

## MASS CUSTOMIZATION BASED E-BUSINESS STRATEGIES

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*While the competitive advantage of mass customization has been widely substantiated in management theory, a deficit exists in the empirical examination and the implementation of mass customization in e-business strategies. Founded on an exploratory study of more than 100 international mass customizers we deploy a systematization to demonstrate how modern Internet technologies and possibilities of e-business work as success factors for mass customization. Thus, four fields can be derived based on the degree of interaction between customer and manufacturer required and the digitizability of the products and services to be customized. The business models developed here work as starting points to create new value added for innovative e-businesses. However, our suggestions for action must not be understood as generic strategic patterns but rather as ideas where a successful mass customization based e-business concept can start.*

### 1 The Role of Information for Mass Customization

The objective of mass customization is to deliver goods and services for a (relatively) large market which exactly meets the needs of every individual customer with regard to certain product characteristics (*differentiation option*) at costs roughly corresponding to those of standard mass produced goods (*cost option*). Mass customization shall give an answer to “smart customers” (Glazer, 1999) demanding more and more individualized and personalized products. Explanations may be found in the tendency towards an experience economy, the growing number of single households, an orientation towards design and, most importantly, a new awareness of quality and functionality which demands durable and reliable products corresponding exactly to the specific needs of the purchaser.

Until today, mass customization is connected closely to the potential offered by new manufacturing technologies (CIM, flexible manufacturing systems) reducing the trade-off between variety and productivity (Ahlström/Westbrook, 1999; Anderson, 1997; Kotha, 1995; Oleson, 1998; Pine, 1993; Schlie/Goldhar, 1995; Victor/Boynton, 1998). But while the concept has already been discussed in the literature for more than a decade (e.g. Davis, 1987; Kotler, 1989; Mueller-Heumann, 1992; Pine, 1991; Pine, 1993; in fact, already Toffler, 1970 described the basic idea), increased practical implementation of this strategy can be found in business only in

the last few years. This time lag may be explained by the fact that only since few years sufficient technologies exist to handle the information flows connected with mass customization. Especially as mass customization enters more and more consumer markets, new Internet technologies can be seen as its main enabler.

The reason for this information intensity is the direct interaction between customer and supplier for every single transaction. Every order implies a coordination about the customer specific product design. The costs arising from customization consist largely of information costs resulting from the transfer of the individual configurations to manufacturing, the increase in complexity in production planning and control, the coordination of external suppliers involved in individual prefabrication, and the individual distribution of the goods. All these activities are characterized by a high information intensity compared to traditional mass production. Customer-related value added of mass customization is produced on the information level. Therefore, mass customization can be seen closely related to e-business and the new possibilities connected with the Internet economy. In the following, we will show how mass customization and e-business complement each other and can be integrated. Our research is based on the results of an exploratory study of 103 mass customizers, that will be outlined in the next section. Section 3 will introduce two dimensions to systematize mass customized goods and services. Based on this sys-

tematization, four groups of mass customization products are presented, each with different demands to e-business.

## 2 Outline of the Empirical Study

More and more companies enter the market with their very own mass customization program. The impression of Sanjay Choudpouri, Director Mass Customization (sic!) at Levi Strauss, can be regarded as typical for managers in various industries: „Customization in the clothing and footwear industry will become a competitive necessity rather than a nice to have fringe offering“ (in an interview with the authors of this paper). Taken this growing implementation efforts and the long academic discussion into account, it is surprising that, with few exceptions (Pine, 1991; Ahlström/Westbrook, 1999; Piller/Schoder, 1999) there is almost no large scale empirical research about mass customization. We agree with Bettis (1991) and Kotha (1995) that researchers in strategic management should employ more unstructured and exploratory research instead of the dominating multivariate statistical methodology in order to suggest prescriptions that are relevant and practical for managers. However, most authors following this recommendation argue based on few case studies describing successful mass customizers (Feitzinger/Lee, 1997; Kotha, 1995; Gilmore/Pine, 1997; Victor/Boynton, 1998). But to cover a field characterized by a heterogeneous population of firms and strong growth rates only the combination of research looking on a large group of cases with an in-depth study of some exceptional examples seems sufficient. Therefore, we constructed a long-term exploratory study to identify best practices and success factors for mass customization. Data was gathered by secondary sources like database and Internet research and primary sources like interviews and company visits alike. Some important characteristics of our study are outlined in Table 1.

