

Product-Service Systems across Life Cycle

Innovative services for customized, availability-oriented business models for the capital goods industry

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Abstract

Manufacturers of capital goods are subject to high requirements regarding availability and productivity. Services give manufacturers the opportunity to expand technical products and to fulfill all customer requirements. Solution concepts that consist of a union of technical products and services are called Product-Service Systems (PSS). For the realization of PSS, the capital goods manufacturer (PSS-provider) must collaborate with each participant of his extended value-added network. The extended value-added network consists of members of the development, production and service. This cooperation and complete interconnection with each participant provides the foundation of the development and offer of availability-oriented business models. This paper presents an approach for PSS which enables innovative services for the extended value-added network and for the customers in order to realize customized, availability-oriented business models. The approach is based on three sub-goals. First, development of PSS and customized, availability-oriented business models. This goal is presented in the paper. Second, development of smart components for collecting and processing of service relevant data. Third, design and configuration of an information management platform to provide and exchange service relevant data.

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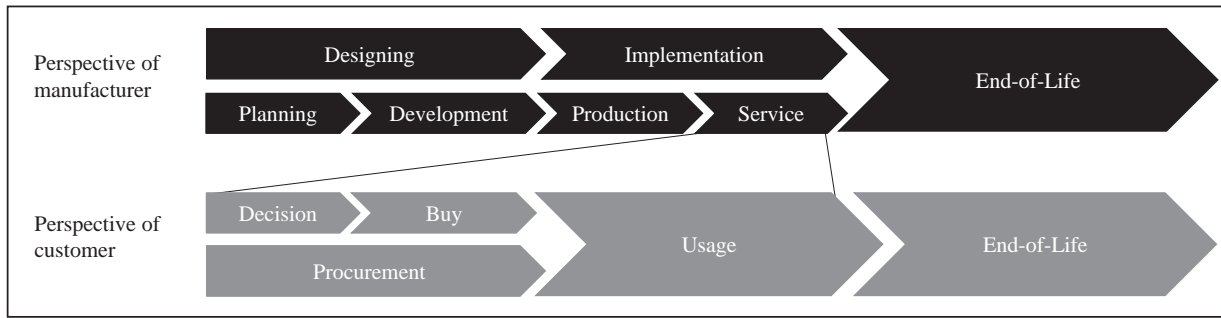
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1. Introduction

Capital goods are subject to high requirements in productivity and availability [1]. Customers require integrated solutions combining products and services. So called Product-Service Systems (PSS) enable this combination. PSS are realized by purchasing capital goods and additional acquisition of specific and useful services [2]. However, function-oriented business models are only partially adaptable to dynamic markets and fluctuating customer demands. Contrary to this, availability-oriented business models guarantee the operational capability of capital goods. Thereby, manufacturers of capital goods insure the agreed availability by implementation of suitable services [3]. It has to be taken into account, that these business models can only be implemented, if every partner in the extended value-added network (product development network, manufacturing network and service-network) are fully interlinked and share relevant information with each

other. In spite of increasing demand for guaranteed availability, manufacturers do not want to provide this. Reasons are high costs due to high risks and uncertainties resulting from missing operational data, customer behavior and insufficient transparency of machine condition. In addition, essential data management to handle a vast amount of information is insufficient.

The presented approach overcomes the described deficits by using upcoming internet-based technologies in context of Industry 4.0. An overview of the state of the art of PSS and business models is given. The main part presents the approach how to develop innovative services for customized, availability-oriented business models for the capital goods industry. In addition to that, a brief summary on further activities is given.



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Figure 1: PSS life cycle from the perspective of manufacturer and customer [2]

2. State of the art

2.1. Product-Service Systems in extended value-added networks

Customers require integrated solution concepts that can be served by offering technical products with services. Product-Service Systems (PSS) are such a solution concept which combines products and services. It is a marketable concept and enables to fulfill customer’s need [4]. According to Lee et al. PSS aim to achieve sustainability and customer satisfaction by systematically integrating various elements with products [5]. PSS are also defined as a system of products, services, networks of actors, and supporting infrastructure [6]. The aims of PSS are to be competitive, satisfy customer needs and have a lower environmental impact than traditional business models [6]. PSS are characterized by the integrated and mutually determined planning, development, provision and use of product and service shares and represent a “knowledge-intensive socio-technical system” [7].

The life cycle of PSS is more comprehensive than the life cycle of a single product. The manufacturer respectively PSS-provider offers his customer a cooperative partnership during the usage of his product. Manufacturer and customer act as internal and external production factors during the whole work process [2]. Because of the customer-oriented instead of product-oriented perspective, the life cycle of PSS is not only considered from the PSS-provider but also from the customer’s perspective [2]. Figure 1 presents both life cycle perspectives.

From the perspective of the manufacturer the life cycle of PSS consists of the three main phases Designing, Implementation and End-of-Life. During the Designing phase products and services need to be developed integrated and a customer-specific configuration of the product and service components should be done. For the customer the life cycle starts with the Procurement and ends with the End-of-Life [2].

PSS-provider or one single company cannot independently create, deliver and capture PSS value [8, 9]. For offering PSS successfully manufacturers need to cooperate with the extended value-added network (see Figure 2). That extended value-added network consists of the development network, production network and service network of a PSS-provider [2]. This kind of network is also called value creation architecture for PSS [10, 11]. Both wordings define a network organization in which PSS-provider, customer and suppliers work together to achieve the highest value of PSS. Missing capacities or limited resources from the PSS-provider can be completed by suppliers [7]. Although knowledge and experience of PSS business models are limited [12], different researchers emphasize the importance of the relationship with external partners when implementing a PSS business model [8, 13].

2.2. PSS for availability-oriented business models

Current available technologies and an intensive use of Internet also in terms of business activities and processing provide new opportunities for developing innovative business models. In a broad definition, business models are the economic model of an enterprise in order to generate value and

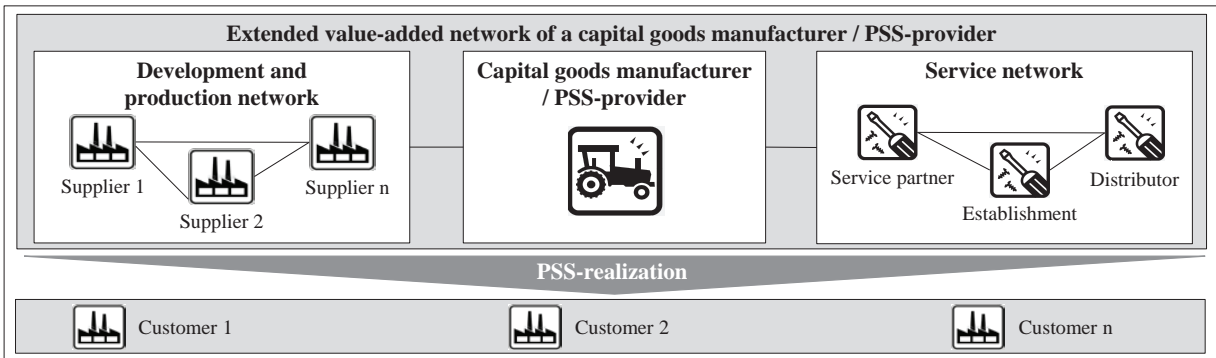


Figure 2: Extended value-added network of a capital goods manufacturer / PSS-provider

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