

Adaptable and customizable development process for Product-Service Systems

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Abstract

Systematic development is of utmost importance for the market success of Product-Service Systems (PSSs). A multitude of methods and processes to support the development of PSS has already been published. Yet empirical studies in this context prove that the level of utilization of methods and processes is still minor. As a contribution to solve this problem the authors suggest an adaptable and customizable development process for Product-Service Systems. The solution is based on three approaches: (i) a procedure for designing development processes for PSS according to the requirements, (ii) a procedure for individualizing the development process according to specific requirements like e.g. industry, product groups, markets and (iii) the integration of a practical procedure for achieving market-adequate costs in the development process. With this application oriented approach the efficiency of the development process for PSS is increased and the application of methods is promoted.

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1. Introduction

The relevance of PSS in practice keeps increasing [1]. Some manufacturers of machine tools are already achieving double digit percentage proportions of their total turnover with services related to their physical goods. However, that requires clearly defined service offers as well as methods and processes for their development [2]. A multitude of method-based development processes has already been designed [3,2]. But in contrast, there is a limited utilization of tools for developing PSS in practice: according to a poll among German service providers [4], only 12% of the respondents use Service Blueprinting and just 19% Quality Function Deployment – two central methods for developing PSS [5]. In a similar survey [6] it was observed that organizational units for the development of services exist in only 9% of the companies – a precondition for the occurrence of specific and standardized approaches.

This corresponds to a third comparable survey [7]. It was determined here that just 10% of the enterprises have clearly defined processes for developing services. According to the authors there are two main reasons for the discrepancy between the multiplicity of existing methods and processes and their minor penetration in practice: (i) it is hard to have an overview of the approaches existing and (ii) with the manifold kinds of services it is difficult to find a methodology that covers as many cases as possible.

In order to improve this situation the diverse requirements on PSS Development Processes (PDP) are derived first. Based on this the authors of this paper suggest three new approaches with the goal of improving the efficiency and the quality of the development of PSS: (i) a procedure for designing development processes for PSS according to the requirements, (ii) a procedure for individualizing the development process according to specific requirements like industry, product groups, markets and (iii) the integration of a practical

procedure for achieving market-adequate costs in the development process.

The methodological approach of the presented study follows the approach of applied sciences that has its origin in problems recognized by practical experience. For their solution scientific findings are further developed in close exchange with their practical utilization so that new application oriented solutions emerge. These are then verified and modified according to new findings. The scientific relevance and hence the transferability of the solutions achieved is secured by the feedback from diversified practical use.

2. Individuality of the development of PSS

Just by looking at eight different types of PSS listed in [8] their dissimilarity becomes evident: (i) product-related service, (ii) advice and consultancy, (iii) product lease, (iv) product renting and sharing, (v) product pooling, (vi) activity management, (vii) pay per unit use and (viii) functional result. When additionally taking into consideration that the standard types again have quite different forms of appearance it becomes evident how distinct PSS can be. This is going to be demonstrated by the following two use cases:

2.1. Use case I: Comprehensive Development Tasks

A manufacturer of machine tools already offers a wide portfolio of IPS² (Industrial Product Service Systems) and introduces a new product technology: in order to produce graphite electrodes for electrical discharge machining, a special graphite machining center has been developed. The three-axis-system comes with a base frame of granite and linear axle of carbon-fiber-reinforced plastic (CFRP). This allows extremely dynamic part movements with maximum positioning accuracy in milling [9].

If the development were limited to the new machine when introducing the new technology, the service components of IPS² would remain on the same old level. On the one hand, damage from crashes is unlikely due to the robust layout of the machine and the limited strength value of the material usually processed (graphite). On the other hand, the design material CFRP has a different vulnerability compared to steel. While running the machine, the following scenarios are possible: components made of CFRP can be damaged when handled improperly by customers' machine operators that are not specifically trained. Because the damage is hard to recognize, inexplicable scrap is produced and the damage of the machine proceeds. Without specific training the maintenance staff on site would not be able to resolve the defect because besides knowledge and experience they also lack the relevant tools. In this situation expensive CFRP-parts would have to be replaced prophylactically even after small crashes – if there is a supply of spare parts without long shutdown time at all. Further negative consequences on other typical services like process optimization, training etc. can be derived.

This use case also indicates that it is reasonable to closely link the PDPs of both components when developing complex

IPS². The importance of the total cost of IPS² can easily be derived, too: The advantage of short process times and small waste must not be consumed completely by higher cost for services. The development of a PSS using new technology requires the consideration of a number of aspects. Thereto a very individualistic PSS development process is necessary. It has to support a close linking of the development of the PSS – as well as Target Costing.

2.2. Use case II: Limited Development Tasks

The second use case deals with the application of the internet of things. The provider is a start-up company newly founded for this special purpose: Cold chain monitoring for multi-unit restaurant management using network-compatible temperature sensors will be offered [10]. The sensors are connected to the internet via Wi-Fi. They are offered to the companies in the context of a service-model. The data collected is stored in the cloud. It can be accessed by the users using various devices. The elements of this PSS consist of adapted network-compatible temperature sensors, a control and evaluation software as well as a financing model. The initial benefits for the customer are the savings for the manual recording and documentation of temperatures in the cold chain. But an even higher gain is the increased reliability of the automatized monitoring of the cold chain. Moreover the regulations regarding industrial hygiene can be met in a more secure and traceable way.

The technology of network-compatible temperature sensors is not new. But provoked by the continuous decline in prices new fields of application are rendered possible. Despite obvious advantages mobile temperature sensors are rarely applied in multi-unit restaurants. Besides the lack of specific solutions, this is also – by financial reasons – the necessity to equip entire shops. Further preconditions are e.g. fitted sensors, specifically developed software as well as services and business models adapted to the particular industry. The producers of the sensors in turn lack specific know-how of the respective industry sector. However, as suppliers they have to be integrated in the development.

Despite manageable tasks the development process is challenging.

The existential economic risk due to high investments calls for a professional approach. Naturally a start-up only has very limited planning resources. An adequate solution is required for this development task that is completely different from the one described in 2.1.

2.3. Factors of Influence for the design of a PDP

Both use cases demonstrate the individuality of development tasks that not only result from the task itself. Table 1 indicates the essential criteria that influence the choice of the appropriate development process.

It does not seem reasonable to develop an algorithm that combines all the aspects listed in Table 1 for deriving a particular PSS development process. In turn, it is evident that complex and risky development tasks require comprehensive

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