Our study didn't concentrate on financial success indicators (as our sample is too heterogeneous and many companies are still in their start-up phase) but rather on the grade and excellence of fulfillment of different tasks described in literature as critical success factors for mass customization. Without discussing these points any further in this paper, we evaluated (based on a 5-point scoring model) how the companies

- *integrate knowledge* about their customers' wishes and needs in the design of their product architectures and individualization options in order to both create enough possibilities for customization and make the system as easy as possible (e.g. by establishing strong modular product systems to reduce complexity) (Ishii/Juengel/Eubanks, 1995; Jiao, 1998);

Table 1: Key characteristics of our empirical research

<b>Research time</b>	June 1997 – June 1999	
<b>Cases covered</b>	103	
<b>Market focus</b>	Business-to-consumer (b-to-c)	68
	Business-to-business (b-to-b)	29
	Hybrid	6
<b>Origin and main target market</b>	United States and Canada	57
	Germany	37
	Europe (without Germany)	4
	Japan	5
<b>Mass customization concept</b> (Piller/Schoder, 1999; for other differentiations see Gilmore/ Pine, 1997; Lampel/ Mintzberg, 1996; McCutcheon et al., 1994; Pine, 1993; Robertson/Ulrich, 1998) (if two concepts were mixed, the dominating one was counted)	<i>Modular product architectures</i>	54
	<i>Service customization</i> (customized services around standardized products)	17
	<i>Customization-standardization-mix</i> (customize either the first or last activities of the value chain, keep others standardized)	13
	<i>Flexible customization</i> (flexible manufacturing systems used in constant, controlled processes)	12
	<i>Point-of-delivery customization</i>	4
	<i>Self customization</i> (customizable products / services)	3
<b>Interaction channel with customers</b>	Traditional retail channels	54
	Internet	43
	Hybrid channels	6

- *solve the configuration process* to transfer the customers' wishes in concrete product specifications;
- *plan their manufacturing* and fulfillment processes;
- *integrate* the whole internal and external *supply chain*;
- *use information about customers* to build up "learning relationships" (Peppers/Rogers, 1997) with their customers in order to improve efficiency and quality in follow-up business.

### 3 Customer Integration and Degree of Digitizability

Our research showed that companies pursuing mass customization successfully build an integrated information flow that not only covers one transaction but improves the knowledge base of the whole company by information gathered during the fulfillment of a customer-specific order. Successful mass customizers establish an information cycle interconnecting all steps of the mass customization process and integrating their customers and suppliers alike. As the importance of information is stressed by this result again, we will discuss in the following, which mass customization strategies are connected with e-business. A distinctive feature of new Internet technologies is that they enable direct communications between customers and suppliers. Thus we will examine the influence of the extent of customer integration required for a specific product or service. As we will focus on e-business strategies, we will further consider the degree of digitizability of customized product or service components. This will allow us to separate four strategic fields, which are illustrated by some successful cases from our research in Figure 1.

