

^{1,2,4}. Teodora STOJANOVA, ². Valentina GECEVSKA,
³. Zoran ANISIC², ⁴. Dimitar MANCEV

IMPLEMENTATION OF MASS CUSTOMIZATION STRATEGY FOR INDIVIDUALIZED PRODUCTS

^{1,2,4}. UNIVERSITY SS. CYRIL AND METHODIUS IN SKOPJE, FACULTY OF MECHANICAL ENGINEERING
KARPOS 2 BB, SKOPJE, MACEDONIA

³. UNIVERSITY OF NOVI SAD, FACULTY OF TECHNICAL SCIENCES, TRG DOSTIEJA OBRADOVICA 6, NOVI SAD, SERBIA

ABSTRACT: This paper gives an overview of the Mass Customization as a new paradigm that replaces mass production, which is no longer suitable for today's turbulent markets, growing product variety, and opportunities for e-commerce. With the increasing competition in the global market, the manufacturing industry has been facing the challenge of increasing customer value. Much has been done to reduce costs and improve quality. Quality does not mean only conforming to specifications but ensuring customer satisfaction and enhancing customer value to the extent that customers are willing to pay for the goods and services. The mass customizers analyze as IT tools and possibilities to customize products targeted for individual customers or for niche markets better than mass production efficiency and speed. Customers want individualized products, services or combination of both. The case study in this paper shows the implementation of test web-based product configurator in a company.

KEYWORDS: Mass Customization, Product, Mass Customizer

INTRODUCTION

A standard product that bears certain flexibility, so that the retail or customers themselves can customize it, can be regarded as a mass customized product. In addition, providing a set of individual value added services around a standard product could also be regarded as a form of mass customization. Mass customization is a hybrid manufacturing concept existing to provide highly value added products. It is about delivering the desired product after the needs of an individual customer have been expressed [1].

Configurators are information systems that support the specification of product individuals and the creation and management of configuration knowledge, therefore being prime examples of information systems supporting mass customization. The configurators have been used in different companies to help the customers to create the product they need.

While mass producers stand behind products and services at prices low enough, that nearly everyone can afford them, mass customizers advocate producing goods services with enough variety and customization so that everyone finds what they want. Companies operating in a demanding environment may need to react by providing flexible manufacturing systems, but these systems exclusively are not enough to offer variety without compromising on profitability [2]. The transformation process necessary to become a mass customizer is still not fully developed, and research on practical implementations is needed to gain experience on how to proceed.

The high product variety of a mass customization strategy induces a high level of complexity both from the mass-customizer's perspective as well as from the customers viewpoint. Mass customization is the interaction of customer, provider and product. The product adapts to the needs of the customer, and the customization is an outcome of customer-product interaction. A customized product is a special product designed for individual customers to meet their needs.

CUSTOMER INVOLVEMENT INTO THE PRODUCT CREATION PROCESS

A major success factor of mass customization is the ability to match the level of customization offered with customer's needs [1]. Here customers gain added value from a heterogeneous good that fits their needs better than the best standard product within reach. However, a significant point of conflict in mass customization debate is determining the level of individualization that characterizes a truly mass-customized product. On the one hand, purists attribute mass customization concept only to products that fulfill all requirements made by individual customers. On the other hand, pragmatists do not require complete individualization in order to qualify as mass customization. They

suggest that mass customization is about customers choosing from independent number of options and adjusting their final solution based on them [3]. The solution for this debate lies in company's ability to determine and maintain the range in which products or services can be customized, and how individuals make options upon this range.

Customer co-design and integration are the keys to mass customization [4]. This is the core element that differentiates mass customization from other strategies like lean management or agile manufacturing [1]. With today's information technology, MC customers can be included into the value creation chain by defining, configuring or modifying an individual order. Though an interactive website customers can configure specifications of the product or service, packaging and even delivery options. For example, when ordering a computer on some website, one may choose a monitor size, two or four GB RAM memory capacities, desired pre-installed software, keyboard and mouse. It is essential for customization that consumers contribute to specification of the product by communicating their needs and desires. Different than a do-it-yourself approach, which is an autonomous creation by consumers, this is done through "co-creation" - a mode of interaction with the manufacturer, who is responsible for providing the custom solution [5].

