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Leveraging the sustainability potential of mass customization through product service systems in the consumer electronics industry

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Abstract

Companies experience an increasing importance for implementing sustainability concerns into their processes and product offerings. In the consumer electronics industry, traditional manufacturing-focused initiatives to minimize the environmental impacts of products are currently still far from satisfactory. The European research project SMC-Excel aims at enhancing the ecological sustainability in the consumer electronics industry through the integration of new business models based on the ideas and concepts of mass customization. In this paper, first insights of the project revealed during a Business Model Innovation workshop are presented. The main hypothesis derived in this workshop – the suitability of product service systems as a lever for the sustainability potential of mass customization – is discussed with the help of an analysis of the state-of-the-art literature on product service systems and mass customization. The paper concludes that the combination of mass customization patterns and product service system patterns carries a significant potential to foster the environmental sustainability of the full business model, but that this potential is highly context dependent. The insights of this paper set up the basis for further empiric research in the consumer electronics industry.

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1. Introduction

Over the last decades there has been a growing awareness of the collective impact of human society on the planetary boundaries. Subsequently, companies are confronted with new requirements for production and experience an increasing pressure to become more sustainable [1, 2]. Hence, business models do not only have to be economically viable but also have to cover certain environmental and social concerns according to the triple bottom line approach [3].

The concept of mass customization (MC) has been discussed broadly in management literature as a viable business model pattern for companies operating in markets that are characterized by high heterogeneity in customer needs [4, 5, 6]. By tailoring products and services according

to the needs of individual customers, firms hope to realize price premiums and increase profits [7]. Subsequently, the concept of MC may serve as a potential pattern of an economically sustainable business model in the context of heterogeneous markets. However, in the light of the ongoing debate on the sustainability of business models as a triple bottom line, the analysis of social and environmental aspects of the MC concept has gained importance. In this context, an increasing number of publications dedicated to the analysis of the sustainability impact of MC can be observed. Thereby, more and more authors claim that MC – besides being an economically attractive business approach – carries the potential to be environmentally beneficial: for example, MC could help to reduce overproduction and resource consumption [8] or could enable more efficient modes of reuse and recycling of products [9, 10]. At the same time, there are only few studies that go beyond

conceptual research and that provide empirical evidence for the beneficial impact of MC [e.g. 11, 12], so that it remains unclear whether the implementation of MC can indeed foster environmental sustainability. In this context, Porabdolloahin et al. [13] state that the realization of an MC strategy will result in various positive as well as negative environmental impact factors, with each of these factors being dependent on the specific MC approach that is chosen.

The European research project SMC-Excel as part of the European Community's Seventh Framework Programme (FP7/2007-2013) within the second call of the ECOINNOVERA Programme aims at enhancing the ecological sustainability in the consumer electronic industry through the integration of a new business model based on the ideas and concepts of MC. Thus, the project has two main objectives: Firstly to develop a new sustainable business model and secondly to assess and prove the potential of MC to foster environmental sustainability.

In this research paper, we present the general context and scope of the SMC-Excel project and outline preliminary results of the first steps of the business model development process. Here, we especially focus on first insights revealed during a Business Model Innovation (BMI) workshop at Vestel Electronics, Manisa. Furthermore, we scrutinize the results of our literature analysis which we conducted to prove the outcomes of this BMI workshop. This literature review addresses primarily the concept of Product Service Systems (PSS) and its relation to the environmental perspective of sustainability. In order to be able to assess the connectivity of PSS to MC, a short literature review has also been conducted for the concept of MC and the general idea of understanding MC as a business model pattern (chapter 3). The conclusion provides answers to the research question, whether PSS has the potential to be a suitable complementary business model pattern to leverage the sustainability potential of MC. The overall aim of this paper is to set up the basis for a future empiric analysis of the suitability of combining the business model patterns of MC and PSS in the CE industry.

2. The SMC-Excel project and its context

The CE market is highly influenced by technological developments. It has changed constantly in recent years through digitalization, innovation and the connection between different devices and systems [14, 15]. Due to these rapid changes, the life cycles of CE products are getting shorter and shorter [16, 17]. Until today, the CE industry is a typical example of mass production. This model raises numerous environmental issues throughout the entire product life cycle: A lack of resource efficient designs of appliances and processes leads to an increased use of raw material – including overproduction – as well as the ongoing use of hazardous materials. A potentially beneficial impact of new technologies is often offset by rebound-effects [18]. Further, CE equipment currently

requires costly processes to perform dismantling and recycling [19]. In addition, off-shore production (mainly in Asian countries) leads to increasing energy demand covered predominantly by coal-fired power stations, and tremendous transportation emissions [18]. Thus, the CE industry can be considered as highly unsustainable.

