Managing High Variety:
How to Overcome the Mass Confusion Phenomenon of Customer Co-Design

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The idea of integrating users into the design and production process is a promising strategy for companies being forced to react to the growing individualization of demand. While there is a huge amount of managerial literature on manufacturing and information systems for mass customization, research on the role of the customer within the co-design process is rare. However, customers face new uncertainties and risks when purchasing a customized good. We discuss these risks and provide a new approach to address these problems based on personalization and collaboration. We will analyze how personalization of the co-design process and collaboration of users within communities can render (mass) customization more efficient. Our objective is to set a research agenda in the field of user interaction with toolkits for customer co-design.

1. Customer Co-Design and Mass Customization

Enterprises in all branches of industry are being forced to react to the growing individualization of demand and to find ways to manage the resulting product variety. Yet, at the same time, increasing competitive pressure dictates that costs must also continue to decrease. Companies have to adopt strategies which embrace both cost efficiency and a closer reaction to customers' needs. Strategies like agile manufacturing, focused factories, mass customization, flexible manufacturing, or customer relationship management are seen as concepts to address these competitive demands (Sahin 2000). While the approaches are characterized by different manufacturing philosophies and/or fulfillment systems, they share an intense customer centric view. Products and services are not being mass produced for an anonymous market but customized in a high variety for each

individual customer. In doing so, the customer is seen as a partner in the value creation: as co-producer or even co-designer.

In the following, we will concentrate on the concept of mass customization (Pine 1993), which is gaining growing interest both from academia and business (see Duray 2000; Piller 2001; Tseng/Jiao 2001 for an overview). In the mass customization concept, goods and services are to meet individual customer's needs produced with near mass production efficiency (Tseng and Jiao 2001). This preposition means that individualized or personalized goods can be provided without the high surpluses connected traditionally with (craft) customization. Until today, mass customization was argued to be possible due to the capabilities of modern manufacturing technology such as flexible manufacturing systems or modular product structures, reducing the trade-off between variety and productivity (e.g. Ahlström/Westbrook 1999, Duray 2000, Kotha 1996, Pine 1993, Tseng/Jiao 2001). However, new flexible manufacturing systems are a necessary but not sufficient condition for successful mass customization. They have to be supplemented by information technologies capable of handling the information flows and transaction costs connected with mass customization. Mass customization is characterized by a high intensity of information compared to mass production (Duray 2000, Lee/Barua/Whinston 2000, Reichwald/Piller/Möslein 2000). Whereas modern flexible manufacturing technologies have already been in place for more than a decade, systems to handle the increasing intensity of information and interaction with the customers have only been available for a few years. Especially Internet technology can be seen as a main enabler for such systems.

The significance of information handling capabilities is grounded in a two stage process of product development. While product architectures and the range of possible variety are fixed during a preliminary design stage, a second design and development stage takes place in close interaction between the customer and the supplier. Zipkin (2001) calls this process the elicitation of a mass customization system, the mechanism for interacting with the customer and obtaining specific information in order to define and translate the customer's needs and desires into

a concrete product specification. The importance of efficient information handling capabilities may explain the time lag between the long discussion of mass customization in the literature and its late implementation in practice. While the concept has been described in literature for more than a decade (e.g. Davis 1987, Pine 1993; in fact A. Toffler had already illustrated the basic idea in 1970), increased implementation of mass customization principles can be found only in the last few years. Unlike in many business-to-business (B2B) markets, where customization is relatively common (however, often connected with high surpluses), in business-to-consumer (B2C) markets implementation of mass customization has only recently started.

During elicitation, the customer is integrated into the value creation of the supplier. “Consumers take part in activities and processes which used to be seen as the domain of the companies” (Wikström 1996, p. 360). The result is a system of co-production, i.e. a manufacturer-customer interaction and adaptation for the purpose of attaining added value (Milgrom/Roberts 1990; Normann/Ramirez 1994). The customer becomes a “co-producer” respectively “prosumer” (Toffler 1970). While this view is not new (see Ramirez 1999 for an overview), it is only today that we see a broader application of this principle in practice (in business-to-consumer as well as in business-to-business markets). However, as the main part of the interaction with the customer takes place during the configuration and therefore the design of a customer specific product, it seems appropriate to call the customer rather a co-*designer* than a co-producer. *Customer co-design* describes a process that allows customers to express their product requirements and carry out product realization processes by mapping the requirements into the physical domain of the product (Helander/Khalid 1999, Tseng/Du 1998, von Hippel 1998). During these co-designing processes, users sometimes even take over the role of being the innovators: the “need-information” is converted into a solution at the locus of the user without costly shifts of the information from user to the manufacturer (von Hippel 2001).

