



Designing the sustainable product-service integration: a product-service blueprint approach

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ARTICLE INFO

Article history:

Received 26 January 2010

Received in revised form

18 November 2010

Accepted 25 May 2011

Available online 12 June 2011

Keywords:

Product-service system

PSS

Design

Service blueprint

Sustainability

ABSTRACT

As a means for providing the sustainable production and consumption, the concept of product-service system (PSS) has received increasing attention. What is at the core in the PSS is the design, since it determines the distinctive characteristics and quality of PSS. Even though some tools have been suggested for PSS design, previous tools mainly focus on identifying the relationship between actors in a conceptual level. Despite the fact that it is significant and cannot be neglected, what is more important in a practical situation is to represent the detailed flow or relationship of PSS elements, with the consideration of products and services. In response, this paper proposes a “product-service blueprint” which is a new and systematic way to elucidate the relationship between products and services, providing the implication of how PSS can provide the sustainable production and consumption. Employing the service blueprint as a starting point, new areas, lines, and symbols are introduced to represent the distinctive features of PSS. The proposed product-service blueprint represents the product use throughout the life cycle, service flow from the management to the customer, and the relationship between products and services. Taken together, the product-service blueprint will help both managers and researchers to promote the product-service integration under the concrete framework.

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1. Introduction

Today, the body of literature has been almost unanimous for the needs of sustainable production and consumption which aims at the sustainable and environmentally-oriented design and production (Mont, 2002; Manzini and Vezzoli, 2003; Morelli, 2006). This paradigm shift cannot be separated from the concept of functional economy which regards the function as a key to customers' satisfaction (Stahel, 1989, 1997; Mont, 2002). In a functional economy, what the customer actually purchases is the function instead of products; for example, mobility instead of cars, cleaning services instead of washing powders and movies instead of videocassettes (Mont, 2002). The value is delivered through the provision of services, providing the desired function that a customer wants to get. What is notable is that all these paradigm shifts are to improve the “sustainability” in production and consumption.

As a direct means for achieving sustainability, product-service system (PSS) has been discussed as a key concept. It is defined as “a system of products, services, networks of players and supporting infrastructure that continuously strives to be competitive, satisfy customer needs and have a lower environmental impact than

traditional business models” (Goedkoop et al., 1999). Since PSS accompanies the paradigm shift toward functional economy with lower environmental impacts, it differs from traditional production offering from various perspectives including the role of producers and consumers, its organizational basis, design particularities, and environmental profile (Mont, 2002).

Dealing with these differences, many studies have been conducted regarding the PSS. What is at the core among many research agenda is, obviously, the design. It is by no means surprising, since the design stage determines the characteristics of PSS as well as the quality of PSS (Hara et al., 2009; Kimita et al., 2009). Since the PSS encompasses the product behavior along the product life cycle, the service flow of customers and providers, and the interactions between different actors involved (Boughnim and Yannou, 2005), the effective design of PSS is the key to the success of PSS. For this reason, the PSS design has been highlighted both in the academia and practice.

Recognizing the importance of PSS design, there have been some methodological supports for the PSS design, suggesting the methodology for PSS development such as Kathalys method (Luiten et al., 2001), DES (design of eco-efficient services) (Brezet et al., 2001), PSS innovation scan for industry (Tukker and van Halen, 2003), SPSS (Sustainable Product and Service Development) (Maxwell and van der Vorst, 2003), HiCS (Highly Customised Solutions) (Manzini et al., 2004), MEPSS (Methodology for Product-

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Service System development) (Van Halen et al., 2005), and practical guide for PSS development (Tukker and Tischner, 2006). These methods provided the concrete framework and systematic process for the PSS development, from strategic analysis to the actual development. Most of these methods provide not only the systematic process for the PSS development but also the relevant design tools which can be effectively used to design the PSS in each stage. The design tool is the key to the PSS development, since it can design the actual relationship between PSS elements, illustrating the actual concept of PSS.

Therefore, many design tools have been developed to facilitate the development of PSS. To illustrate, the stakeholder motivation matrix, the interaction storyboard, the solution element, and system maps have contributed to the PSS design (Verkuil et al., 2006). These work as a series of formats for 'Design Plan' to represent the PSS effectively (Manzini et al., 2004). More specifically, the stakeholder motivation matrix provides the matrix to fill the contribution, the benefit, and the synergies of stakeholders. The interaction storyboard also points out the steps of interaction between different actors. The solution element brief provides the breakdown of solution elements and their attributes to each of the actor, using the matrix-shaped structure. The system map provides the illustration according to the actors. The area is distinguished based on actors participated in the PSS. However, these tools mainly focus on identifying the conceptual level relationship between actors, for example, filling in the stakeholder's matrix with related actions, or explaining the experience of the final user as well as the various stakeholders along the performance of the solution.