However, initiatives for integrating environmental concerns into production have taken place in the CE industry for already decades. For instance, multinationals such as Electrolux, Philips and Dow have adopted the aim of enhancing the eco-efficiency of their products since the 1990s [2]. From this time forward the concept of eco-design – defined as “systematic integration of key environmental aspects of a product into the early stages of design and development” [20] – has been put into the center of attention. However, eco-design has its limitations. According to Roy, eco-design is a strategy, which attempts to enhance traditional patterns of production without considering other patterns of need satisfaction [2].

The European Research Project SMC-Excel therefore takes a different approach to enhance the ecological sustainability in the CE industry. The focus of the project is not focused on technological constraints, but rather on the underlying business model. Using the example of TV sets, the project analyses and develops new business model patterns, implementation guidelines, and policy recommendations to enhance the eco-sustainability of TVs. The main focus is put on possibilities to shift the TV's value chain from the current mass production of products with short technology cycles towards an MC of TV sets meeting individual customers' demands.

We will present the general idea of MC and our comprehension of MC as a business model pattern in the following section.

3. Mass Customization as a Business Model Pattern

Even though MC has been discussed for more than three decades in strategic management literature and there are many business cases from different industrial applications available, it is rather difficult to provide a precise definition for the phenomenon. A first definition was provided by Davis [21, p.169], who defined MC as “[reaching] the same large number of customers [...] as in mass markets of the industrial economy, and simultaneously [treating the customers] individually as in the customized markets of pre-industrial economies.” In accordance with this, many authors agree that the idea of MC can be pinpointed to the efficient mass production of customized goods [e.g. 22, 23, 24]. Nevertheless, beyond this rather fuzzy definition, Piller [25, p.314] claims that “the term [MC] is used today for all kind of strategies connected with high variety, personalization, and flexible production.” Also, it has to be noted that research in this field was not able to define threshold values – e.g. for the degree of customization or a minimum sales volume – beyond which a strategic approach

may be regarded as MC, yet. Subsequently, it has to be stated that research on MC has not yet mastered the issue of defining the concept of MC precisely.

Regarding this dilemma in defining the construct, we suggest to no longer view MC as a stand-alone business model or strategy, but rather as a so-called business model pattern. Such business model patterns are archetypal and reusable descriptions of business approaches with similar characteristics, behaviors or building blocks [26]. Patterns can be retrieved from existing business cases and can then serve as blueprints for the development of business model innovations. Following this logic, Gassmann et al. [27] have identified 55 business patterns, one of them being MC.

According to the idea of business model patterns, an individual pattern cannot be implemented as a ready-to-use business model by itself. Instead, the pattern is merely used as a starting point for the development of a new business approach. In case of MC, for example, the business model pattern only describes the idea of profiting from heterogeneous markets by offering customized products or services according to the individual needs of the customers. However, the pattern does not provide any guidelines concerning the realization of such a customization concept. If a firm wants to profit from this specific business model pattern, it has to build a full business model around this core idea of profiting from heterogeneities in customer needs under consideration of the specific context of the firm. Therefore, it has to make assumptions on how the implementation of the pattern affects, for instance, the existing manufacturing processes or distribution channels of a company. The pattern only suggests a customer value proposition, but it cannot provide answers with regard to the resources and processes that are needed for realizing this proposition [28]. Subsequently, there cannot be a standardized MC business model, as each business model that is built on this pattern is strongly context dependent [29, 30].

Despite this strong context dependency, there are researchers that try to support practitioners by providing generic guidelines for transforming an organization towards MC. Following the argumentation of the resource-based view of the firm, these studies argue that the implementation of MC demands profound organizational change [25, 31] and that companies need to acquire a distinct set of strategic capabilities for this endeavor [32, 33]. However, it can be expected that each individual approach to MC requires its specific configuration of strategic capabilities and organizational resources [34].

4. Implementation of the Business Model Pattern logic into the SMC-Project

As part of the SMC-Excel research project, a first BMI workshop has been conducted at an early stage of the project. The main goal of this BMI workshop was to envision different scenarios for MC based product offerings

for TVs as well as to discuss the implications for new business models drawn upon the basis of these product offerings. In this workshop the project consortium worked out that MC approaches which focus on customizing the hardware attributes of the product itself are rather limited. These limitations result from a relatively low level of differentiation opportunities of functional key value attributes of TVs related to hardware [35]. Furthermore, it became obvious that an MC offering which is only focused on customizing hardware attributes during the manufacturing phase, does not leverage the full sustainability potential of MC. Instead, focusing on the usage phase could be a promising strategy for the development of an MC offering.

Software customization is the first and probably the easiest way to move away from typical hardware customization. In this manner, a software-customizable product in comparison to a standard product probably fits better to the individual customer's needs. Furthermore, given the possibility to adapt the software not only once during purchase but also during the usage phase, it is likely that the life of the product could be enlarged. Nonetheless, we believe that software customization does not have a high impact on the environmental sustainability of the product.