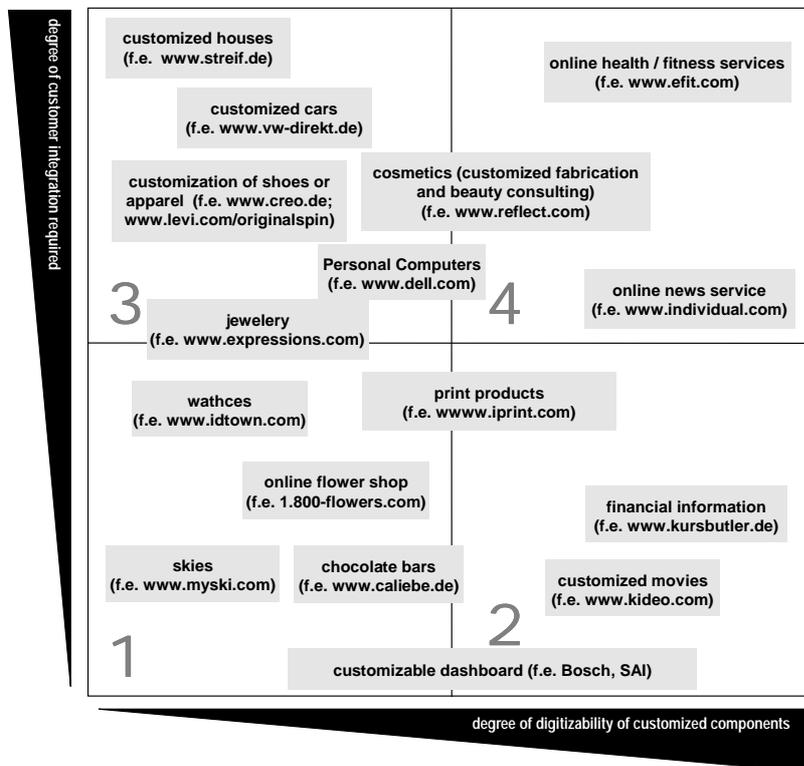
process is a distinctive feature of customized production. One can look at the relation between the customer and supplier as a cooperation providing benefits for both sides, but demanding inputs of both participants, too. In mass customization processes, this integration of the customer is required primarily during configuration. The “costs” of this process from the customer’s point of view are an important success factor. Especially in consumer markets customers often do not have sufficient knowledge for the definition of the product specification, which corresponds to their needs. As a result the configuration process may last pretty long, and customers may experience an increasing uncertainty during the transaction process. Comparison processes are more difficult because of smaller transparency of supply compared to standardized goods or services. Uncertainty exists, too, about the behavior of the provider. Further, the cooperative character of the configuration results in an asymmetrical distribution of information – a typical principal agent constellation. Information gaps are increasing the newer and more complex individualization possibilities are. Without a clear reference point for the definition of an optimal performance it is also difficult to judge whether a case of warranty arose.

The integration of the customer into the production

These uncertainties and factor transfers can be

interpreted as additional transaction costs of the customer. One of the most important tasks of the mass customizer it to ensure that the customer’s expenditure is kept as small as possible, while the benefit she experiences has to be clearly perceptible. Leading companies of our sample have implemented strong instruments to build trust and reliability in order to reduce the risk seen by prospective customers in mass customization processes. Other instruments minimizing the risk of the customer are warranties or the reputation of the provider. But independent from trust and warranties, the degree of customer integration required into the customization process is positively connected with the expenditures and risk realized by the customer. Thus, the degree of interaction required for customization will not be equal for all products and services. The buyer of a personalized gift watch of *idtown.com* with a purchase price of 35 € will experience smaller complexity of the purchase process than the

Figure 1: Examples of mass customization



buyer of a VW sedan, which can be configured and ordered completely without engagement of a dealer on the Web Site of *Volkswagen-Direct*. Therefore, the characteristics of the product or service being individualized have to be taken into account. Accordingly, the degree of customer integration required is influenced by the relative price of the products and services, the possibility to use instruments to prevent bad investments (e.g. warranties, exchange policy, time of delivery, screening possibilities), the customer's experience with a product (e.g. second buy, product specific knowledge) and its complexity (customization possibilities; product structure). Another point to consider is if the configuration process itself can be regarded as part of the product purchased (configuration as buying experience, leisure activity).