Against this background, research on the process of customer integration and how to enable users to design the product desired seems obvious. Customer co-

design is a distinctive principle of mass customization and the basis of the differentiation benefit of customized design and manufacturing leading to products that correspond exactly to the customer's needs (Piller 2001). However, as we will discuss in the following chapter (*Part 2*), co-design can lead to a complex, risky and uncertain buying situation counterbalancing the benefits of customization from the customer's perspective. The use of dedicated tools to handle and reduce this complexity is a major success factor of mass customization (Bourke 2000, Weston 1997, Piller 2001). These toolkits are the locus of customer integration and, thus, the place where co-design is performed. We will discuss briefly the basic design and layout of these toolkits for customer integration in *Part 3* of this paper. However, just a good configuration engine is not enough. The ability to handle modular product architectures and to bundle modules to a customized product is important.

Empirical research[1] showes that despite of a good configuration logic customers often still feel uncomfortable with the co-design task and experience high risk. The objective of this paper is to introduce two further approaches to reduce these uncertainties and to help customers to co-design a customized product: Personalization and Collaboration. *Part 4* and *5* of this paper discuss how personalization and user collaboration (within communities) can support customer co-design and mass customization. *Part 6* will bring both approaches together.

2. The Customer's Perspective: High Variety or Mass Confusion?

While mass customization is often addressed in the literature as a promising and beneficial approach to meet today's market demands, some authors have recently discussed its limits and concerns (e.g., Agrawal/Kumaresh/Mercer 2001, Zipkin 2001). One limit of mass customization often quoted is that excess variety may

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[1] Empirical research on mass customization and configuration is just evolving. See Franke/Piller (2002) for an overview and a discussion of the state or research.

result in an external complexity that Pine termed as “mass confusion” (in: Teresko 1994). It’s a common problem of what Gross calls the “Multi-Options Society” (Gross 1994).

One can look at the relation between the customer and a 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 (Huffman/Kahn 1998).

Customers can be overwhelmed by the number of choices during product configuration (Friesen 2001, Huffman/Kahn 1998). Large assortments and choice are often negatively perceived by consumers. Instead of offering degrees of freedom, they seem monumental and frustrating. It has been found that in some cases very large assortments may make consumers more promotion sensitive than when faced with smaller assortments. Possibly this is because the promotion information is used to screen out unacceptable alternatives from the large assortment into smaller manageable consideration sets (Kahn 1998, Miller 1956). Everyone who has experienced decision situations in the face of numerous choices – e.g. in a super market in a foreign country trying to figure out which of the 200 detergents to choose or in a restaurant facing a menu with 500 meals – knows that to equate a high number of possibilities with high customer satisfaction would be starry-eyed optimism.

The number of choices on typical mass customization sites exceeds these well-known decision problems by far. In fact, one has to convert the number of choices into a familiar area to get an adequate understanding of *how* many choices the customer has. Imagine somebody wanted to build a shop large enough to display all variants of Customatix.com sport shoes (approximately $3*10^{21}$) the surface of the whole earth would be scarce – in fact one would need 7’000 planets of the size of the earth, each of them completely covered with shoes. The burden of choice

may simply lead to information overload (Maes 1994, Neumann 1955), resulting from the limitations of the human capacity to process information (Miller 1956).

As a result the configuration process may last quite long, and customers may experience an increasing uncertainty during the transaction process. Proposing such a large number of variants requires comparison processes and the selection process becomes more difficult than for 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 problem. Information gaps are often associated with unfamiliar and complex individualization possibilities. Additionally, online buyers of mass customized goods face additional risks in the configuration process on the Internet.