Including the customer in the product design also establishes an individual contact between the manufacturer and customer, which offers possibilities for building up a lasting relationship. If the customer is satisfied with an individual purchased item, it awards the manufacturer with an increased chance for customer loyalty as reorders become simplified [6]. For example, online mass customization companies offer a service where a customer creates a user profile and is able to save previous orders and hence combinations of preferences. The future orders therefore become simplified for the customer and the seller is rewarded with preference database. Co-design activities are the necessary prerequisite of mass customization, these activities are also a major cause for complexity, effort, and perceived risk from the customers perspective, creating obstacles for the success of mass customization strategies. For instance, if a customer decides to order a mass customized bicycle through an online channel, it presents an element of complexity, such as multiple possible combinations, perceived risk, such as the uncertainty of the final visual and technical outcome, delivery and even fraud.

Customer integration plays a key importance in a mass customization strategy [1, 4]. Integration means getting the customer involved in designing or configuring a product, which is by definition, an essentially central element of mass customization. By integrating the customer into the design or configuration process, a possible adversarial relationship between a customer and provider may be transformed into a synergy [4]. Customer's positive experience of a co-creation may lead to further gains for the company, such as positive word of mouth. This psychological transformation is a significant factor in the success of a mass customization strategy. With the development of technologies in user interface, customers are enabled to choose from offered options in a modular manner. Often, the online tool contains a price calculator, which can advise the end price of a solution, based on the selection of offerings and product configurations. This creates visibility for the consumer and reduces the barrier of uncertainty, often associated with customization. Successful customer integration depends on many factors like demand flexibility, supply flexibility, smart information system and affective design [4].

It is important to note that in mass customization, where customers are presented with a variety of choice, they are not involved in the specification of that variety [7]. Customers must first interact with the manufacturer, the retailer, or the product itself in order to configure the end solution. In other words, depending on the situation, customers can be involved in specifying features of the product during phases of design, fabrication, assembly, or use [8, 9].

Introducing consumer participation into the company's value creation process, increases customers sense of involvement in the end product and brings real first hand consumer knowledge back into consumer product manufacturing [10]. The possibility to configure one's own product can be pleasant because of the entertainment value and the enhanced control. In addition, customers will likely be more satisfied obtained something that fits exactly what they want.

Mass customizers believe that customer involvement into the product creation process builds the relationship between the two, and the customer is more likely to feel attached to the product that he or she participated co-creating. Mass customization strategy is one solution for this kind of retention. Even if customized products or services are more expensive to produce, the savings generated from increased customer satisfaction and developed brand loyalty, can make up for or even exceed the costs. Researches and observations show that consumers are often willing to pay a price premium for a customized solution to reflect added value they gain from a product that better fits their needs than the standard product [11, 12]. Added value of mass customization may be considerable, but the product still needs to remain affordable to maintain competitiveness against mass-production.

In mass customization, communication between the customers and supplier is necessary. Customers express their individual needs, which enable the mass customizer to manufacture the custom-made product. To relate customers needs to the information need and supply model, customers needs are considered from two perspectives, namely as the information the customers should know or actually know about their own needs.

The decision makers are the customers. The task that must be fulfilled by the customers is the selection of the optimal product variant from the solution space (achievement potential) of the mass customizer. Two main categories of information emerge: the objective information about individual needs that the customers would require to select the optimal product variant and the subjective information about individual needs that the customers actually use to select a product variant. We call the first category of information the objective customers needs and the second category the subjective customers needs. The information supply relates to the information that the customers receive from the mass customizer in order to carry out product selection. This information refers to the achievement potential and is called offered variety.

CONFIGURATOR-THE BRIDGE BETWEEN CUSTOMER AND PRODUCER

A configurator is a software system for configuring a product from the modules according to customer needs. Configurators are therefore important for enabling mass customization [13]. Configurators may either exist in enterprise wide solutions, like Enterprise Resource Planning (ERP) or Customer Relationship Management (CRM), or they may exist on a separate system integrated in ERP and PDM systems.

