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For managers, new ideas from current research

insights from MSI

E-commerce

What consumers like in mass customization

Traditionally, markets have distinguished between uniform, mass-produced products and more expensive, custom-made goods. But advances in marketing, production, and distribution technologies are blurring this distinction. All the pieces are in place for a new hybrid: "mass customization."

Mass customization, in which customers "create" products that closely match their needs while firms maintain low costs, has been celebrated as a key benefit of the online economy. But almost all of the research to date has focused on the challenges to production and supply chain management. There has been little analysis from the perspective of the consumer. Do online shoppers actually realize these expected benefits? How do firms empower the consumer with greater choices without turning them off with too much complexity? Is mass customization an effective marketing tool?

To optimize satisfaction, firms should offer many options clustered around popular choices, total prices, and low-priced defaults.

In their study, "Consumer Preferences for Mass Customization," Benedict Dellaert of Maastricht University and Stefan Stremersch of Erasmus University, Rotterdam focus on what they see as the central trade-off of mass customization: increased customer choice versus increased complexity. "Despite the fact that mass customization allows consumers to select exactly those products that they require, it is still not widely offered," Dellaert explains. "Consumers' perception of the complexity of dealing with mass customization could be one explanation."

Computer shopping simulation

To capture consumer perceptions, Dellaert and Stremersch created a detailed shopping simulation for perhaps the most commonly purchased mass-customized product: personal computers. In their simulation, more than 400 participants were

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asked to build a computer from lists of possible components—CPUs of varying speeds, memory and hard drives of varying size, etc.

Dellaert and Stremersch varied the overall selection options (the number of components to select) as well as the number and type of alternatives for each component. In doing so, they were able to track four defining characteristics of a mass customization system.

1. *Number of Choices.* Participants were asked to select either four or eight components, and for each component, they were offered either four or eight alternatives. In other words, participants were always asked to choose a CPU, monitor, memory, and hard drive, but in some cases they were also asked to choose their mouse, keyboard, video card, and speakers. And among hard drives, for example, they were offered either four or eight alternatives.
2. *Range of Choice.* The alternatives that participants were offered for a component varied in range. For example, when offered four choices of CPUs, in one condition of the simulation respondents were asked to pick from a set of two 650MHz and two 700MHz chips (Intel or AMD); in the other condition, they were asked to choose from a 600MHz, 650MHz, 700MHz, or 850MHz CPU.
3. *Individual versus Total Pricing.* Participants were always told the total price of the system they were building. In some cases, Dellaert and Stremersch also provided the price of each individual component to test this effect.
4. *Presence of Default Configuration.* The simulation either offered or didn't offer a default configuration, and for those that did, the default was built from either low- or high-end components.

After respondents finished building a system, Dellaert and Stremersch asked them to rate the experience by answering several questions: Would they use this customization system to order a PC? How likely were they to purchase the PC they had just constructed? How complicated did they find the customization process? By matching these responses to the number and type of options presented, and asking each participant to repeat the exercise with different options, Dellaert and Stremersch were able to test the effect each of the four characteristics ultimately had on a respondent's evaluation of the product and the customization system itself.

Respondents were less happy with their custom PCs when they were given the price of each alternate component.

As expected, their central trade-off proved real: the more complicated a participant found the system, the less likely he or she was to want to use it. And the more a participant liked the computer and price they constructed, the more they liked the customization process itself.

What made the process seem more or less complex? Surprisingly, it was not the number of options offered. As Dellaert reports, "When consumers were presented with more components to select, and more alternatives for each option, they did not perceive significant increases in complexity, while they were indeed able to achieve higher product satisfaction."

However, customers did not like those numerous options to be spread too far apart. Respondents who had to choose from four alternative CPUs, for example, preferred a range of 650MHz to 700MHz to a range that went all the way from 600MHz to 850MHz. So cluster your options near the sweet spot, advises Dellaert: "Offer more additional options in the most popular range and fewer additional options at the extremes."

Stick to total pricing

The results also suggested that firms should stick to the total price when presenting options. Respondents were less happy with their custom PCs when they knew the price of each alternate component. Dellaert and Stremersch found that these price details made the whole process seem more complex and may have inspired them to choose cheaper components than they ultimately would have preferred.

Finally, Dellaert and Stremersch found that offering a default configuration of preselected components gave users "a key starting point for mass customization that helps minimize complexity," but only if based on less expensive options. Customers are far more likely to upgrade than to downgrade an option, and, Dellaert points out, beginning with higher priced options may push a consumer into "a product that is more advanced than they actually need."