While all mass customized products are characterized by a more or less intense integration of the customer, not all of them can be transferred to an „info sphere” where the customization of products and services can be delivered often very efficiently. The traditional mass producer reduced the information intensity of his products and production processes as far as possible to achieve a good cost position. However, today a fundamental enabler for an economical individualization of products and services is to increase their information intensity. New information technologies allow to substitute product functions by information activities (Wigand/Picot/Reichwald, 1997). Information richness is a strong indicator for the digitizability of goods and services (Choi/Stahl/Whinston, 1997; Shapiro/Varian, 1998). *Digitizability* describes the extent, in which functions, that are relevant to a customer, can be fulfilled by the use of information technology only. For fully digital products modern information technology is the only necessary instrument to deliver customization. These goods can be sold on electronic markets, customized, and distributed over computer networks relatively easily and without high additional costs – building the “heart” of the e-business (Choi/Stahl/Whinston 1997). The degree of digitizability is based on the content of information based components in relation to the whole product or service. While products like newspapers or music can be digitalized totally others like apparel have an information content of zero. But also for this products new Internet technologies facilitate the collection and employment of numerous data concerning the individual customer by permitting interaction between economic units connected via electronic networks.

#### **4 Mass Customization Strategies in E-Business**

Based on different combinations of possible degrees of the interaction required and the digitizabil-

ity four fields can be derived, each with different requirements for the mass customization and e-business strategy. They will be discussed in the following based on the examination of clusters of our sample. This systematization can demonstrate the importance of integrated information flows and the possibilities of new information technology better than the known models to implement mass customization (described above in Table 1).

(1) *Add-on*: A first group of rather simple, not complex products and services shows a very small or no degree of digitizability. Also, there is no deep interaction necessary to collect the information required for customization as only few components can be individualized or most customers have enough knowledge about the product so that they can find the sufficient configuration easily and feel no large risk in the buying process. The production of these products is based on the potentials of modern manufacturing and logistics systems. However, the configuration (interaction with the customers) and the planning of the operations are based on integrated information flows. A chocolate bar can be personalized and distributed as a very special greeting card for 5 € only, if the configuration process can be fulfilled by an automated self-service process in the Internet. Success factors for these products and services are first integrated information flows connecting the production system with configuration (direct Web-EDI linkages). Second, the degree of interaction has to be increased in order create a deeper learning relationship with the customer (as long as this can be automated from the supplier's point of view). Therefore, new functionalities or additional online services may be added. By doing so, the degree of digitizability can be also increased by providing easy-to-implement customized services around a (standardized) core product. Although the core product of an online flower shop (just in time delivery of a bouquet) is not digitizable, it differentiates itself from brick-and-mortar stores – and other competitors on the web – in particular through customized services such as a birthday reminder, an address book or a writing program for creative greeting cards.

(2) *Attract attention*: While the degree of customer integration required is small in this group, customization can be digitized to a large extent. These products and services are information products in the broadest sense that can be sold, customized and delivered via e-business-networks. Customization serves primarily to differentiate a company from its the competitors in order to increase customer loyalty. Mass customization can be seen as a strategy to create economics of attention (Goldhaber, 1997; Shapiro/Varian, 1998). Economics of attention are a result from the observation

that information is freely available on the Internet while the attention of the users is limited. By increasing the degree of attention, a company shall be able to introduce new products and thus to implement network effects more easily. In this context, mass customization offers an additional way to attract attention based on the incentive of additional customer benefits. While, for example, today some thousand Internet radio stations compete for the attention of the users, mass customizer *imaginera-dio.com* allows its listeners to create their very own radio station playing their preferred music. Here, mass customization serves as a base for new models to create economic value: As the high degree of digitizability makes customization economically feasible, the individualized product or service is often offered free of charge. The objective is to initiate a learning relationship and to gain more information about the individual customers in order to sell either (standardized) products and services fitting to the customized information content or just advertising space on the web site.