These uncertainties and the effort put into the configuration process can be interpreted as additional transaction costs for the customer. One of the most important tasks of the mass customizer it to ensure that the customer's expenditure is kept as low as possible, while the benefit she experiences has to be clearly perceptible. Leading companies have implemented strong instruments to build trust and reliability in order to reduce the risk seen by prospective customers in the mass customization process. Other instruments minimizing the risk of the customer are warranties or the reputation of the provider. 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. The buyer of a personalized gift watch of *idtown.com* with a purchase price of 35 Euro will experience smaller complexity of the purchase process than the buyer of a *VW S*edan (a car), which can be configured and ordered without the involvement 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 required degree of customer integration is influenced by the relative price of the products and services, the possible use of instruments to prevent bad investments (e.g. warranties, exchange policy, time of delivery, screening possibilities), the customer's experience with a product (e.g.

recurring purchase, product specific knowledge), and its complexity (customization possibilities; product structure). It is also worth considering if the configuration process itself can be regarded as part of the product purchased (configuration as buying experience, leisure activity). This would positively stimulate the customers to make the effort.

Thus we conclude that the co-design process as well as the co-design environment need to be carefully planned in order to successfully reduce the complexity and risk of the configuration process and to create a positive flow experience (Oon/Khalid 2001, Novak/Hoffman/Yung 2000, Totz/Riemer 2001).

3. Configuration Toolkits to Limit Mass Confusion

Interaction systems for mass customization are the primary instrument to reduce costs and to create a positive design experience. Known as configurators, choice boards, design systems, toolkits, or co-design-platforms, these systems are responsible for guiding the user through the configuration process. In these systems different variants are represented, visualized, assessed and priced which starts a learning-by-doing process for the user. While the term “configurator” or “configuration system” is quoted rather often in literature, it is used for the most part in a technical sense addressing a software tool. The success of such an interaction system is, however, by no means not only defined by its technological capabilities, but also by its integration in the whole sales environment, its ability to allow for learning by doing, to provide experience and process satisfaction, and its integration into the brand concept. Tools for user integration in a mass customization system require more than mere arithmetic algorithms to combine modular components. Using an expression from von Hippel (2001), we will therefore use the term “toolkit”.

While toolkits theoretically do not have to be based on software, all known mass customizers use a system which is at least to some extent IT-based. Mass customization toolkits consist of three main components (Bourke 2000; Weston 1997; Piller 2001):

- The core *configuration software* presents the possible variants, and guides the user through the configuration process, asking questions or providing design options. Consistency and manufacturability are also checked at this stage.

- A *feedback tool* is responsible for presenting the configuration. Feedback information for a design variant can be presented as a visualization or in other forms (containing e.g. price information, functionality test etc.) and is the basis for the trial-and error learning of the user.

- *Analyzing tools* finally translate a customer specific order into a list of material, construction plans, and work schedules. They transmit the configuration to manufacturing or other departments.

There is a broad spectrum of toolkits for customer driven product development and configuration. On one end of the continuum there are simple toolkits where users are just allowed to choose from different options (color, size, etc.) – a good example is Dell Computers. In such systems, the degree of possible innovation is rather limited. On the other end of the scale, there are toolkits that assign the user a much more active role. The user actually *creates* (and not only chooses) which allows for radical innovation. An example for these more extreme toolkits is open source software where the users are (almost) free to program whatever comes to their mind. But although toolkits thus can be quite heterogeneous the user's interaction with it is of particular importance for the success of the respective user integration system.

The existence of a configuration toolkit, however, does not automatically solve the problems with the complexity of the configuration process. Toolkits do also not decrease the additional transaction costs of the customer per se. Making the configuration process available on an electronic platform and an easy-to-use user interface is a prerequisite for handling configuration complexity. To really decrease the configuration complexity, the configuration toolkit has to explicitly support the customers in specifying their needs and in making informed choices. Our approach to this issue is not to concentrate just on user interface improvements

(usability), but to utilize *personalization* and *customer collaboration* (communities) as innovative means to deal with mass confusion.

The use of electronic media for customer integration adds a new potential to the vendor-buyer relationship. It gives the customer a voice, an input channel from which she can participate in a number of activities such as product development, feedback, support for other customers, recommendations etc. This can be in the form of active participation or simply a sharing of preferences. The structuring and organization of this participation may empower the customer and may result in new kinds of dynamics in customer collaboration. Our objective is to bring together the two "worlds" of customer collaboration and personalization in order to enable new forms of collaborative mass customization of individual products – without mass confusion.