So, while mass customization may be in its infancy, Dellaert and Stremersch have begun to identify what works best from the customer's point of view. Numerous options, clustered around popular choices, with only the total price reported and low-priced defaults to start the ball rolling, will offer consumers an "easy-to-use mass-customization process that can be a tool in achieving greater product appreciation and possibly higher long-term customer loyalty."

By Betsy Reed and John Stamm

From "Consumer Preferences for Mass Customization" (MSI Report No. 04-118)

The role of knowledge

Understanding the drivers of radical product innovation

Firms in technology-intensive industries strive to develop products that are technologically novel and deliver superior customer benefits. At present, however, not much is understood about what drives these two distinct but interrelated dimensions of radical product innovation or how they interact with each other. Moreover, even though the financial markets value innovations that score high on both dimensions, the number of new products that actually do so is relatively small.

In a study titled "Drivers of Technological Novelty and Superior Customer-Need Fulfillment in New Product Development," Stefan Wuyts of Tilburg University, the Netherlands, and Shantanu Dutta of the University of Southern California examine new product development in the pharmaceutical industry to address two questions of concern to technology-intensive industries generally: Do different dimensions of radical product innovation have different drivers? And what is the role of internal knowledge and external knowledge, respectively, in radical product innovation?

Novelty vs. superior customer benefits

Wuyts explains the significance of these two questions by saying, "The first is important because several products turn out to be technologically novel but not superior in fulfilling customer needs, and the other way round. The second question is important because, along with their internal knowledge development efforts, firms in technology-intensive markets are increasingly turning to external knowledge sourcing. Yet there has been hardly any research, to date, that considers both."

In their study, he and his coauthor consider how internal and external knowledge, alone and in combination, influence the achievement of technological novelty and superior customer-need fulfillment in new product development.

Wuyts and Dutta define the two dimensions of radical product innovation thus: "If a product employs a technology that no previous product has employed in a core component, then we label this product 'technologically novel.' If a product's magnitude of improvement in fulfilling customer needs is substantial compared to other products in the same product category, then we label this product 'superior in customer need fulfillment.'" Firms of the kind that they study, the authors say, sometimes fail to appreciate the distinction between these two dimensions, thus diminishing the effectiveness of their product development efforts.

As for the sources of radical product innovation, Wuyts and Dutta distinguish between internal knowledge development, which they operationalize as the unique character of a firm's patent base, and external knowledge sourcing, operationalized as the diversity of a firm's portfolio of R&D agreements with other firms. The importance of internal knowledge development for innovation in technology-intensive markets is obvious and has been extensively studied, the authors note. In such markets, however, external knowledge sourcing also plays a major role in radical product innovation.

Firms can't go it alone

In the pharmaceutical industry, for example, Wuyts notes, major firms are now engaging in R&D agreements with innovative biotechnology firms in order to gain access to knowledge developed in that industry. The reason, he says, is simple: "No firm can go it alone in an industry like pharmaceuticals and keep track of its fast-paced technological evolution, because the number of knowledge trajectories a given firm can follow internally is limited, and there is a risk that the firm may overlook or otherwise be unable to pursue promising alternative trajectories. External knowledge sourcing alleviates this selection problem, allowing firms to have a stake in a wider range

External knowledge sourcing gives firms a stake in a wider range of technologies than they could pursue internally.

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of technologies than they could reasonably pursue internally."

How knowledge sources drive innovation

Wuyts and Dutta's first finding is that the development of a unique internal knowledge base and the assembling of a diverse portfolio of R&D agreements with other firms are alternative routes to developing technologically novel products. "We find that developing a unique internal knowledge base has a direct effect on the generation of products that are technologically novel, but we also find a positive and direct effect on technological novelty for a diverse portfolio of agreements," Wuyts says. "The lack of interaction effects seems to suggest that internal knowledge development and external knowledge sourcing are distinct paths to the generation of technologically novel products."

When it comes to generating products superior in customer-needs fulfillment, however, the authors find that a unique internal knowledge base and a diverse portfolio of R&D agreements are not alternative routes to success. For while the external sourcing of knowledge does stimulate the development of superior products, building a unique internal knowledge base has no direct effect in this regard. Wuyts and Dutta note that, in the pharmaceutical industry, it is unclear until the final round of clinical trials whether a new drug will provide substantially better patient benefits than an existing therapy—leaving firms that rely on an internal knowledge base with more to lose from the uncertainties of the R&D process. "When a firm focuses solely on internal knowledge development, it is bound by the choices of knowledge trajectories it has made in the past," Wuyts observes.