One way of describing configurators is to divide them into internal and external configurators. Internal configurators are for the company's internal use, where engineers and other persons in contact with the products can create variants according to customer needs. External configurators are front end interfaces that should support customers in a way that they could even themselves configure a product due to their needs [13].

There is also another classification of configurators that is similar. Product configurator is software for configuring a product combining product modules, and therefore could act as an internal configurator. Sales configurator then configures the product according to the features customer wants. Sales configurator does not necessarily show the product structure, and could be then used by a customer who does not know or understand the structure of the product.

Web-based product configuration systems are important enablers of the mass customization paradigm and nowadays are well-established in commercial environments. They enable users to specify desired product variants - typically on a technical level, because in practice the technological perspective dominates the user perspective [13]. Thus, they efficiently support product experts in configuring their desired product variant. However, most current systems do not take into account the fact that online configuration systems should be usable and helpful for heterogeneous user groups. Online customers typically have a different background in terms of experience or skills or are simply different in the way they prefer to or are able to express their needs and requirements. The configurators whether internal or external, are the relationship between the customers and the companies Figure 1.

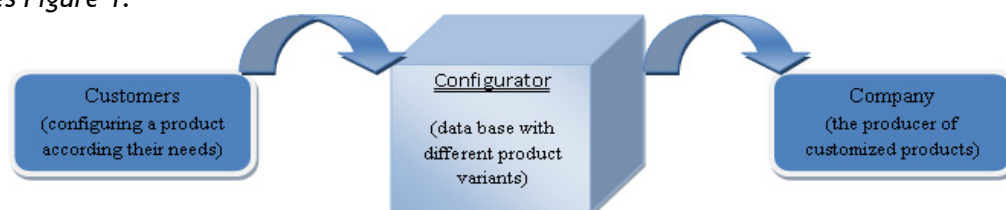


Figure 1 - The relationship between customers and companies

Before a configurator is selected and represented, the architecture for product configurability has to be determined. There are basically two different approaches, top-down hierarchical and bottom-up flat, but often the actual solution is a mix of both varying from one approach to the other depending on the case [14].

In a hierarchical approach, the configuration process starts from the top-level, for example by choosing the product that is wanted to be bought, like a car, and then continuing to the model, the product family and finally to the variant wanted. After every selection from the alternative components, the selections available further down in the branch are consequently restricted according to the choice made in the previous selections. The configuration is therefore formulated as a tree structure. The configuration logic is simpler than in a flat approach, but the component sharing opportunities are not as apparent across several hierarchies, as from a tree to another tree [14]. An intelligent configurator can use selection rules to determine which families, products or components are required to satisfy customer needs [14].

A flat approach aims at a minimum of restrictions in selecting the components. This means that the configurator enables a configuration of a product that has not been made before. For example, if

a customer wanted a vehicle that is a combination of a bus and a truck, the configurator would try to create the configuration using any components possible. The components then would not be restricted to be used in a certain product family or category, but could be configurable with minimum restriction. This increases the possibility of non-possible combinations that are neither profitable nor mechanically possible. Therefore, the configurator must be able to take into account the relevant business rules and technical constrains [14].

MASS CUSTOMIZATION BENEFITS

Management at many companies is using mass customization to successfully create greater value for their customers and competitive advantage for their companies. They are also using this strategy to minimize their “company sacrifices.” The modern consumer is more demanding than ever in the past and due to the increasingly easy access to a global marketplace the industry dynamics are continuously changing [15]. Companies operating in a demanding environment may need to react by providing flexible manufacturing systems, but these systems exclusively are not enough to offer variety without compromising on profitability [2].

It is these pressures that mass customization attempts to address, by providing an option to answer new market realities while maintaining high levels of efficiency [16]. Mass customization technologies make it possible for companies to create a cost efficient value chain, while increasing flexibility towards answering customers needs from heterogeneous market demands. In this relatively new concept of industrial value creation, companies listen to their consumers [18] pay higher attention in delivering services and, instead of solely acquiring new customers, they concentrate on building lasting relationships with the existing clientele. Introducing consumer participation into the company’s value creation process, increases customers’ sense of involvement in the end product and brings real first hand consumer knowledge back into consumer product manufacturing [10].