4. Personalized Customer Co-Design

Personalization must not be mistaken with customization. While customization relates to changing, modifying, assembling or modifying *products* or (primary) *services* according to a customer's needs and desires, personalization relates to the *communication* and *interaction* between two parties, namely customer and supplier. Personalization in general is about selecting or filtering information objects or products for an individual by using information about the individual (her customer profile). From a large set of possibilities, customer specific recommendations are selected. From a technical point of view, automatic personalization or recommendation means matching meta-information of products or information objects against meta-information of customers (stored in the customer profile). Personalization is increasingly considered to be an important ingredient of Web applications. In most cases personalization techniques are used for tailoring information services to personal user needs. In marketing, personalization supports one-to-one marketing (Peppers/Rogers 1997) which should increase the customer share over a lifetime.

A good example of both customization and personalization provides *Land's End,* a catalog retailer. The company has implemented a virtual model and recommendation service on its web site since 1999. The system recommends a customized bundle of standard mass products matching each other and the customer's style profile. This service provides customers with a concerted outfit rather than with various articles of clothing. However, the products itself are unchanged. In 2001, Land's End introduced customization. Customers can order made-to-measure trousers and shirts. All products are made to order from the factory. Design options and variety are quite large (despite an almost unlimited number of sizes). However, this customization process is not supported by personalization. A consumer has to know by herself which style, waistline and length suits her best. The configuration toolkit of Land's End does not provide any information or consultancy. For this company personalization as performed (almost ironically) for standard products would provide real additional benefit and would empower a customer without the knowledge of a tailor to customize a product more easily.

Personalization can support mass customization and customer co-design by providing personalized product configurations and by selecting display options in the configuration process:

- By presenting a personalized pre-configuration, the co-design process of a customer can be shortened, streamlined and focused on providing real customer value. Instead of starting to combine the core product from scratch with hundreds or millions of options, the customer can concentrate on designing a solution that fits her known needs.

- During the configuration process the complexity and burden of choice can be reduced heavily by presenting only options being identified as relevant from a customer's profile.

AutoScout24, a European intermediary and brand-independent seller of cars is good example for a company supplying customer-specific recommendations. While many European car manufacturers have a configurator on their web site that

enables customers to choose from millions of combinations, AutoScout24's configuration process is based on questions regarding their needs (family size, urban or country driver, safety needs, speed or fuel efficiency etc.). Based on this profile, different cars which fit these parameters are individually pre-configured for each customer providing a good starting point for the individual co-design.

The ability to deliver automated personalization rests upon (1) the acquisition of a "virtual image" of the customer (customer profile), (2) the availability of meta-information about the different options and (3) the availability of methods to combine the datasets in order to derive recommendations for the customer. In practice, the first point – the acquisition of the customer profile – is most crucial. Depending on the personalization methods used, there are two requirements for the representation of the customer profile:

- Information about preferred content and relationships to content objects has to be stored for *content based filtering*.
- Relationships to other customers and ratings have to be managed for *collaborative filtering*.

The acquisition and usage of customer profile information for automated filtering and other automatic processes is extensively discussed in (Schubert/Koch 2002, 2003). In addition to the problem of collecting enough information about the customer to provide valuable recommendations the main problem is the trust which customers have in the platform.

5. Collaborative Customer Co-Design

(Mass) Customization is almost exclusively connected to "individuality" – to serve each individual customer with a customized product or service according to her personal needs. Thus, mass customization is reduced to the interaction between a firm and *one* customer. However, customization in regard to (aesthetic) design is often influenced by peers and the taste of a community rather than by the individual

taste of a single person (the EuroShoe (2002) study proved this, for example, significantly for the footwear industry). Also, customization in regard to functionality is often defined by the needs of a community of users (due to interface requirements, network effects, etc.). But communities may not only set (restrict) the range of customization, but provide also sufficient support for a user during her own customization process.

Early examples of communities of end-users developing products jointly came from the sports goods industry. For example, Lüthje (2002) found that in a representative sample of outdoor athletes, ten percent built a prototype of new sport equipment. Franke/Shah (2002) found even higher proportions of innovators in four samples of snowboarders, canyonists, handicapped cyclists, and sailplaners. In both studies, new products and co-design activities were not performed by single users but the result of a joint effort of a (real life) community of athletes.