Yet when complemented by a diverse portfolio of R&D agreements, the researchers also find, a unique internal knowledge base does aid in developing products superior in customer-needs fulfillment. "The main explanation we offer for this finding is that the flexibility offered by a portfolio that is technologically diverse compensates for the inflexibility and path dependency of a unique internal knowledge base," Wuyts says. "It becomes possible to abandon unsuccessful options and pursue more promising ones as uncertainty diminishes."

The effects of experience

In their study, Wuyts and Dutta examine an additional driver of technological novelty and superior customer-need fulfillment: the experience of firms in developing new products along either of these dimensions. Here their results are surprising. Experience in developing products superior in customer-need fulfillment turns out to aid in the subsequent generation of both superior and technologically novel products. Yet experience with developing technologically novel products does not affect the likelihood of generating future products along either of the two dimensions. "What makes the first of these findings intriguing is that it suggests a role for marketing upstream in the identification of relevant technologies," Wuyts says. "The explanation for the second may be that in-house knowledge development is necessarily narrow in scope."

Wuyts and Dutta believe that, besides confirming the popular notion that firms cannot "go it alone" in technology-intensive industries, their study can help firms—not just in pharmaceuticals but in industries such as IT, semiconductors, and telecommunications—to create strategies for increased success in radical product innovation. As Wuyts explains, "What managers can learn from these findings is that internal knowledge development and external knowledge sourcing ought to be managed jointly. The complementarity of both in the pursuit of products superior in customer-need fulfillment makes it crystal clear that internal knowledge development and external knowledge sourcing are not isolated approaches to innovation."

By Daniel Penrice

From "Drivers of Technological Novelty and Superior Customer-Need Fulfillment in New Product Development" (MSI Report No. 04-117)

Innovation

A new view of technological evolution

Technological innovation is a powerful force in today's markets. It can boost product performance, increase sales, and radically change the playing field by creating new brands, new products, new leaders, and even new markets. In order to remain competitive, managers must understand how technologies evolve, and theorists have charted the course of technological evolution to tell them when and how to shift resources between technologies. In "The S-Curve of Technological Evolution: Strategic Law or Self-Fulfilling Prophecy?" Ashish Sood and Gerard Tellis, both of the University of Southern California, argue that they've gotten it wrong.

A simple S-curve?

The conventional understanding holds that technological growth follows a simple S-curve. According to this theory, the performance of a new technology begins below that of an existing one, improves with time, crosses the performance of the old one once, and then plateaus at a higher level than the old technology could ever expect to attain. Despite a lack of broad empirical support, this thesis is so pervasive that it has made its way into textbooks and forms the basis for marketing strategy. Sood and Tellis, however, found it difficult to accept its simplicity.

"The evolution of technology is a complex phenomenon," Sood explains. "To pin it down to a simple theory just did not seem right. The appeal of simple elegant patterns often leads to misleading, dangerous conclusions if the underlying theory is not sound." To support their view, the researchers gathered detailed histories of how technologies start, grow, and compete over time. They studied the origin of innovations and analyzed the rate of change over various time periods. Their findings suggest radically different strategies for managers than those implied by prevailing theory.

To begin, Sood and Tellis clarified the definition of "innovation." Instead of defining a technological change primarily in terms of its effect on the market, they focused on intrinsic attributes. They identified three fundamental types of change: platform innovation, which refers to an entirely new technology based on new scientific principles; component innovation, which uses new parts or materials to improve performance of an existing platform; and design innovation, which reconfigures the relationship between components to improve performance of an existing platform. Tellis points out, "The key benefit of this classification is that it eliminates the circularity of first defining an innovation in terms of its effects (e.g., disruptive technology) and then using the definition to predict the same effect (e.g., displacing incumbents)."

Performance path full of irregular steps

Sood and Tellis then collected technical performance data for technologies in six different markets: external lighting, data transfer, computer memory, desktop printers, display monitors, and analgesics. To ensure objectivity and avoid selectivity bias, the authors included *all* of the technologies within each market. For their data, they sourced technical journals, industry publications, white papers of R&D departments, firms' annual reports, and reports of industry associations. For each technology, they considered whether its performance path followed a single S-curve, when, if ever, it crossed the path of other technologies, and how rapidly it evolved. In addition, they examined which firms sponsored new technologies and which clung to the old ones.

Of the 23 technologies examined, 14 had long growth "plateaus" followed by abrupt jumps in performance.

