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Factors Influencing the Adoption of Mass Customization: The Impact of Base Category Consumption Frequency and Need Satisfaction

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Mass customization has received considerable interest among researchers. However, although many authors have analyzed this concept from different angles, the question of which factors can be used to spot customers most likely to adopt a mass-customized product has not been answered to a satisfactory extent until now. This article explicitly deals with this question by focusing on factors related to the base category*, which is defined as the group of all standardized products within the same product category as the mass-customized product under investigation. Specifically, this article investigates the influence of a customer's base category consumption frequency and need satisfaction on the decision to adopt a mass-customized product within this base category. A set of competing hypotheses regarding these influences is developed and subsequently evaluated by a combination of partial least squares and latent class analysis. This is done by using a sample of 2,114 customers surveyed regarding their adoption of an individualized printed newspaper. The results generated are threefold: First, it is shown that there is a significant direct influence of base category consumption frequency and need satisfaction on the behavioral intention to adopt. The more frequently a subject consumes products out of the base category or the more satisfied his or her needs are due to this consumption, the higher the behavioral intention to adopt a mass-customized product within this base category. Second, the article provides an indication that base category consumption frequency has a significant moderating effect when investigating the behavioral intention to adopt in the context of the theory of reasoned action and the technology acceptance model. The more frequently a subject consumes products out of the base category, the more important will be the impact of perceived ease of use mediated by perceived usefulness. Finally, this article shows that different latent classes with respect to unobserved heterogeneity regarding the latent variables base category need satisfaction or dissatisfaction have significantly different adoption behaviors. Individuals who show a high level of need dissatisfaction are less interested in the ease of use of a mass-customized product than its usefulness (i.e., increase in need satisfaction). On the other hand, subjects who have a high degree of base category need satisfaction base their adoption decision mainly on the ease of use of the mass-customized product. These results are of managerial relevance regarding the prediction of market reactions and the understanding of the strategic use of product-line extensions based on mass-customized products. This work provides an*

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indication that base category consumption frequency and need satisfaction positively influence the behavioral intention to adopt a mass-customized product. Hence, mass customization can be seen as one way to deepen the relationship with existing clients.

Introduction

Mass customization (MC) can be defined as "a strategy that creates value by some form of company–customer interaction at the fabrication/assembly stage of the operations level to create customized products with production cost and monetary price similar to those of mass-produced-products" (Kaplan and Haenlein 2006, pp. 176–77). It has, in recent years, received considerable interest among researchers. This is illustrated by, among others, the *Journal of Product Innovation Management* in which several articles dealing with MC have been published (see, e.g., Franke and Piller, 2004; Kaplan and Haenlein, 2006; von Hippel, 2001). *Production Planning & Control* and *IEEE Transactions on Engineering Management* also have already issued special editions devoted to this topic.

Specifically, the question under which circumstances a company should adopt a mass-customization strategy has been addressed by several researchers (e.g., Kotler, 1989). Overall, there seems to be general agreement that MC will never be possible for all types of products or suitable for all kinds of consumers (da Silveira, Borenstein, and Fogliatto, 2001). However, very few critical voices are raised in argument against this strategy. Consequently, companies looking at the example of other firms who have already managed to successfully implement this strategy may suffer from the illusion that successful MC is only about technical and organizational aspects. Yet the main question to be answered before deciding in favor of MC is whether customers actually appreciate this new concept and for which group of customers it could be an option. Whereas the first of these points was raised by da Silveira, Borenstein, and Fogliatto (2001) and partly answered by Hart (1995) or Franke and Piller (2003), the second one does not seem to have been in the focus of research until now.

The present article explicitly deals with the second part of this question, namely the identification of factors that can be used to spot customers most likely to adopt a mass-customized product (see also Kaplan, 2006). This question is of managerial relevance, since being able to predict the market reaction to a new product prior to its launch is essential for marketers to plan tactics to achieve the optimal take-up rate and depth of market penetration. Hereby, the focus of this article is set on factors related to the *base category*, which is defined as the group of all standardized products within the same product category as the mass-customized product under investigation (See Viswanathan and Childers [1999] for a general discussion of the product category term). The main assumption of this article is that factors related to the base category have a significant impact on the likelihood to adopt a mass-customized product within this base category.

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Using only factors related to the base category represents a relatively low cost and, hence, an easy-to-implement approach. These data are most likely already available in every company and do not require specific surveys to be carried out regarding the new product innovation.

This article investigates the influence of a customer's base category consumption frequency and need satisfaction on the decision to adopt a mass-customized product within this base category. A set of competing hypotheses regarding these influences is developed by stating that (1) base category consumption frequency should have a positive or negative influence; and (2) base category need satisfaction or dissatisfaction should have a positive influence on the likelihood to adopt a mass-customized product within this base category. Subsequently, these hypotheses are evaluated by a combination of partial least squares and latent class analysis using a sample of 2,114 customers surveyed regarding their adoption of an individualized printed newspaper. The results generated are threefold: (1) There is a significant direct influence of base category consumption frequency and need satisfaction on the behavioral intention to adopt; (2) base category consumption frequency has a significant moderating effect when investigating the behavioral intention to adopt in the context of the theory of reasoned action and the technology acceptance model; and (3) different latent classes with respect to unobserved heterogeneity regarding the latent variables base category need satisfaction or dissatisfaction have significantly different adoption behaviors.

The remainder of this article is structured as follows. The next section provides an overview of relevant literature in the area of mass customization, which supports the development of the competing hypotheses stated already. The statistical methods applied—partial least squares and latent class analysis—as well as the results generated are then explained. The article concludes with a discussion of managerial as well as theoretical implications.