Even if this is significant and cannot be neglected, what is more important in a practical situation is to represent the flow or relationship of PSS activities in detail, including the product-service interaction in detail. Besides, even if previous methods are powerful and effective, these are suitable for the conceptual development of PSS rather than the detail design stage, since it shows the relationship between actors as a main focus to clarify the conceptual relationships, not focusing on the relationship between PSS elements or activities.

Therefore, for the purpose of detailed design of PSS, a service blueprint has been employed to represent the flow of activities of the PSS, even if it is not a design tool for PSS. The service blueprint is an effective tool for modeling the service system describing the activities and time for the service system (Shostack, 1982; Fließ and Kleinaltenkamp, 2004). Using the service blueprint, Boughnim and Yannou (2005) provided a map of the PSS system using the service blueprint as a means to model the PSS. As well, Morelli (2006) employed the service blueprint to represent the PSS, adding some indication required to provide the useful implication. A unified design method was also proposed to integrate products and service activities using the service blueprint (Hara et al., 2009; Shimomura et al., 2009).

Even though these methods can provide a good representation for PSS, these are limited to simply borrowing the existing service blueprint. Therefore, the representation of PSS might be skewed to the representation of service, which cannot represent the PSS characteristics. However, PSS is an integrated offering composed of products, services, and infrastructures, not a single product or service. Although the service blueprint can provide the effective way for the service design, it needs to be modified to clearly represent the innate characteristics of PSS when applied to the PSS design; the components of PSS are of course different from traditional offerings, many different actors exist, the role of products or services is different, and so on.

In response, this paper proposes a new and effective design tool for PSS: a product-service blueprint. The reason why we employ the service blueprint is twofold. Firstly, the core characteristics of PSS are

inseparable from the service. The value of PSS is delivered by the provision of services rather than the provision of products. Therefore, despite coming from two different points of view: products and services, the design of PSS should be mainly focused on the provision of desired service. Secondly, the service blueprint provides the simple but clear representation of service system in terms of actor behavior, sequential progress, and spatial relationship. Therefore, the service blueprint is employed as a starting point of PSS design tool.

Even though the service blueprint can be employed as a good starting tool, it is not enough to illustrate the PSS effectively. Therefore, differentiated from previous research, this paper introduces the new area and relevant symbols to the service blueprint, suggesting a revised tool for PSS design. It illustrates the product behavior, service activities, and underlying supporting activities to provide the implication of how products and services can be integrated to provide the sustainability and customer value. Using the product-service blueprint as an analytical lens, PSS can be effectively represented by the clear understanding of product use throughout the life cycle, the service flow from the management to the customer, and the relationship between products and services.

The remainder of this paper is organized as follows. The next section deals with the related studies on PSS: the concept of PSS and tools for PSS design. Following on this, the concept and structure of product-service blueprint are proposed with the case examples, providing the managerial implications. Finally, the summary and limitations of this study are given in Conclusion.

2. Product-service system (PSS)

Since this paper aims to propose the "product-service blueprint" for designing the PSS, it is important to capture the distinctive characteristics of PSS. This section deals with the related literature of PSS, from definition to the designing tools.

2.1. What is PSS?

Regarding PSS, much attention has been paid. It is firstly suggested by Goedkoop et al. (1999), defined as "a system of products, services, networks of players and supporting infrastructure that continuously strives to be competitive, satisfy customer needs and have a lower environmental impact than traditional business models" (Goedkoop et al., 1999). Even the definitions of researchers are a little bit different, PSS is generally accepted as a concept of "product(s) and service(s) combined in a system to deliver required user functionality in a way that reduces the impact on the environment" (Goedkoop et al., 1999; Mont, 2002; Manzini and Vezolli, 2003; Baines et al., 2007).

Since the concept of PSS stems from the provision of a function or service by the integrated offering of products and services, the first and foremost characteristic of PSS comes from the integration of products and services. The purpose of the integration is to provide the sustainability, as well as increased customer value (Goedkoop et al., 1999; Mont, 2002). Here, the value in the PSS is created not by purchasing the product but by fulfilling the customer needs. Another important characteristic of PSS comes from this context: the "ownership". Since the delivered offering is a function, not a tangible product, customers do not have ownership for a specified product or service in some cases.

Another important feature of PSS is the achievement of sustainability (Goedkoop et al., 1999; Mont, 2002; Manzini and Vezolli, 2003). Some commentators define the PSS without environmental aspects, focusing on market attributes of PSS whereas some others insist either PSS inherently has lower environmental impacts than traditional business models do or at least environmental improvements are set as a goal (Mont, 2004). However, these two focuses

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