(3) *Configuration*: The third group is characterized by the requirement of an intensive interaction with the customers. An example may be customized apparel where personal measurement activities are necessary during the configuration process. In mass markets, this has to be done by three-dimensional-scanning devices if a company wants to get reliable measurements economically. But body scanning can not be done online (yet) – a personal interaction is needed. The same is true for relatively expensive or complex (from the customer's point of view) products and services, for example the customization of diamond jewelry or (prefabricated) buildings. A customer may not have the necessary know-how to define a configuration corresponding to her desires, so she demands more information and a close interaction with the company. An intensive interaction is also needed from the seller's point of view in order to create confidence and to minimize the purchase risk. While the customization itself is not digitizable, in this group the e-business strategy is focused on an extensive support of the transaction phase. Companies should try to fulfill as much of the configuration process online, but now (compared to group 1) human advice should be offered by a help or call back button. New Internet technologies offer plenty possibilities – from 3D-pictures of the configured objects up to chat robots allowing a conversation in natural speech (Peiro/Steiger 1998). Software tools like recommendation engines simplify the identification of preferences by recording, comparing, and aggregating former sales, pages views or click rates. They enable the direct presentation of individualized content and offer a first suggestion of a configuration by comparing user profiles and indexes of content – even if a user cannot explicitly

express her preferences and wishes (Elofson/Robinson, 1998; Shardanand/Maes, 1995).

These technologies enlarge the range of „configure-it-yourself“ to more complex products. As a result, nowadays even complex products like houses can be configured and ordered online with no architect or real estate dealer involved. The saving potential of this process allows German building contractor *Streif AG* to offer customers a discount of 25 000 € if they configure and order their house online ([www.streif.de](http://www.streif.de)). The use of these technologies has to be guided by the strong necessity to show reliability and to build trust to reduce the purchasing risk from the customer's point of view. New research by Mandel/Johnson (1999) demonstrates strong possibilities to influence the users of a web site by screen design. These findings have to be used to develop „trust-full“ web sites. The whole configuration and interaction process – either online or offline – has to differentiate between old and new customers. For new customers, a general profile of their desires and wishes has to be built up using the technologies mentioned above. For existing customers the old configuration and information gathered during former transactions have to be used to make all following sales as easy (time- and money-saving) as possible. For example, the last configuration may be presented and customers just asked for variations. This is one of the major possibilities to built-up customer loyalty.

As the products of this group are digitizable only to a small degree, often a multi-channel sales strategy is recommendable to fulfill the different preferences of diverse customer groups in regard to online literacy, time sensitivity or product knowledge. Several direct and indirect sales forms can be combined – from direct sales by call centers over a self-service in the Internet up to brick-and mortar stores. The task of traditional dealers switches hereby from the selling of a product or service to the configuration support and the consultation of the customer. As often a repurchase based on an available customer profile is handled more economically online, new profit schemes for the dealers have to be established (e.g. a higher initial bonus and smaller additional provisions for every online sale). After configuration, customer data have to be transferred into the producer's business application systems. As the products of this group are pretty complex, the integration of suppliers in the individualization process enables mass customizers to extend the degree of customizable components. For supplier integration nowadays standardized interface logs permit transactions beyond company boundaries without media discontinuity by using standardized Internet technology

(XML-based Web-EDI) instead of proprietary transaction channels (Turowski, 1999).