Literature Review

According to Franke and Piller (2003, p. 594), a customer's return of adopting a mass-customized product and, hence, the decision to carry out adoption or not, is influenced by two factors: (1) The "value of the customization, i.e. the increment of utility a customer gains from a product that fits better to her needs than the best standard product attainable"; and (2) "possible rewards from the design process such as flow experience or satisfaction with the fulfillment of a co-design task."

Where the first point is concerned, many authors have analyzed circumstances under which a customer prefers a customized product over a standardized one. They all build on the basic assumption that customers will only purchase a product when its perceived value exceeds perceived sacrifices associated with the purchasing process (Zeithaml, 1988). Following this line of thinking, Hart (1995, p. 40) argued that "customer customization sensitivity" is based on two factors: the uniqueness of customers' needs and the existence of a customer satisfaction gap between these unique needs and the features offered by standardized products existing in the market. Building on this work, Bardakci and Whitelock (2003) proposed a set of three hypotheses concerning customers' readiness for MC: Customers need to be willing to (1) invest a reasonable amount of time to specify their preferences when ordering a mass-customized product; (2) pay a price premium; and (3) wait a reasonable period to receive the customized product to be ready for MC. Since, therefore, MC may not be an attractive option for all customers, Squire et al. (2004) proposed a responsive agility tool to help companies differentiate between different customer types according to their value criteria (e.g., price, quality, technical attributes) that finally provide the impetus in their willingness to adopt a mass-customized product.

Regarding the second point, the experience during the customization process, several authors have discussed potential drawbacks of the customer's integration into the value creation process, the most prominent of them being information overload. One manifestation of information overload can be mass confusion (Huffman and Kahn, 1998), which describes the inability to cope with the large number of choice decisions to be made during the customization process. This problem has been the basis of many articles dealing with the optimal design of configuration toolkits (e.g., von Hippel, 2001). For example, Franke and Piller (2004) found that even simple toolkits can create value for customers in a business-to-consumer context. Also, Huffman and Kahn (1998) analyzed the impact of different types of choice decisions taken during the customization process. They came to the conclusion that attribute-based decisions, in which customers provide a preference rating for different levels of a single attribute, lead to

higher customer satisfaction than alternative-based ones, during which customers choose between several alternatives. This result is also closely related to another manifestation of information overload that can lead to difficulties during the customization process, namely the inability to match needs with product specifications. Even when customers have a clear understanding of their own needs they might not be able to choose one best solution (Thomke and von Hippel, 2002).

These arguments show that the customization process cannot be separated from the mass-customized product and that, therefore, both need to be seen in combination when analyzing the adoption decision. The close linkage between customization process and the mass-customized product has also been supported by Riemer and Totz (2003), who stated that satisfaction with the co-production process impacts product satisfaction. This can be seen in analogy to research showing that customers' perceptions of retail environments can have an influence on buying behavior (Mattila and Wirtz, 2001).

Generally, a wide range of theories can be applied when explaining the adoption and diffusion of innovations. A very prominent example of this group of theories is certainly the theory of reasoned action (Ajzen and Fishbein, 1980). This theory assumes that an individual's behavior is determined by his or her intent to perform the behavior, being again influenced by the individual's attitude toward the behavior and his or her subjective norm. Ajzen and Fishbein (1980, p. 6) defined *attitude* as an "individual's positive or negative evaluation of performing the behavior" and *subjective norm* as an individual's "perception of the social pressures put on him to perform or not perform the behavior in question." Both attitude and subjective norm are influenced by a small number of salient beliefs individuals hold about performing the behavior and that they can attend to at any moment. The theory of reasoned action has the advantage of being very general and "designed to explain virtually any human behavior" (Ajzen and Fishbein, 1980, p. 4). However, this also implies that it needs to be adapted to each research situation by specifying the set of salient beliefs held by the individuals concerning the specific system to be researched.

One of these adaptations of the theory of reasoned action is the technology acceptance model (TAM) developed by Davis (1985) to investigate the user acceptance of information systems. This model replaces the salient beliefs lying at the heart of the theory of reasoned action by the two constructs: perceived usefulness (PU) and perceived ease of use (PEOU). These constructs are defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" and "be free of effort" (Davis, 1989, p. 320). They are assumed to influence the behavioral intention (BI) of an individual to use a system. In addition to that, PEOU is also hypothesized to have an indirect effect on BI through PU. As can be seen, unlike the theory of reasoned action, the TAM does not include an attitude construct mediating the relationship between salient beliefs and BI. Although attitude was included in the very first version of the TAM (Davis, 1985, p. 24), Davis (1989) decided for its exclusion, most likely due to the following two reasons: (1) Attitude only partially mediated the impact of PU and PEOU on BI; and (2) as highlighted by Venkatesh et al. (2003, p. 428), the exclusion of the attitude construct helped to "better explain intention parsimoniously." This parsimony allows that the TAM can immediately be generalized to a wide set of different computer systems and user populations. According to Gefen, Karahanna, and Straub (2003, p. 53), it is "at present a preeminent theory of technology acceptance in IS [information systems] research." Venkatesh et al. (2003) counted it among the eight prominent user acceptance models they investigate in their study. During the last two decades it has evolved from a theory used to explain the adoption of specific software tools to an approach used for the investigation of IS applications such as the World Wide Web (Agarwal and Karahanna, 2000) or the analysis of consumer behavior in the context of e-commerce applications (Gefen, Karahanna, and Straub, 2003; Gefen and Straub, 2000).