In the SMC-Excel workshop, the project consortium therefore looked for other scenarios for non-hardware customization having a higher potential to enhance the environmental sustainability of CE products. One important outcome was the development of several scenarios, in which not only the product itself is customized but also the service connected the product. These scenarios include on the one hand product offerings, in which the product is sold with additional services, and on the other hand offerings, in which only the service is sold to the customer instead of the product itself. In such cases, the MC business model pattern has to be complemented by patterns which focus on offerings related to the usage phase of the product life cycle. Gassmann et al. [27] discovered for instance the business model patterns *pay-per-use*, *rent instead of buy* and *Solution Provider*. The participants of the BMI workshop agreed in the assumption that business models created around such MC product service combinations could have a much higher impact on the environmental sustainability than pure tangible MC products.

The following literature review sheds light on this assumption.

5. Product service systems and Sustainability

In literature, such combined offerings of products and services are called product-service systems (PSS) being defined as “tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific customer needs” [36]. PSS have already been discussed intensively in the context of sustainability. The basic idea of sustainable PSS is based on the pursuit of

‘dematerializing’ the economy: creating offerings “that provide consumers with the same level of performance, but with an inherently lower environmental burden” [37]. Thus, the key to sustainable PSS is that they aim at providing customers with a particular result or function (e.g. watching TV programs) without the necessity to own or buy the physical product (TV), in order to get this result [2, 38]. New ownership structures could lead in the best case to a decreasing number of products in the market [39]. Furthermore, literature points out that companies’ responsibility for their offered PSS increases. This leads to a higher probability that companies take back, upgrade, refurbish and reuse their products [37]. Also at the very end of a product’s life, the producer still might have the economic interest to “extend material life, such as recycling, energy recovery or composting” [40, p. 38].

PSS also offer new ways for companies to influence their stakeholder relationships. For instance, through PSS consumers can more easily learn about environmental features of products and companies can inform them better about how to minimize the environmental impacts of consumption [37].

Similarly to the discussion about the question whether MC is a sustainable business model itself, the discussion about PSS encounters its limitations. Scholl argues, that it is not possible to generally claim that for instance ‘use rather than own’ schemes are per se resource-efficient [41]. An empiric study by Leismann et. al revealed resource-saving potentials of ‘use rather than own’ schemes can only be realized if the general “framework conditions associated with using the service do not cancel out the savings achieved” [42]. Hence, the resource-conserving potential of PSS has to be assessed on a case-by-case basis. Therefore, we argue that also in the case of PSS the environmental impacts depend on the overall configuration of the business model. PSS patterns – similar to MC patterns – need to be combined with other sustainability friendly patterns in order to create a fully sustainable business model.

6. Conclusion: Product Service Systems as a lever for the environmental sustainability potential of Mass Customization

Based on the results of the literature review as well as the BMI workshop several insights can be revealed.

Including the pattern of PSS in combination with MC into a company’s business model allows creating new opportunities for individualization and also completely new sources of added customer value. Fulfilling customers’ needs in a customized way through PSS particularly has the potential to build unique customer relationships [36]. From an economic perspective companies could benefit immensely from long-lasting relationships and thus, increasing customer loyalty. Subsequently, these benefits imply an increasing responsibility for companies along the product life cycle. In fact, in mass customized PSS

architectures companies are responsible for their products along the whole life cycle. In this way, it is in the interest of both, producer and consumer, to minimize life-cycle costs of the customized PSS. Hence, as already mentioned above PSS could be an important driver for improving the durability, the reparability and through modularity also the upgradability of TVs during the use phase. Furthermore, firms would also be able to conduct recycling activities at the end of the product life cycle much easier as they have complete knowledge about the product’s components and structure.

In this way, the pattern of PSS could contribute significantly to turning away from already mentioned manufacturing focused sustainability approaches to a full customer-centric approach: This applies in particular to the use phase, which is not covered to the full extent by the MC pattern itself. Thereby, customers could be integrated at nearly all stages of the product life-cycle and in this manner customers and manufacturers could conjointly encourage sustainable development [12].

Thus, for the CE industry the creation of business models based on MC and PSS could surpass or at least complement traditional eco-design and eco-efficiency approaches. Nonetheless it has to be strengthened again, that the environmental outcome of such PSS and MC based business models still depend on how firms further combine these two patterns with other sustainability oriented patterns. The full interplay of the different patterns determines whether the sustainability potential of MC can be leveraged or not. However, it can be concluded that a shift to a business model based on MC and PSS is an opportunity to create radical improvements and innovations that could go beyond incremental environmental improvements [38].

Based on the insights of this paper, an empiric assessment of our hypotheses has to follow in a next step. Therefore, different scenarios for MC based PSS for TVs have to be concretized and consumer tested. Furthermore, for the concrete development of a new sustainable business model for TVs based on MC and PSS, other business model patterns and their compatibility have to be analyzed in more detail.

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