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Their findings ran quite opposite to the prevailing thesis: only 6 of the 23 technologies followed a single S-shaped path with one point of inflection followed by a permanent plateau. In contrast, 14 technologies had long static periods of growth followed by abrupt jumps in performance. This pattern repeated itself over time and resulted in a performance path full of irregular steps.

This finding has enormous strategic implications. Tellis points out, "Any manager believing in the S-curve is likely to jump ship when its performance first plateaus. In so doing he or she could be prematurely abandoning a promising technology. Indeed, some of the biggest improvements in performance followed a long plateau." For example, in the memory market, at one point optical memory surpassed magnetic memory in density. But in a few years, magnetic memory came from behind to take the lead in density. A blind belief in the S-curve would have made the demise of magnetic memory a self-fulfilling prophecy.

A new technology may surpass the old by superior performance on an entirely *new* attribute.

Beware the "upper attack"

The prevailing theory also posits that new technologies generally start off as inferior to the existing technology on the primary attributes of performance. That is, newcomers always attack from below and incumbents that use the existing technology have time to study the newcomer and take strategic actions. Thus, managers are encouraged to keep their eyes focused on new technologies that enter the market from below and to watch for the moment of inflection when their performance begins to pose a challenge to existing technology.

In contrast, Sood and Tellis found that new technologies can also attack existing technologies from above, with superior performance. The danger in such an "upper attack" is that firms using the existing technologies are in a weaker position to defend against the new entrant. This aspect of technological competition calls for great vigilance and broad scanning on the part of incumbents.

The authors also found that new technologies may well create a wealth of new attributes on which to serve consumer needs. In other words, a new technology may surpass an old technology by superior performance on an entirely *new* attribute. Consider the desktop monitor market: CRTs initially competed on the performance attribute of resolution before the arrival of new technologies. But LCDs introduced a new dimension of compactness, plasma introduced a new dimension of screen size, and OLEDs introduced a new dimension of convenience. In this world of technological evolution, faith in generic attributes such as convenience, quality, and price as espoused by the prevailing theory would be misplaced. Rather, Tellis suggests, "managers need to appreciate the richness and complexity of technological evolution. Such an appreciation comes from in-depth research and relentless innovation."

Finally, the authors examined the view that new technologies and especially "disruptive innovations" come from small firms or outsiders to the market, rather than from large incumbent firms. Again, their findings pose a challenge to conventional wisdom: they found that new technologies were introduced by both small and large firms and by incumbents and outsiders. Says Tellis, "The cause of success or disruption lies neither in the size of firms per se, nor in their incumbency status, nor in the nature of the technologies. Rather, successful innovation lies in a deep understanding of technological evolution and an unfailing commitment to lead the curve."

By Rebecca Anderson

From "The S-Curve of Technological Evolution: Strategic Law or Self-Fulfilling Prophecy?" (MSI Report No. 04-116)

Marketing communications

Satisfaction surveys and customer purchase behavior

Asking customers how satisfied they are is not a neutral activity. Research shows that customers who participate in satisfaction surveys subsequently increase their purchasing behavior at both the product-category and brand levels. Further, this "mere measurement effect" is surprisingly durable—lasting up to a year after survey participation, according to one study.

Why does the experience of participating in a customer survey, which may take all of 15 minutes, affect customer behavior so broadly and for such a long time? What processes underlie this effect? In their study "Firm-Sponsored Satisfaction Surveys: Positivity Effects on Customer Purchase Behavior?" Utpal Dholakia and Robert Westbrook, both of Rice University, and Vicki Morwitz of New York University investigate these questions. They analyze data from a longitudinal field experiment conducted by an automotive services firm as part of its ongoing customer satisfaction measurement program.

The researchers gathered four behavioral measures—annualized frequency of service use, annualized purchase amount, number of services purchased per visit, and likelihood of coupon redemption—for 20,119 customers from the firm's customer database for a six-year period prior to the survey and for a one-year period after the survey, as well as for a control group of 4,078 randomly selected customers who had never participated in any firm-sponsored survey.

Previous research—all in laboratory settings and short term—suggested that participating in a survey forced customers to think about their feelings toward the firm, thus increasing the "accessibility" of their judgments in their minds later on. However, in that case, one would expect the customers communicating low satisfaction to decrease their purchasing activity postsurvey, rather than increase it.

The power of positive thinking?

Perhaps, the researchers posited, survey participation fosters positive cognitions about the firm—that the firm values and cares about customers and their opinions, for example—subsequently motivating customers to buy more of the firm's products. That explanation would account for the increased purchase behavior by customers who expressed dissatisfaction.

Even survey participants who expressed low satisfaction increased their service visits, purchases, and coupon use.