Although not labeled using the term *technology acceptance model*, the same constructs have also been used to investigate the adoption of mass-customized products in a study carried out by Dellaert and Stremersch (2005). These authors estimated an extended logit model to explain customers' evaluations of mass-customization configurations. Their research model assumes that complexity and product utility both contribute to the creation of mass-customization utility, which is, in a second step, translated into a yes–no adoption decision. Additionally, complexity is assumed to indirectly influence mass-customization utility by having a direct impact on product utility. It can easily be seen that these constructs and the relationships between them are very similar to the ones used in the context of the TAM. In addition, applying the

TAM to investigate the adoption of mass-customized products takes account of the fact that MC and information technology can be considered as inseparable siblings. Given that mass-customized goods incorporate environmental data, such as information regarding customers' preferences and wishes, they are information-intensive products (Glazer, 1991). To offer a mass-customized product, it will therefore "be necessary for the firm to develop interactive information-processing systems so that the consumer can identify his or her needs and then have the product ... designed to meet these needs" (Blattberg and Glazer, 1994, p. 18). Therefore, an effective MC strategy demands some form of information system that makes modern information technologies as important an enabler for MC as, for example, flexible manufacturing technologies (Piller, Moeslein, and Stotko, 2004). In addition to that, many authors have highlighted complementarities between MC and e-commerce (see, e.g., Lee, Barua, and Whinston, 2000). Hence, extending the application of the TAM from an analysis of e-commerce applications (Gefen and Straub, 2000; Gefen, Karahanna, and Straub, 2003) to an investigation of MC seems to be a natural evolution.

Regarding the specific influence base category consumption frequency and need satisfaction may have on the decision to adopt a mass-customized product within this base category, a set of competing hypotheses can be developed.

With respect to base category consumption frequency, the work of Shih and Venkatesh (2004) provides an indication that intensive users of a product (i.e., users with a high rate and variety of use) show higher interest in future technologies than other user groups. Also, Dickerson and Gentry (1983) found support for the hypothesis that adopters of innovations have more experience than nonadopters, although it needs to be highlighted that consumption frequency and experience are not completely identical. Finally, Gatignon and Robertson (1985) proposed that new product innovators are drawn from heavy users of other products within the product category. Based on these results, the following hypothesis can be formulated.

H1a: Base category consumption frequency should have a positive influence on the likelihood to adopt a mass-customized product within this base category.

On the other hand, it seems likely that high consumption frequency leads to habituation, which could result in a certain resistance to change given the cognitive effort (Shugan, 1980) and time needed (Bardakci and Whitelock, 2003) to perform the customization process. This is also in line with Lambert-Pandraud, Laurent, and Lapersonne (2005), who found that old consumers tend to choose established instead of new brands when purchasing automobiles. Their higher level of experience leads them to consider fewer brands and to be more loyal to them. Hence, base category consumption frequency should have a negative influence on the likelihood to adopt a mass-customized product within this base category. This leads to the following hypothesis.

H1b: Base category consumption frequency should have a negative influence on the likelihood to adopt a mass-customized product within this base category.

Concerning base category need satisfaction, Garbarino and Johnson (1999) showed that there is a positive relationship between satisfaction and trust in an organization's ability to perform the desired service. This implies that the higher the degree of need satisfaction a customer is experiencing, the higher the trust in the partner of the relational exchange. Additionally, the work of Nooteboom, Berger, and Noorderhaven (1997) provides an indication that there is a negative relationship between trust and risk. Since relational risk consists of two dimensions, namely size and probability of loss, and trust can be considered to decrease the perceived probability of loss, an increase in trust can be said to decrease the perceived risk associated with the relational exchange. As the likelihood of adopting an innovation increases with decreasing risk (Ram and Sheth, 1989), this implies that customers with high base category need satisfaction should be more likely to adopt a mass-customized product within this base category. Hence,

H2a: Base category need satisfaction should have a positive influence on the likelihood to adopt a mass-customized product within this base category.

Looking at a potential influence of base category need dissatisfaction, it first needs to be highlighted that need dissatisfaction is not necessarily equivalent to stopping consumption of the product the consumer is dissatisfied with. As, for example, highlighted by Andreasen (1985), real or perceived exit barriers may cause dissatisfied customers to choose a "political option" and to voice their complaints instead of stopping consumption. And even if such exit barriers do not

exist, negative word of mouth can still be considered as a substitute to exit as has been discussed in the retail banking context (Panther and Farquhar, 2004). However, when customers with a high degree of base category need dissatisfaction are faced with the decision to adopt a mass-customized product within this base category, it is likely that they decide to switch from the standardized to the mass-customized product. Previous research has shown that adding familiar attributes to a product usually improves product evaluation, even when these new attributes are irrelevant or even potentially harmful (Carpenter Glazer, and Nakamoto, 1994; Meyers-Levy and Tybout, 1989; Nowlis and Simonson, 1996). Therefore, a product with the add-on attribute of being customized and adapted to a customer's specific preferences should receive better evaluations than one without this attribute. The likelihood of adoption has been shown to be greater the greater the relative advantages of the innovation compared to existing products (Rogers, 1995), which implies that the likelihood of adoption is higher for customers with high need dissatisfaction. Therefore,

H2b: Base category need dissatisfaction should have a positive influence on the likelihood to adopt a mass-customized product within this base category.

This approach, in which the "researcher examines evidence on two or more plausible hypotheses" (Armstrong, Brodie, and Parsons, 2001, p. 175), has been referred to in the literature as the method of competing hypotheses. It stands in contrast to the predominant approach of studying one dominant hypothesis, which is most often designed to rule out a null hypothesis. The method of competing hypotheses "enhances objectivity because the role of the scientist is changed from advocating a single hypothesis to evaluating which of a number of competing hypotheses is best" (ibid.). As highlighted by Armstrong, Brodie, and Parsons (2001) most studies published in major journals apply the dominant hypothesis method, although marketing scientists to a large extent express the opinion that competing hypotheses should be the preferred approach when at least some information about the subject is available. Hence, Armstrong, Brodie, and Parsons (2001) recommend a more widespread use of the competing hypothesis approach. However, this method also has some drawbacks, for example the assumption that a set of commensurable theories can be identified or the risk of obtaining conflicting results, as has been stressed by Sawyer and Peter (1983).

