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A novel concept for the development of availability-oriented business models

P. Kölsch^{a*}, C.F. Herder^a, V. Zimmermann^b, J.C. Aurich^a

^aInstitute for Manufacturing Technology and Production Systems, University of Kaiserslautern, Germany

^bUnity AG, Wankelstraße 3, Stuttgart, Germany

* Corresponding author. Tel.: +49-631-205-2618; fax: +49-631-205-3304. E-mail address: publications.fbk@mv.uni-kl.de

Abstract

Globalization, Industry 4.0 and increasing price pressure are only a few impact factors influencing the competition in capital goods industry. Thus, the manufacturers need to differentiate by creating individual bundles, consisting of technical products and lifecycle-oriented services, called Product-Service Systems (PSS). There is an increasing demand of availability-oriented PSS, in which the manufacturer guarantees the availability of the technical product and takes over a part of the customer's manufacturing risk. PSS can be offered by means of different business models. This article presents a novel concept to develop availability-oriented business models, which considers requirement elicitation for technical development of smart machine components, and customer-oriented methods of design thinking approach, i.e. Persona analysis, Value-network mapping and Customer Journey. The concept was validated in three use cases, regarding technology-push and market-pull perspective.

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Keywords: availability; business models; PSS 4.0

1. Introduction

Due to globalization, increasing individual customer demands, price pressure and the influence of Industry 4.0, the competition for manufacturers intensifies. A possibility to differentiate from competitors and creating additional value in business-to-business-markets is to develop integrated and customized solutions, combining products and services, so called Product-Service Systems (PSS) [1]. Offering PSS requires suitable business models [2]. Capital goods are subject to high requirements in productivity and availability. For capital goods industry there is an increasing demand of availability-oriented business models, in which the PSS-provider guarantees the availability of the capital good. In spite of this increasing demand, OEMs hesitate to offer those guarantees. The reasons are uncertainties, resulting from a lack of transparency of machine condition and missing suitable concepts to develop availability-oriented business models [3]. In this article, a novel concept to develop availability-oriented

business models is presented, considering the requirements elicitation for technical development of smart components, which are necessary to monitor the machine condition and calculate the availability. Furthermore, design thinking methods are used to ensure a customer-oriented development process.

In the first part, a brief overview of the state of the art of PSS, business models and design thinking is given. In the following main part, the concept for the development of availability-oriented business models is presented, including the description of the validation scenarios, followed by a summary.

2. State of the art

2.1. Product-Service Systems

Product-Service Systems (PSS) are individual bundles, consisting of technical products, complemented by different

services over the entire product lifecycle [4]. The primary goal of a PSS is to increase the customer satisfaction and loyalty. Compared to a single technical product, a PSS includes tangible and intangible values. This leads to a customer-oriented solution, an increasing product value [5] and thus an increasing customer value.

In general, there are two different perspectives of the PSS lifecycle, the manufacturer's and customer's perspective. The manufacturer's perspective can be subdivided into three phases: Designing, Implementation, and End-of-Life. The design phase contains the two main parts planning and development. The implementation phase can be further divided into production, and service. The customer's perspective is represented by the phases Procurement, Usage, and End-of-life, whereas the procurement phase can be further divided into Decision and Buy [6]. In this article, a concept for developing availability-oriented business models is presented. The business model development is not considered as separate phase in the lifecycle. For this reason, it is important to integrate the business model development in the lifecycle of PSS. The addressed lifecycle phase is the designing phase from the manufacturer's perspective.

As a result of the transformation from a manufacturer to a producing service provider, PSS-provider have to cope with new tasks and challenges. This requires an intense collaboration with different external stakeholders, like service partners, distributors, suppliers, etc. [7]. This collaboration is called the value (-added) network for PSS [3]. The goal of this collaboration, between the PSS-provider and his extended value network, is to compensate limited resources and missing capacities [4].

2.2. The Influence of Industry 4.0 on PSS

The transformation from a manufacturer to a manufacturing service provider is subject to a strong impact of Industry 4.0 technologies [8]. Many manufacturing systems are still not ready to handle big data, due to the lack of those technologies [9]. With sensor-, cloud-, and internet technologies, and emerging methods like business analytics and mobile computing, new ways of developing, providing and operating PSS are possible [10]. This impact generates a new form of PSS, so called PSS 4.0 [11]. The term PSS 4.0 defines the integration of Industry 4.0 technologies in PSS within its entire lifecycle considering the extended value network. The application of Industry 4.0 technologies pave the way to new business models, mostly availability- and result-oriented business models.

2.3. Availability-oriented business models in PSS 4.0 context

In general, the term business model is not finally defined, yet. There is a large amount of definitions, as it can be seen in [12]. For the purpose of this article, the definition and the components of business models compiled by Osterwalder and Pigneur are used. According to this, business models describe how companies generate, deliver, and capture value [13]. As stated in [4], PSS enable innovative function-, availability- and result-oriented business models. Applying availability-oriented business models, the PSS-provider guarantees the customer the

availability of the technical product and thus, he takes over the customer's business process and bears a part of the customer's manufacturing risk. To develop availability-oriented business models, the integration of Industry 4.0 technologies is essential [14].

The availability of a technical product can be calculated by the down time and the time between failures. The down time consists of the time to repair and time periods for troubleshooting, ordering spare parts, arrival time of the technician, etc. [15]. Consequently, there are two parameters, which can be considered to increase the availability: the time between failures and the down time of the product. Focusing on the time between failures, it is indispensable to implement Industry 4.0 technologies to monitor the condition of a machine. Further Industry 4.0 technologies and methods like mobile computing and big data analytics can be used to support the service technician and decrease the down time of a product, resulting in an increase of availability. Industry 4.0 technologies enable real time services and availability-oriented business models in capital goods industry. Hence, the technical development of smart products and smart service processes plays an important role towards the realization of availability-oriented business models. For this reason, the elicitation of technical requirements needs to be addressed in the concept.

2.4. Design Thinking

The approach of design thinking plays an important role according to the innovation process of companies [16]. Referring to the transformation from a manufacturer to a manufacturing service provider, innovations in both fields, products and services, become more and more important. Consequently, there is not only the single physical product in focus, but also innovative processes, services and ways of communication and collaboration, means human-centered activities. With the application of design thinking methods, new forms of value creation can be created [17]. As stated in [18], the development of PSS addresses a customer-oriented solution. It has to be taken into account, that the development process should be customer-oriented as well. Thus, the design thinking approach is used, which places the user in the center of the development of products and services [19]. By using methods of the design thinking approach, it is possible to match customer's needs with technological feasible solutions, which should be part of a viable business strategy and can create customer value and market opportunity [17]. Common methods while using the design thinking approach are [16]:

- **Persona:** According to Pruitt and Adlin, Personas are "clearly defined, memorable representations of users that remain conspicuous in the minds of those who design and build products" [20]. By applying the Persona concept, the social role of a person in a specific context is identified [21]. This helps the developer to get a better understanding of a person's behavior [22].
- **Value Chain Analysis:** As stated in [22], the definition of the Persona is only possible after identifying the structure of an ecosystem or rather the extended value network. With this, the service and the relations between the different partners become transparent.

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