Their analysis supported that notion. Dholakia and his colleagues found that, even among customers who expressed low satisfaction, the number of annualized service visits, number of services purchased per visit, and likelihood of coupon use all were higher in the surveyed group postsurvey than in the control group.

However, when the researchers broke down the results by customers' level of experience with the firm, they found some evidence for the increased-accessibility explanation. High-experience customers who expressed low satisfaction visited fewer times postsurvey than the control group, had a significantly lower annualized purchase amount, and purchased significantly fewer services per visit. While this finding suggests that the "positivity effect" doesn't hold for experienced customers, it does offer further evidence of the potential consequences of survey participation.

Public policy implications

Together, these findings challenge the conventional view that opinion elicitation and promotional efforts are completely separate. The public policy issues their research raises are significant, Dholakia notes. "To the extent that such inferences and resulting behavior are unintended, consumers should be cognizant that survey participation could lead them to behave differently toward the firm." Should customers be informed of this potential influence, and if so, how? The finding that positivity-driven influences have a cognitive basis suggests that providing respondents with warnings about the effect of survey participation may mitigate its influence.

From a marketing perspective, the implications are numerous. Managers

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currently treat customer satisfaction surveys as an expense, but this study suggests that customer satisfaction surveys can result in revenue benefits via customers' increased purchasing behavior and increased coupon redemption. Customers' responsiveness would also suggest they would be more interested in further participation in marketing research in the future.

Combine this with the recent research finding that survey participants are less likely to defect to competitors, and it seems possible that the combined economic effects of surveys could offset much or all of the survey's cost.

Overall, Dholakia concludes, it's clear that "survey-based marketing research can have positive consequences for the firm. Rather than being viewed as a cost center, survey-based marketing research could generate net positive revenues. Our research suggests that managers need to consider survey-based consumer research in a new light."

By Deborah Kreuze

From "Firm-Sponsored Satisfaction Surveys: Positivity Effects on Customer Purchase Behavior?" (MSI Report No. 04-121)

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Addressing consumers' latent needs

Until now, studies of the relationship between market orientation and new product success have focused on responsive market orientation, which addresses customers' expressed needs. In a study appearing in the *Journal of Product Innovation Management*, John Narver, Stanley Slater, and Douglas MacLachlan extend the measurement of market orientation to include proactive market orientation, which addresses opportunities for customer value of which the customer is unaware.

Using data from a sample of technologically diverse businesses, the study develops a measure of proactive market orientation, refines extant measures of responsive market orientation, and analyzes the relationship of both to a firm's new product success.

The findings suggest that, to create and sustain new-product success, a responsive market orientation is not sufficient, and that a proactive market orientation plays an important role in a firm's new product success. The researchers note that the finding makes intuitive, as well as empirical, sense: Firms that rely solely on what customers state as their new product needs are vulnerable to customers' "best guesses" and to competitors' new product responses and price competition.

They conclude, "A business that relies solely on customers' expressed needs to develop its new products creates no new insights in value-adding opportunities for the customer, and thereby creates little or no customer dependence and foundation for customer loyalty."

From "Responsive and Proactive Market Orientation and New-Product Success" (2004) Journal of Product Innovation Management *21 (5) (September), 334.*

Mapping customer preferences

Product recommendation models can help managers match customers to products, but their predictive power depends on firm databases. Sangkil Moon and Gary Russell have developed a product recommendation model based on the principle that customer preference similarity, as determined by prior purchase behavior, is a key element in predicting current product purchase.

Using a joint-space map based on past purchase behavior, they develop a model in which the probability that a customer will buy a product depends upon the customer's relative distance on the map from customers who have already purchased the product. In other words, the "space" in their model is a replacement for variables such as lifestyle, word-of-mouth, and product features that may drive consumer choice but are not explicitly included in customer databases.

From "A Spatial-Choice Model for Product Recommendations" (MSI Report No. 04-120)

Brand-level effects of SKU reductions

When retailers reduce product assortment, how do shoppers reallocate their purchases? A brand-level analysis by Jie Zhang and Aradhna Krishna reveals differences across brands, driven by several factors. For example, reduction in the number of brand sizes offered has more influence over a brand's purchase share after an SKU reduction than the reduction in the number of SKUs. Further, brands with higher market share and those with frequent promotions tend to gain share. Overall, the researchers note, the effects of SKU reductions on category purchase incidence, sales quantities, and revenue are negative, although the extent varies by category.

From "Brand-level Effects of SKU Reductions" (MSI Report No. 05-104)