In addition to the direct influences for each of these factors, it can also be expected that base category consumption frequency, need satisfaction and dissatisfaction have a moderating impact in the context of the TAM. A *moderator* is defined as a qualitative or quantitative "variable that affects the direction and/or strength of the relation between an independent ... and a dependent ... variable" (Baron and Kenny, 1986, p. 1174). Moderators have been investigated extensively in the context of both the theory of reasoned action (see, e.g., Sheppard, Hartwick, and Warshaw, 1988) and the TAM (see, e.g., Venkatesh and Davis, 2000). In line with the argumentation just given, high base category consumption frequency can be expected to lead to habituation, which could result in a certain resistance to change. Hence, for people with high base category consumption frequency, PEOU can be expected to be more important than PU when making the adoption decision. These people need to change their habits and are therefore likely to put relatively high value on an easy customization process with low cognitive effort. Consequently, with increasing base category consumption frequency, the paths from PEOU to BI and PU can be expected to increase which, ceteris paribus, results in a decrease of the path coefficients from PU to BI. Regarding base category need satisfaction, the same effect can be observed for people with high need satisfaction. These people are likely to expect only limited utility increase from the switch to a mass-customized product, which results in a high relative importance of PEOU. A contrary effect is, however, to be expected for consumers with high base category need dissatisfaction, who are more likely to see PU as the major driver for their adoption decision. Hence, with increasing base category need satisfaction or dissatisfaction, the paths from PEOU to BI and PU can be expected to increase or decrease, whereas the path from PU to BI is likely to decrease or increase.

The next section describes in more detail the methodology used to empirically test these competing hypotheses on the influence of base category consumption frequency and need satisfaction on the likelihood to adopt a mass-customized product within this base category.

Methodology

To empirically test the set of competing hypotheses developed in the previous section, the following three-step procedure was applied. First, the existence of a

direct influence of base category consumption frequency and need satisfaction or dissatisfaction on the BI to adopt a mass-customized product within this base category was investigated in the context of the TAM using partial least squares (PLS) analysis. Second, an analysis was performed of whether these three variables have a moderating impact on the relationship between PU and PEOU and BI. Finally, different subpopulations, with respect to unobserved heterogeneity caused by the base category need satisfaction or dissatisfaction variables, were evaluated to test whether they show significantly different adoption behaviors.

PLS analysis (see Haenlein and Kaplan [2004] for a detailed description) is an approach to estimate parameters of a structural equation model (SEM), which was introduced by Wold (1975). It is a variance-based technique that focuses on maximizing the variance of the dependent variable explained by the independent variables in the model. This approach is different from the one applied in the more widely known covariance-based method—implemented, for example, in the LISREL software tool—that "attempts to minimize the difference between the sample covariance and those predicted by the theoretical model" (Chin and Newsted, 1999, p. 309). Although having its origins in the analysis of chemical reactions, PLS analysis has been used occasionally in marketing (see, e.g., Fornell and Bookstein, 1982) and strategic management (see, e.g., Hulland, 1999).

When comparing PLS to covariance-based approaches, there are two reasons for which the first seems to be preferable to the latter in the context of this analysis. First, being a limited information approach, PLS has the advantage that it "involves no assumptions about the population or scale of measurement" (Fornell and Bookstein, 1982, p. 443). Consequently, it works without imposing any distribution and with nominal, ordinal, and interval scaled variables. This was of particular importance in this study as all indicators used for operationalization were highly nonnormally distributed (all Kolmogorov-Smirnov Z-values exceeded 7.168; p-values all below .0005) and measured on 5- and 11-point Likert scales. Second, PLS is applicable even in situations where sample size is small. For covariance-based SEM, it is generally advised that the sample size should exceed 200 cases (Boomsma and Hoogland, 2001). PLS, however, is applicable even under conditions of very small sample sizes. For example, a Monte Carlo simulation performed by Chin and Newsted (1999) indicates that PLS can be performed with a sample size as low as 50. The multigroup approach, which was chosen to test for moderating effects and differences between latent classes, required the total sample of 2,114 observations to be split into various different subgroups, the size of the smallest one being 175. This falls below the threshold usually imposed for LISREL.

The methodology used to test moderating effects differed depending on the scaling of the moderator variable. In case of the observable variable base category consumption frequency, which was measured with one categorical item, the procedure followed the recommendations of Baron and Kenny (1986). First, all observations were split into as many groups as there were different response categories for the categorical item. Subsequently, separate PLS models were estimated for each group, and the corresponding path coefficients in these models were compared following a procedure recommended in Keil et al. (2000). In case of the latent variables base category need satisfaction or dissatisfaction, the present study applied a method suggested by Chin et al. (2003): For each of the moderating effects, indicators measuring the interaction effect were calculated by multiplying all indicators of the moderator and corresponding predictor variable. Interaction effects measured by these sets of indicators were then added to the PLS model as an independent variable, and the associated path coefficients were estimated.

Though the analysis of moderating effects can provide some insight into the more complex influences these variables may have on BI to adopt, it still makes the simplifying assumption that all observations come from a single, homogeneous population. In reality, however, "individuals are likely to be heterogeneous in their perceptions and evaluations of unobserved constructs" (Ansari, Kamel, and Jagpal, 2000, p. 328). Generally, there are two kinds of heterogeneity: (1) observed heterogeneity, which can be revealed by looking at observable variables, such as demographics or stated preferences; and (2) unobserved heterogeneity, for which the sources of heterogeneity are unknown and where individuals can, hence, not easily be divided into subpopulations. Since not accounting for unobserved heterogeneity "can result in misleading inferences and incorrect conclusions" (ibid.), the decision was made to carry out a latent class analysis to take unobserved heterogeneity with respect to the latent variables base category need satisfaction or dissatisfaction into account. Such an analysis was,

however, not necessary with regard to the observable variable base category consumption frequency, since observed heterogeneity with regard to this variable had already been investigated with the multigroup moderator approach just described.