In mass customization, the customers can be seen as partners where companies allow consumer input to influence the value creation process to a predetermined degree [1]. In order for mass customization to work, it needs to function near the mass-production efficiencies, and therefore managers must find an optimal balance between the additional customer value created and the investments required to allow customization on a mass scale [9, 20].

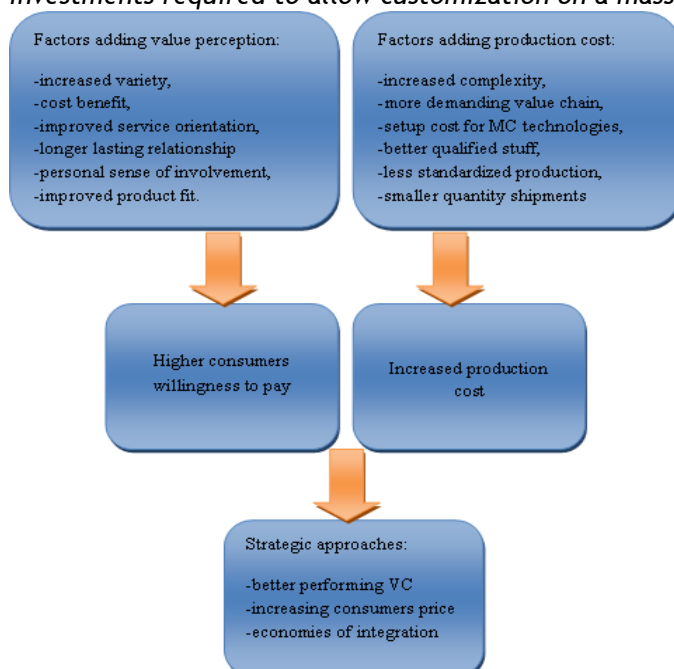


Figure 2 - Simplified added value model in mass customization [20]

Mass customization of a product hardly ever justifies substantially higher consumer prices than its mass produced alternatives. This is most notably due to high levels of competition that pose pressure on pricing. These pressures grow stronger as, through technological advancements, the barriers to entry are low for non-established mass customization markets and geographical location sets lesser limitations to the size of serviceable consumer base. To help companies in balancing between increased cost and consumers willingness to pay premium prices for the customized product [1] has identified three strategic approaches: Firstly the company can gain competitive advantage through a better performing value chain. The overall performance can be improved, as the requirements need to be set higher. Companies can obtain more stable processes, high variety of production planning and better control [19], but also gain from specialized information systems, order

tracking and improved ability to interact with individual customers.

Second, and the most common way to deal with customization-related costs, is by increasing the consumer price of the customized product or service. This can be easily observed in cases when the company traditionally offers a portfolio of mass-produced items and, by the means of mass customization, reaches out for the niche consumer segments that are willing to pay premium for added customization.

Thirdly Piller and Schaller [17] introduce a concept ‘economies of integration’, where a better-integrated consumer can be harnessed to provide the company with new cost-saving potentials. The cost savings can be obtained by using the insights collected from the more precise information about individual consumers behavior, by postponing some activities, which are traditionally made without

the involvement of the consumer (or the first supplier) to the point when the order is placed. This way of direct interaction with the buyer may also boost consumer loyalty [17]. All of these three approaches are supplementary and often times used together to maximize the benefits obtainable through mass customization strategy [1].

As an attempt to simplify the dynamics of added value creation in mass customization, discussed in this segment, we have drafted Figure 2. This figure simplifies the different factors that influence consumer perception of value, the total cost of production and the most generally used reactions by mass customizing companies.

MASS CUSTOMIZATION WEAKNESSES

Companies that used mass customization also have detected some weaknesses like lower on-time deliveries, increased order response time, reduction in product quality. This is mainly due to the premium cost that the production system incurs for including the flexibility of customization, and sacrificing some degree of cost efficiency that usually is associated with standardization. Further, the production process at most companies may not have fully evolved into a mass-customizing one, but continues to produce batches of standardized products [21]. There are disadvantages also for the customer. The layover time is one of the biggest problems of Mass Customization. Since it is a custom product it will take longer to reach the consumer. When you order something that isn't custom it will reach you in a decent amount of time. When you customize it, it will take three to four weeks longer than a non-customize product because they have to build it up for you. The time depends of the complexity of the customized product. Another disadvantage would be that you can not return a custom product if you are not satisfied because it was created specifically for you. It is not a rule but most of the managers applied this as a condition in their companies.