A firm may draw from this experience and innovative power of communities to enable mass customization more efficiently: Supporting whole communities of customers instead of individual customers can enable customer to co-design and solve some of the problems discussed in part 2 of his paper. Bringing communities of people together stimulates three major potentials:

(1) The collection and effective use of community information and generation of customer knowledge: Within a community, knowledge is created and shared collaboratively (Ishida 1998). Thus, users may be supported finding a solution fitting better to their needs. Also the evaluation of different options can be supported. Note that this support is generated – at least in the theory of a perfect community – by the users themselves and not by the supplier of the customized good – increasing the interaction and configuration efficiency of the supplier.

(2) Collective invention: Sharing innovation in community may drive new innovations. Collaborative co-design can foster creativity and stimulate better solutions due to the effect of intrinsic motivation on innovation-related activities (self reward and exchange of information, see Franke/Shah 2002).

(3) The building of trust: If a customized solution is jointly developed by a group of users, the result is more robust and often considered as more trustful. In a traditional mass customization system. Users have to trust their own configuration skills. In a system of collaborative customization, trust is generated jointly and thus stronger.

One example where we find collaborative design features is the non-commercial LEGO User Group Network (LUGNET™, www.lugnet.com). Within this community, hundreds of users create virtual and real worlds out of Lego blocks, using a powerful configuration system (a CAD system based on the LEGO product architecture). Lugnet is a fascinating example of how users make use of a modular product structure (a typical mass customization situation) in combination with a dedicated interaction system for collaborative co-design to create new products and foster creativity. The LEGO Company is currently investigating possibilities to use the potential of this community and the community processes in general to support their product marketing and sales – and to enable their regular users (kindergarten and school children) to interact better with their products.

Another, much simpler example provides *American Eagle*, a US-based fashion retailer. Instead of investing in customization technologies for the manufacturing process or interaction toolkits which are used *before* purchasing the product, the firm does provide customization after the purchase: In selected shops, special workshop areas are created where customers can transform from-the-rack clothes into individual clothes (by literally cutting holes in t-shirts) with the help of trainers. What sounds like an obscure marketing idea proofed to be a large success – mainly because of the joy and experience of jointly post-designing clothing by a group of customers. Customer inspire themselves and get a positive feedback from their counterparts in the shop. The workshops became major meeting points in shopping malls and increased customer traffic to the stores significantly.

6. Personalization Meets Collaboration

Groups of customers who are drawn to the Internet in order to perform online purchase transactions and collaborate in the process of product purchases are often referred to as “Virtual Communities of Transaction”. Platforms for communities of transaction can result in an enriched product catalog, which Schubert (2000) termed “Participatory Product Catalog”. Involving different customers and breaking down the barrier among customers, in the Internet or in offline scenarios as described above, opens several possibilities for improving the personalization process. Community platforms which support communication among people can be used for collecting information about these people (to be used in automated personalization), for collecting (trusted) comments from users, and for establishing direct relationships and communication among customers.

While current work on personalization usually focuses on *automatic (collaborative) filtering* processes, where the customer does not get in contact with other customers, another interesting option is providing support for *interactive collaborative filtering* where users directly interact on the supporting platform (Twidale et al. 1997; Twidale/Nichols 1996). In order to realize collaborative forms of customer co-design interactive collaborative filtering has to be provided in addition to automatic collaborative filtering. Customers are supported in talking to each other and in collaborating with each other. Collaboration is one of the (often forgotten) core features of communities and customer behavior in the real world. In (virtual) communities of transaction recommendations for initial set-up configurations can be provided directly by other users. These configurations can be used for mass customization configurators or selections from possible configuration options. Twidale and Nichols (1996) investigated this form of collaboration for the task of searching for information. Their findings can also be applied to collaborative customization for mass customization.

Users might not always trust the automatically generated system recommendations – a major problem of traditional personalization approaches which we mentioned earlier. Trust in recommendations is usually higher when the

recommendations stem from peers. (Virtual) product communities, where customers can interact with other customers can help in generating trusted recommendations (Schubert/Ginsburg 2000). The opinions about different product configurations, components and functionalities exchanged in these communities can be traced back to real people. Even when the recommendations are exchanged automatically, the link to real peer customers and the possibility to check this customers reputation or contact them helps in building trust in the recommendation.