Latent class analysis, which is also referred to in the literature as finite mixture modeling, can be used to classify subjects based on similar response patterns to underlying, or latent, variables. For covariance-based SEM, approaches to simultaneously estimate the finite mixture and SEM were proposed several years ago (Jedidi, Harsharanjeet, and DeSarbro, 1997). Finite mixture PLS, on the other hand, is a rather new development (Hahn et al., 2002). It has not been applied extensively until now, and standard software tools for its estimation are not yet commercially available. To ensure that the findings generated and approach used in this article can potentially be replicated by a large group of researchers, the decision therefore was made not to apply this method but to follow an alternative two-step procedure, although knowing that such a sequential use of statistical techniques may possibly lead to inefficient estimators. First, latent classes regarding the underlying variables base category need satisfaction or dissatisfaction were determined. Second, separate PLS models for each of these latent classes were estimated. Finally, corresponding path coefficients were compared using the same procedure as previously described.

The data used for the empirical analysis stem from a survey about the adoption of an individualized printed newspaper carried out in Germany in 2004. In total, 2,114 respondents were surveyed in face-to-face interviews by a professional market research agency. All interviewees were presented with the same information (see detailed description in Appendix A) regarding a telephone-based configuration system that would give customers the possibility of selecting desired topics from a list provided by the newspaper publisher. A certain number of articles for each topic—also to be specified by the subscriber—would then be included in an individualized printed newspaper, delivered personally to the customer each morning. In case of a change in preferences, the customer would be able to adapt the topic list and number of articles using the same system.

The example of an individualized newspaper was chosen for this study because it had already served as a typical showcase for mass-customized products. For example, Boar (1997, p. 43) described the potential of MC by using the example of defining "your own newspaper by selecting sections from different sources" that "is automatically assembled to your specification and electronically delivered to you at the time you requested." Also, Pine (1993, p. 8) stated that customers may "be receiving a newspaper, magazine or catalogue with text and advertisements different from the same issues other subscribers receive," and Schoder et al. (2005) analyzed an individualized printed newspaper as an example of mass-customized media goods. Furthermore, this product is in line with the definition of mass customization developed by Kaplan and Haenlein (2006) and the framework proposed by Silveira, Borenstein, and Fogliatto (2001). The decision was made to investigate a printed rather than an electronic individualized newspaper to focus on the adoption of a product not yet existing on the market.

With regards to the operationalization of the key variables, the three latent variables of the TAM—PU, PEOU, and BI—were measured by their original scales, which had already been used by Davis, Bagozzi, and Warshaw (1989) and had proven to have excellent measurement properties. Items to operationalize base category need satisfaction or dissatisfaction were identified following the process recommended by Churchill (1979). An item pool of 27 items, identified in collaboration with the market research agency carrying out data collection, served as a starting point, which was subsequently purified by the means of a principal components analysis. This resulted in the deletion of eight items due to low loadings (below 0.5) on all components, five items due to loading on one component on which no other item would load and one item due to a relatively high percentage of missing values (19.8%). The remaining 13 items showed a clear factor pattern loading on two components, namely base category need satisfaction (six items; Cronbach's alpha = 0.859) and base category need dissatisfaction (seven items; Cronbach's alpha = 0.788). Finally, base category consumption frequency, being an observable variable, was measured by one item only. A detailed list of all items used for operationalization can be found in Appendix B and an assessment of their measurement quality in Tables 1a and 1b.

Results

These operationalizations were subsequently used in a PLS model to investigate the existence of a direct

Table 1a. Assessment of Measurement Model[a]

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
PEOU	0.919	0.938	0.791
PU	0.890	0.922	0.748
BI	0.787	0.903	0.822
Need Satisfaction	0.859	0.895	0.587
Need Dissatisfaction	0.788	0.804	0.526

[a] PEOU, perceived ease of use; PU, perceived usefulness; BI, behavioral intention.

Table 1b. Intercorrelations between Latent Variables[a]

	PEOU	PU	BI	SAT	DSAT
PEOU	1.000	0.431	0.450	0.011	−0.128
PU		1.000	0.668	0.141	−0.130
BI			1.000	0.188	−0.166

[a] PEOU, perceived ease of use; PU, perceived usefulness; BI, behavioral intention; SAT, need satisfaction; DSAT, need dissatisfaction.

influence from base category consumption frequency and need satisfaction or dissatisfaction on BI. For this a basic TAM—including only PEOU, PU, and BI—was estimated, to which one of these three variables was added one at a time. Though base category need dissatisfaction did not turn out to significantly influence BI (t-value = 0.9568), both base category consumption frequency (path coefficient = 0.126, t-value = 2.4789) and base category need satisfaction (path coefficient = 0.106, t-value = 2.0179) showed an influence that was significant at the 5% level.

The next step focused on the analysis of potential moderating effects regarding the observable variable base category consumption frequency. The sample was split into four subgroups depending on whether people considered themselves as reading a newspaper daily, almost daily, sometimes, or rarely or never. Subsequently, separate PLS analyses were carried out in each group (see Table 2) and corresponding path coefficients were compared using an adapted version of the t-test as proposed by Chin in Keil et al. (2000). These comparisons all turned out to be significant at the 5% level (all t-values exceeding 4.2), except for two: The path coefficient from PEOU to BI was not significantly different between ''almost daily'' and ''sometimes'' (t-value = 0.6137), and the same was true for the link from PU to BI for the levels ''sometimes'' and ''rarely or never'' (t-value = 0.6642). This resulted in the conclusion that besides having a direct influence, base category consumption frequency also

Table 2. Analysis of Moderating Effect of Base Category Consumption Frequency[a]

	Daily	Almost Daily	Sometimes	Rarely or Never
Sample Size	1054	378	348	312
Stone-Geisser Q^2	0.573	0.573	0.532	0.562
R^2 value (PU) (%)	21.8	17.8	16.0	13.4
R^2 value (BI) (%)	46.5	51.6	44.5	39.0
Path coefficient PEOU–PU	0.467	0.421	0.400	0.366
Path coefficient PEOU–BI	0.209	0.249	0.246	0.185
Path coefficient PU–BI	0.559	0.577	0.529	0.532

[a] PU, perceived usefulness; BI, behavioral intention; PEOU, perceived ease of use.

has a significant moderating effect when investigating the behavioral intention to adopt in the context of the TAM.

