in-bank ATMs, then stand-alone ATM kiosks, Internet banking, mobile banking to full-featured app banking. These devices are becoming our mobile 24/7 banks.

Retail businesses are replacing cash registers with mobile devices that can record and process transactions and even read credit and debit cards. Dr. John Bennett, editor-in-chief of Internet medicine.com, reported that the health-care profession uses mobile devices for records management and processing and even diagnostic testing, such as ear and eye exams, microscopes, ECG/EKG machines, glucometers, dermatoscopes, ultrasound testing and blood pressure testing. Some devices even help identify micro-organisms in petri dish processes.

In education, they are replacing textbooks and introducing self-paced tutoring, testing and hands-on simulation learning. Innovators also are developing online classrooms and learning plat-

forms for a growing body of freeware and subject education on practically any topic you can name. With advances in photographic and video technologies, these devices are rapidly enabling individuals to create products previously only possible by professionals over long production cycles.

From banking, the medical field, retailing, education, entertainment and manufacturing, standardization and mass production techniques are being adapted to facilitate mass customization and personalization.

Future opportunities look bright

A lot has been happening in the business world over the past two decades. This has been both bad and good for the mass customization movement.

On the negative side, the primary objective for most businesses has been to reduce costs and response times. Accordingly, they have developed technologies and designed management programs to accomplish those objectives. On the good side, while mass customization may not have been the primary focus, some of the changes have increased the capability of businesses to begin more aggressive implementation of mass customization.

Perhaps the mass customization movement is nearing the tipping point and will become a key area of emphasis in the next decade. As stated at the be-

ginning of this article, we see explosive growth in new technologies, personalization and automated production and delivery. There are very few products and services not affected by the changes currently being experienced. This is not the mass customization of the past. The challenges to the mass personalization of the future are great, but the opportunities are even greater. ♦

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