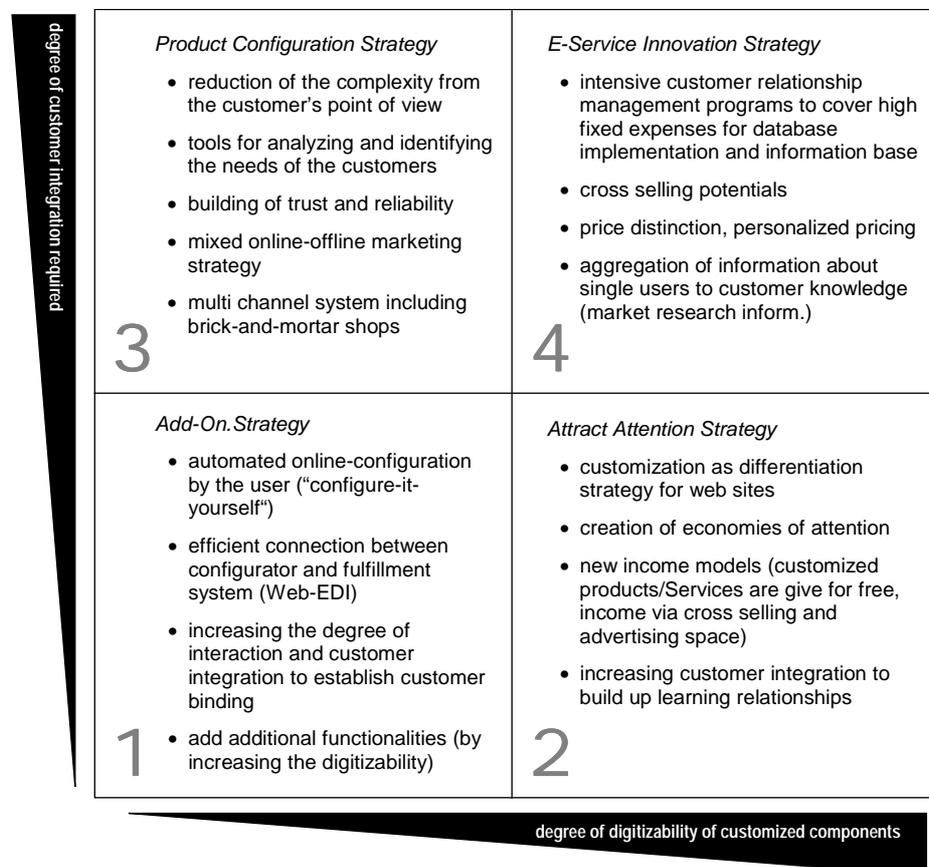
(4) *E-Service-Innovations*: The fourth group is characterized by a high degree of interaction and digitizability. Examples are information goods like consulting and information services. An online health center may replace the work of (expensive) wellness consultants and trainers. After an initial health check each day a customized “wellness map” is created and distributed electronically covering a plan for the daily workout, nutrition suggestions and perhaps the calculation of today’s bio-rhythm. Users have to report daily several feedback data. Thus these services must offer a high benefit for a customer to make this expenditure worthwhile. The customer interaction serves as an excellent base to establish intensive learning relationships. The mass customizer has to use information about the individual customer to serve her more comfortably (i.e. at smaller interaction expenditure) and to deliver improved personalized content. That’s the starting point for new cross-selling activities. The information about the fitness condition of a customer may provide the initial configuration for customized vitamin products or skin treatment (that strong trust and security issues are essential has not be stressed further).

Services of this group offer a substantial potential for price distinction and personalized pricing – one of the major strategies suggested in e-business (Choi/Stahl/Whinston, 1997; Wigand/Picot/Reichwald, 1997). This is done normally by versioning, a buyer chooses under different given versions the product version corresponding to her personal ability to pay (Shapiro/Varian 1998). Mass customization allows to switch from versioning (selection between fixed, bundled products) to an individual pricing system based on different valued components that can be mixed freely. Beyond that, individualized digital products reduce the incentive for buyers for arbitrage businesses between users that had to pay different prices. A

further source of income is the aggregation of the individual customer information to customer know-how, which can be sold as market research to other companies. The customizable news services for music lovers *mylaunch.com* or the on-line supermarket *Peapod* have a substantial source of income from this aggregated customer knowledge (reaction to price adjustments, advertising measures, reaction on new products).

The argumentation above is summarized in Figure 2 showing a systematization of different mass customization strategies in e-business. The suggestions for action found there must not be understand as generic strategic patterns but rather as ideas where a successful mass customization concept can start. Managers should never forget: Every mass customization strategy has to be customized, too.