Regarding the analysis of moderating effects for base category need satisfaction and dissatisfaction, the recommendations of McClelland and Judd (1993) served as a yardstick. This implied that not only the interaction effect but also a direct influence from the moderating variable were included into the SEM. However, none of the effects investigated was significant at the 5% level. There are, therefore, no indications for significant moderating effects of base category need satisfaction or dissatisfaction in the context of the TAM.

Finally, a latent class analysis was carried out following the three-step approach proposed by Vermunt and Magidson (2002). First, different solutions for an increasing number of latent classes between one and five (since the six-class solution would have resulted in zero degrees of freedom) were estimated. Out of these five solutions the one- and two-class solutions showed p-values below the 5% threshold and hence were discarded. From the remaining three models the three-cluster solution was subsequently chosen as the final one, due to its highest p- and lowest AIC, BIC, and CAIC values.

The resulting three classes showed a clearly interpretable pattern: Class 1 (1,299 subjects) consists of individuals with a very high degree of need satisfaction with respect to traditional newspapers. More than 85% of all subjects read a newspaper daily (66.7%) or almost daily (20.8%) with an average reading time of roughly 41 minutes per day, and more than 45% read more than one newspaper. Class 2 (488 subjects) shows a medium level of base category need satisfaction and dissatisfaction. Overall, individuals in class 2 are neither in favor of nor against

newspapers, with most of them reading a newspaper only sometimes (33.7%) for an average reading time per day of 27 minutes. Class 3 (175 subjects), on the other hand, shows a very high degree of need dissatisfaction with respect to the base category. It consists of people reading a newspaper rarely (41.2%) or never (28.8%) and has the lowest average reading time of 15 minutes per day. Looking at differences in demographic characteristics across those latent classes reveals that class 1 consists of relatively old people (60% are over 44 years old) and class 3 of relatively young ones (28% between 16 and 24 years). Looking at occupation, this corresponds to the fact that many retired people are in class 1 (30.6%), whereas class 3 has the highest number of students (10.8%).

Subsequently, separate PLS models for each of these latent classes were estimated. Table 3 shows the resulting R^2 values, Stone-Geisser Q^2, and path coefficients (all of which were significant at the 5% level, all t-values exceeding 2.5). Corresponding path coefficients were then compared using the same procedure as previously outlined, and all differences turned out to be significant at the 5% level (all t-values exceeding 7.5). These results, therefore, indicate that different latent classes with respect to unobserved heterogeneity regarding the latent variables base category need satisfaction or dissatisfaction have significantly different adoption behaviors.

As suggested by one of the two reviewers, the influence of base category consumption frequency and need satisfaction or dissatisfaction on PEOU and PU was also investigated. It could be expected, for example, that base category consumption frequency, as a variable related to constructs like experience or familiarity not only could moderate the impact of PEOU on PU but also could have a direct effect on either of them, as found by Dellaert and Stremersch (2005). Furthermore, the effect of base category need dissatisfaction on BI could have been fully mediated by PU. From the six paths investigated, one—base category need satisfaction on PU—turned out to be significant (path coefficient = 0.1400, t-value = 2.1431), whereas all others showed t-values between 0.4617 and 1.1834.

Table 3. Latent Class Analysis with Respect to Base Category Need Satisfaction or Dissatisfaction[a]

	Class 1	Class 2	Class 3
Sample Size	1299	488	175
Stone-Geisser Q^2	0.590	0.532	0.514
R^2 value (PU) (%)	20.3	16.4	12.8
R^2 value (BI) (%)	47.5	45.5	44.4
Path coefficient PEOU–PU	0.450	0.405	0.357
Path coefficient PEOU–BI	0.198	0.237	0.129
Path coefficient PU–BI	0.577	0.543	0.609

[a] PU, perceived usefulness; BI, behavioral intention; PEOU, perceived ease of use.

Discussion

It has frequently been stated that a customer's return from adopting a mass-customized product is influenced not only by the value of the product itself but also by the experience made during the customization process. Since the customization process for these information-intensive products demands some form of information system, MC and information technology can therefore be considered as inseparable siblings. Hence, the behavioral intention to adopt a mass-customized product can be analyzed using the TAM, as was done in Dellaert and Stremersch (2005). Using this model as a starting point, for the present study a set of competing hypotheses was developed regarding the influence of base category consumption frequency and need satisfaction or dissatisfaction on the decision to adopt a mass-customized product within this base category. These hypotheses were subsequently tested building on a sample of approximately 2,000 customers surveyed regarding their intention to adopt an individualized printed newspaper using a combination of PLS and latent-class analysis.

The statistical analysis resulted in three findings. First, there is a significant direct positive influence from base category consumption frequency and need satisfaction on the behavioral intention to adopt a mass-customized product within this base category. Such an influence was, however, not detectable for the base category need dissatisfaction construct. This can be seen as a support for H1a and H2a. The more frequently subjects consume products out of the base category or the more satisfied their needs are due to this consumption, the higher is the BI to adopt a mass-customized product within this base category.