CASE STUDY: TEST WEB-BASED CONFIGURATOR

All companies are too much focus on their products and services, but some of them began to appreciate the customers needs and opinions. Producing customized products means increasing product variety. We mention that the relationship between the customers and producers, for involving customers in the product design, are the configurators. This is one way to increase the company profit and competitiveness. Customers are ready to pay the price of their individualized product that satisfy their needs. Because of this, we have been developed a test web-based configurator in a company.

The case study is a about a company which is furniture manufacturer in Macedonia. First, we studied the production process in the company in order to recognize the process activities that can be customized. After that the test web-based configurator was created and has been added to the company web site. This test web-based configurator was intended for only one product of the company. In Figure 3 and Figure 4 you can see the interface of the test configurator and also how can customers make customization of the product. In Figure 3 there are three parts of the assembly that can be customized. In Figure 4 there are all available materials offered for the previously selected part.



Figure 3 - Selecting object

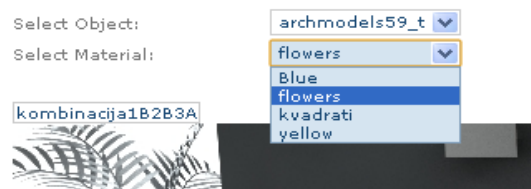


Figure 4 - Customizing product materials

Customers can make changes to the standard product only where the production process allows it. These changes are the potential product combinations which the configurator offers to the customers. The main idea of the top management in the company was implementing web-based configuration in order to help the customers for online buying their products. Customers can order their products by using this web configurator and the company will produce them as soon as possible. An example of two different variants A and B of the product that was intended in the test configurator in this case are presented in Figure 5. In fact this is the same product with different materials which can be customized from the customers according their wishes and needs.

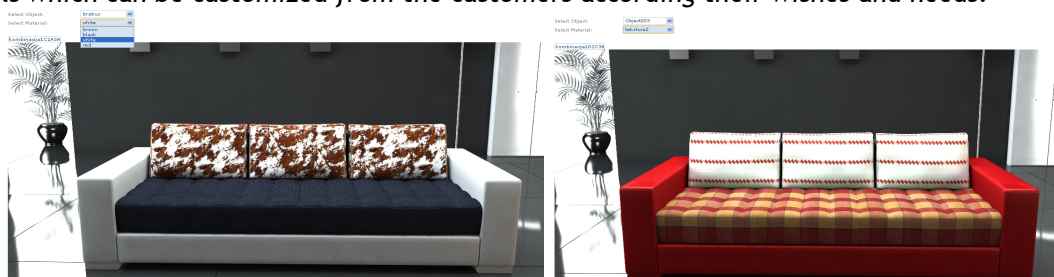


Figure 5 - Combination (A, B) of the product

Development of configurator on the web site, enables manufacturers available with various information about customers. It shows the company which are the main customer needs. This can be very simple solution for a company to increase the sale, because it offers the customers to customize their product for the same price as the standard product. In our case the top management of the company was very thankful for the test implementation of the configurator and their real configurator now is in progress. They think that web-based configurator allows the company to be a step before the competitors and also the company can offer more variants of a product to the market.

CONCLUSIONS

The objective of the Mass Customization strategy is to fulfill the most specific customers desires. Mass customization dramatically increases the number of product variants. This means that customers are partners of the company and co-designers of the final product solution. Nowadays, web-based configuration systems are well-established in industrial environments and essential for the success of mass customization. These configurators are the simple way for communication between the customers and the companies. This provides the opportunity for the companies to fulfill the wishes of each of its customers. Customers get what they need and companies produce what customer need.

The main benefits of mass customization and the use of configurators are: higher profit, a rich source of new ideas, satisfied customers and growing product variety. However, the consequences of implementing Mass Customization strategy without preparing properly the planning and operating system of the company, may be disappointing bringing disadvantages such as increasing material cost, higher manufacturing cost, lower on-time deliveries and poor supplier delivery performance.

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