Figure 2: Mass Customization Strategies in E-Business



## REFERENCES

- Ahlström, P. and Westbrook, R., „Implications of mass customization for operations management: an exploratory survey,” International Journal of Operations&Production Management, 19 (March 1999), 262-274.
- Anderson, D.M., Agile product development for mass customization, Chicago: Irwin, 1997.
- Bettis, R., „Strategic management and the straightjacket,” Organizational Science, 2, 315-319.
- Choi, S.-Y., Stahl, D.O. and Whinston, A.B., The Economics of Electronic Commerce, Indianapolis: Macmillan Technical Publ., 1997.
- Davis, S., Future Perfect, Reading: Addison-Wesley, 1987.
- Elofson, G. and Robinson, W.N., “Creating a custom mass-production channel on the Internet,” Communications of the ACM, 41, (March 1998), 56-62.
- Feitzinger, E. and Lee, H., “Mass Customization at Hewlett-Packard: The Power of Postponement,” Harvard Business Review, 75 (January-February 1997), 116-121.
- Gilmore, J.H. and Pine, B.J., „The four faces of mass customization,” Harvard Business Review, 75 (January / February 1997), 91-101.
- Glazer, R., „Winning in smart markets,” Sloan Management Review, 40 (summer 1999), 59-69.
- Goldhaber, M.H., “Attention Shoppers!,” Wired Magazine, 1997, No. 12.
- Ishii, K., Juengel, C. and Eubanks, C.F., Design for product variety, Working Paper, Department of Mechanical Engineering, Stanford University, 1995.
- Jiao, J., Design for mass customization by developing product family architectures, Diss., The Hong Kong University of Science and Technology, 1998.
- Kotha, S., „Mass customization: implementing the emerging paradigm for competitive advantage,” Strategic Management Journal, 16 (1995; special issue ‘Technological transformation and the new competitive landscape’), 21-42.
- Kotler, P., „From mass marketing to mass customization,” Planning Review, 18 (No. 5 / 1989), 10-13, 47.
- Lampel, J. and Mintzberg, H., „Customizing customization,” Sloan Management Review, 37 (spring 1996), 21-30.
- Mandel, N. and Johnson, E.J., Constructing preferences online, Working Paper, The Wharton School of Business, University of Pennsylvania, 1999.
- McCutcheon, D. et al., „The customization-responsiveness squeeze,” Sloan Management Review, 35 (winter 1994), 89-99.
- Mueller-Heumann, G. „Market and technology shifts in the 1990s: market fragmentation and mass customization,” Journal of Marketing Management, 8 (No. 4 / 1992), 303-314.
- Oleson, J.D., Pathways to agility, New York: Wiley, 1998.
- Peiro, J.L. and Steiger, P., “Making electronic commerce easier to use with novel user interfaces,” Electronic Markets, 8 (3/1998), 8-12.
- Peppers, D. and Rogers, M., Enterprise One to One, New York: Doubleday, 1997.
- Piller, F. and Schoder, D., „Mass Customization and Electronic Commerce,” Zeitschrift fuer Betriebswirtschaft, 69,(October 1999) 1111-1136.
- Pine, B.J., Mass Customization, Boston: Harvard Business School Press, 1993.
- Pine, B.J., Paradigm shift: From mass production to mass customization, Master thesis, Cambridge: Massachusetts Institute of Technology, 1991.
- Robertson, D. and Ulrich, K., „Planning for product platforms,” Sloan Management Review, Vol. 39, (summer 1998), 19-31.
- Shapiro, C. and Varian, H., Information rules, Boston: Harvard Business School Press, 1998.
- Shardanand, U. and Maes, P., „Social information filtering: algorithms for automating word of mouth,” Proceedings of the CHI 1995, ACM, 1995.
- Schlie, T. W. and Goldhar, J.D., “Advanced manufacturing and new directions for competitive strategy”, Journal of Business Research, 33 (2/1995), 103-114
- Toffler, A., Future shock, Cologny, Geneva; Orbit Publ., 1970.
- Turowski, K., “A virtual electronic call center solution for mass customization,” Proceedings of the 32nd Annual Hawaii International Conference on System Sciences, Maui, Hawaii, 1999.
- Victor, B. and Boynton, A.C., Invented here, Boston: Harvard Business School Press, 1998.
- Wigand, R., Picot, A. and Reichwald, R., Information, organization and management, Chichester, New York: Wiley, 1997.



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