Second, the results indicate that base category consumption frequency has a significant moderating effect when investigating BI to adopt in the context of the TAM. This is best seen when looking at the link between PEOU and PU, which gets stronger with increasing base category consumption frequency. Hence, the more frequently subjects consume products out of the base category, the more important will be the impact of PEOU mediated by PU. This finding

is consistent with the results of Davis, Bagozzi, and Warshaw (1989), who stated that the influence of PEOU on PU gets more important with increasing experience. Regarding the influence of PEOU and PU on BI, the analysis shows that these links are strongest for subjects with medium base category consumption frequency.

Finally, different latent classes with respect to unobserved heterogeneity regarding the latent variables base category need satisfaction or dissatisfaction have significantly different adoption behavior. One possible explanation for these differences in path coefficients could be that individuals who show a high level of need dissatisfaction are less interested in the ease of use of a mass-customized version of this product than its usefulness (i.e., increase in need satisfaction). This is supported by the fact that class 3 has the lowest path coefficient from PEOU to BI (0.129 versus 0.198 and 0.237) and PEOU to PU (0.357 versus 0.450 and 0.405). On the other hand, subjects who have a high degree of base category need satisfaction base their adoption decision mainly on the ease of use of the mass-customized product. This can be seen by looking at class 1, which has the strongest path from PEOU to PU (0.450 versus 0.405 and 0.357).

This analysis may suffer from some limitations, three of which are directly or indirectly related to applying the TAM. First, the empirical analysis focused only on the behavioral intention to adopt a mass-customized product and not on the relationship between intention and actual usage or adoption. Previous studies have found substantial empirical support for a link between intention and actual behavior. For example, a meta-analysis carried out by Sheppard, Hartwick, and Warshaw (1988) for the theory of reasoned action showed a correlation of 0.53 between intention and behavior and Davis (1989) and Davis et al. (1989) also found strong empirical support for the same relationship in the context of the TAM. Yet the gap between intention and behavior could be larger in the present study since there may only be limited consumer knowledge regarding an individualized printed newspaper given that this product does not yet exist on the market. This lack of market presence for such a product, although it would be technically feasible, may be due to the fact that transitioning from standardized to mass-customized manufacturing requires a significant transformation (Pine, Victor, and Boynton, 1993), which no publishing company has risked so far given the difficult situation the newspaper publishing industry is facing at the moment.

Second, by applying the TAM to investigate the behavioral intention to adopt a mass-customized product, the analysis does not provide insight into specific reasons for adoption that could be addressed by managerial strategies. To obtain such insights, it would have been necessary to extend the research model by a set of potential antecedents of PEOU and PU. Such model extensions have not been pursued due to the different focus of this study: to better understand the influence of factors related to characteristics of the base category on the behavioral intention to adopt. However, publications addressing this gap could be a very interesting area of further research. Particularly, investigating the positive or negative impact of perceived innovativeness (see, e.g., Garcia and Calantone, 2002) and perceived newness (see, e.g., Hoeffler, 2003) of a mass-customized offering in a certain product category on the adoption decision seems to be highly interesting.

Third, the research model did not include a variable measuring an individual's subjective norm. This variable, which was part of the original theory of reasoned action, has only been recently added to the TAM by Venkatesh and Davis (2000). It may be possible that, especially in the case of mass customization in which a product and a technology are inseparably interwoven, the reliance on others' opinions might play an interesting role to be investigated. Furthermore, the empirical analysis focused on the investigation of one specific product example only—an individualized printed newspaper—and data collection was limited to one country, Germany. It may therefore be possible that the findings are idiosyncratic and not fully generalizable to either other product categories or other countries. Additionally, by surveying people at one specific point in time, the present study does not provide insight into the longitudinal characteristics of both the adoption decision and the influence of potentially moderating variables. For example, the work of Davis, Bagozzi, and Warshaw (1989) provides an indication that PEOU may become less significant with increasing experience of using a new technology.

Overall, it seems likely that newspapers belong to a low-involvement product category. Therefore, using this example might have led to conclusions that are different from those that might be obtained when researching a high-involvement product such as, for example, cars, fragrances, or fashion items. Bloch (1982) concluded, based on a theoretical discussion of product importance, that important products are more

likely to affect attitudes and behaviors than unimportant ones. Moreover, highly involved consumers are likely to attend to and comprehend more information regarding the shopping situation and therefore to gain more elaborate knowledge and inferences from it (Celsi and Olson, 1988). Therefore, it seems sensible to extend the analysis to products with different degrees of involvement to test the robustness of the findings obtained (See Laurent and Kapferer [1985] and Zaichkowsky [1985] for a definition of the involvement construct and potential operationalization). This is especially important since the finding that there is a significant positive influence from base category need satisfaction on BI to adopt a mass-customized product seems to contradict the work of Chamberlin (1950) and followers (see, e.g., Rothschild, 1987). They state that product differentiation results from a lack of satisfaction with an existing standard offering. Furthermore, the positive impact of base category consumption frequency on BI to adopt may not hold in product categories where users are more or less obliged to a certain level of consumption frequency. In the case of newspapers, users have the option to decide whether and how often they want to consume the product. If they decide for a low consumption frequency, they can either use other media to satisfy their information needs or decide not to satisfy them at all and to live uninformed. In the case of apparel items like shoes, which have been used previously as an example in MC literature (see, e.g., Boer, Dulio, and Jovane, 2004), consumption frequency is relatively high by definition, since everybody wears shoes most of the time. In this case, the question might be more whether there is a high relative consumption frequency—compared to the average one for all users—for one subproduct in the base category. People wearing sports shoes most of the time might then be generally more interested in purchasing mass-customized sports shoes than people who wear sports shoes only for going to the gym.