Another problem of automatic personalization is the acquisition of customer profiles. Communities can also help with this issue. Where in traditional (electronic) shopping malls users are often skeptical and cautious towards providing profile information, users are usually more willing to share personal information in an online community (Schubert/Koch 2002). Also people tend to spend time in the community, offering more possibilities for the system to gain implicit user information by observing their behavior.

Additionally, similarities and relationships between users need not be automatically recognized, but can be specified by the users themselves. Some filtering methods, especially collaborative filters, are more accurate, if explicit information about users' relationships is provided. Virtual communities have a potential for the generation of valuable knowledge. An appropriate system should support users in talking about designs and recommending designs or design changes to each other directly. Similar features can already be seen on major web sites like amazon.com but have never been used together with a collaborative design environment as we foresee it for the co-design interface.

It is important to note that when buyers and sellers are brought together there may be very little value-sharing between these two communities as in the classic communities discussed by authors like Rheingold (1993). We have seen that the hype around communities as "Virtual Enterprises" glorified by Hagel and Armstrong (1997) has recently faded. However, the knowledge-oriented view of

buyer communities taken by Hagel and Armstrong still seems very promising and its full potential for personalization is only at its beginnings.

There are two important lessons to be learned which have not been stressed appropriately in technology and marketing literature: (1) Personalization and communities are closely related. (2) Personalization is not (only) about grabbing information from the customer, and using it to provide a personalized offer. Its broader value proposition lies in supporting long-term relationships between customer and online merchant where the electronic platform (the Web site) learns from the customer, thus establishing trust and better catering to the customer's individual needs. Personalization has to support (product/service) customization. This is the final benefit and the only need a customer has in a relationship with a company: to get better fitting goods at low (transaction) costs.

7. Conclusion and Future Research

In this paper we have given a detailed overview of mass customization and the connected problem of mass confusion. In order to solve this problem we presented means of how personalization and community communication techniques can be used to support the collaborative co-design of individual products. Many consumers already take it for granted that they will be addressed personally when re-entering major online-shops and will not have to give their address and banking details with every new purchase. Apart from this very simple aspect of personalization, the concept hides a wealth of possibilities.

Personalization in the sense of recommending a fitting pre-configuration as starting point with the help of the community may be a promising way to overcome the phenomenon of mass confusion (resulting from high variety offers often linked to customization possibilities). We can thus conclude as follows:

- In transaction systems people appreciate personal recommendations. It is most likely that this also applies to systems for configuration and co-design.

- Valuable recommendations stem from people we trust. Human beings are searching for confirmation from others (these may be strangers that are backed by unknown others – see reputation indicators as discussed by Eisentraut et al. 2001).

- Community platforms gather information about users (customer profiles) that can be used in personalization (creation of recommendations).

- Community platforms can be used for collecting trusted comments (indirect information exchange among customers) or for getting in contact with other customers during the process of co-design.

In an interdisciplinary project[2] we intend to develop solutions that enable these capabilities. The project is aiming at providing customers and sales staff with filtered, context sensitive (personalized) access to information about possible design scopes. Personalization methods will be used to generate product configuration proposals, to recommend degrees of freedom for changing a configuration and to generate personalized manuals.

"Traditional" personalization of information and product customization are combined to provide a new generation of co-design environments in which aspects of the physical world can be collaboratively customized. The research project is still in its early stage. In the coming work packages we will continue the modeling of customer profiles and product (feature) descriptions and will apply concrete filtering algorithms to them. The proposed solution will focus on generic customer and product models with a variety of algorithms working on them and with tight integration into operating customer platforms. Once we have established the technological infrastructure for collaborative, personalization based customer

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[2] The project "P3: Generation and Interactive Customization of Individualized Product Information" is part of larger joint research center towards local production of individualized products funded by the German Research Foundation (DFG). For more information on the "Sonderforschungs-bereich SFB582 -- marktnahe Produktion individualisierter Güter" (Production of Individualized Products Close to the Market) see www.sfb582.de.

co-design we are looking forward to observe if customers are really using the potentials discussed in this paper.

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