Also, two methodological concerns need to be highlighted. First, the fact that no significant moderating effects with respect to the base category need satisfaction or dissatisfaction construct were detectable may need to be interpreted with caution. McClelland and Judd (1993) gave an indication that interaction effects may be very hard to detect in nonexperimental settings. Due to a large number of factors (e.g., measurement error) they showed that under certain circumstances the researcher needs several thousand observations to be able to achieve a sufficient level of statistical power. Second, the use of PLS instead of LISREL could be seen as a limitation, since it has been stated in the literature that LISREL is better suited when the researcher wants to explain relationships between latent variables in an SEM whereas PLS is more recommended when the desire is to predict a dependent variable (Haenlein and Kaplan, 2004).

However, even in the presence of these limitations the analysis results in interesting insights of high managerial relevance regarding the prediction of market reactions and the understanding of the strategic use of product-line extensions based on mass-customized products. These findings indicate that base category consumption frequency and need satisfaction positively influence the behavioral intention to adopt a mass-customized product. Hence, mass customization can be seen as one way to deepen the relationship with satisfied existing clients. This is fundamentally different from seeing mass-customized products as an approach to prevent dissatisfied customers from leaving. This would have been, for example, the case when base category need dissatisfaction would have had a significant influence on the behavioral intention to adopt.

Furthermore, the findings also point to at least two promising areas of further research. First, there is a significant influence between factors related to the base category and the behavioral intention to adopt a mass-customized product within this base category. It would be an interesting topic to investigate this interrelationship even further, for example, by analyzing the importance of the add-on attribute of being mass customizable using discrete choice models, similar in spirit to the work of Dellaert and Stremersch (2005). Second, the results provide an indication that need satisfaction and dissatisfaction are not simply different sides of the same coin but must be considered as different concepts. If one was the strict opposite of the other, then the positive influence of base category need satisfaction would have been mirrored by a negative influence of base category need dissatisfaction. The absence of the latter finding gives a strong indication that need satisfaction and dissatisfaction are in fact different dimensions. This has important implications for consumer behavior research in general and new product innovation research in particular. It implies, for example, that empirical studies using need satisfaction as an independent variable should also include need dissatisfaction in their model to ease interpretation. Furthermore, different models and hypotheses may need to be developed for satisfied

and dissatisfied customers, since one may not simply be a negation of the other.

In summary, a set of competing hypotheses regarding the influence of base category consumption frequency and need satisfaction or dissatisfaction on the behavioral intention to adopt a mass-customized product within the base category was developed. Using a sample of approximately 2,000 customers surveyed regarding their adoption of an individualized printed newspaper these hypotheses were subsequently evaluated using a combination of partial least squares and latent class analysis. The results generated are threefold. First, the hypotheses that base category consumption frequency and need satisfaction have a significant positive influence on the behavioral intention to adopt a mass-customized product were supported. Second, different levels of base category consumption frequency lead to significantly different behaviors when analyzing the behavioral intention to adopt in the context of the TAM. Finally, there is evidence that different latent classes with respect to unobserved heterogeneity regarding the latent variables base category need satisfaction or dissatisfaction have significantly different adoption behaviors. These findings are of high importance for managers and researchers alike, as they help to better predict the market reaction to the introduction of a mass-customized product and to better understand the strategic use of product line extensions based on mass-customized products.

Appendix A. Information Presented to Interviewees

The following information was presented to all interviewees in the German language.

Assume it would be possible to get an individualized printed newspaper fully adapted to your personal preferences. For example, if you are particularly interested in politics, sports or science, the newspaper would contain mainly articles from these areas. The newspaper would therefore be adapted to your personal preferences in terms of content and size. The process to follow to personalize your newspaper would be as follows:

(1) The topics of particular interest are identified out of a topic list (e.g., local news, politics, events, special kinds of sports, certain stock prices)
(2) The resulting personalized topic list is transferred via phone using a toll-free number (either by using tone dialing or voice)
(3) This personal topic list can be changed any time by phone (without further calls the current personal topic list remains as it is)

Appendix B. Construct Operationalization

Perceived ease of use (PEOU, measured on a five-point Likert scale)

- I think the process of customizing is clear and understandable.
- After several uses I will probably become more skilful in the process of customization.
- The process of customizing seems to me easy to learn.
- I think that I could operate such a customization process well.

Perceived usefulness (PU, measured on a five-point Likert scale)

- I would find an individualized newspaper very useful to me.
- Using an individualized newspaper would enable me to attain important information faster.
- Using an individualized newspaper would increase my degree of being informed.
- I would enjoy reading a newspaper customized according to my interests.

Behavioral intention to adopt (BI, measured on an 11-point Likert scale)

- How probable would it be that you test such an individualized newspaper?
- How probable would it be that you order such an individualized newspaper?

Base category consumption frequency

- How often do you read a newspaper?
  - Daily
  - Almost daily
  - Sometimes
  - Rarely
  - Never

Base category need satisfaction (measured on a five-point Likert scale)

- Reading a newspaper enables one to better participate in, for example, conversations with neighbors, friends, and colleagues.

- I like newspapers as one can read them everywhere, whether at home, in the office, or on public transport.
- For me, glancing through and browsing a newspaper is important. I find this stimulating, and it gives me interesting ideas.
- I like newspapers as one can read them at any time rather than having fixed program times.
- I like newspapers as one has something in black and white in front of oneself, enabling one to reread important articles or underline important points.
- Reading a newspaper is part of my daily life.

Base category need dissatisfaction (measured on a five-point Likert scale)

- Reading a newspaper is too time consuming.
- Newspapers contain too many irrelevances, and much that is not of interest to me.
- Reading a newspaper is often difficult and exhausting.
- It often takes a long time to find the information in which one is really interested in newspapers.
- Newspapers are often not up to date; the latest news can be accessed elsewhere faster.
- Newspapers often look boring and have little appeal.
- Newspapers are often not convenient and are too large.

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