

OPPORTUNITY PARAMETERS IN THE DEVELOPMENT PRODUCT/SERVICE-SYSTEMS

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1. Introduction

In the light of the current focus on innovative business development throughout industry and society, the concept of product/service-systems (PSS) is a promising approach to product development, which may yield product offers that benefit the company, customer and society alike. Only recently researchers have made attempts to formulate requirements and procedures for the integration of product and service development [Steinbach 2005]. In the field of environmental studies, the concept of PSS has been investigated for some time, especially for the opportunities of lowering environmental impact while maintaining a high level of need satisfaction [Mont 2004]. The enhancement of goods with the provision of services has been practised in some industrial sectors for decades, mainly based on maintenance deliveries to capital investments in B2B settings. Researchers working with these business models also use the terms functional products or total care products [Alonso-Rasgado et al. 2004]. In the age of industrial globalisation, we believe PSS-based business integration can help traditional product based companies to strengthen their position in the marketplace. By following a product/service-oriented strategy we believe companies can deliver superior value solutions and ensure more optimal utilisation of resources by aligning operations with their customers compared to traditional product-oriented offers.

The corresponding integration is not reflected in existing models and processes of product development. Our aim is to build a foundation and provide tools for integrated development of products and service-systems.

The shift from product- to product/service-orientation can be a difficult strategic task. There are many degrees of freedom in the configuration of the product offers. The stakeholder network that has to be managed in a product/service-oriented setting is a degree more complex compared to the fewer and well defined relationships in product-oriented business models. The responsibilities of the providing company are often expanded compared to a product-oriented setting. All these factors introduce risk and uncertainty, if the nature of PSS is not well understood.

Although still on a speculative level, we believe the mindset presented in this paper is a good foundation for understanding product/service-integration. The presented results can guide considerations to shape strategic PSS concepts and delimit the extend of product offers to be developed.

To enable a company in providing PSS-solutions, a number of conditions must typically be fulfilled, namely the following:

- The product development activities must be more closely coordinated with customers' activities and their development.
- The product development activities must be more closely coordinated internally to align the development of goods and the connected service development and delivery systems.

- The company must usually engage in strategic alliances with other organisations in order to enrich the product offer.
- The activity pattern of the company must expand, from the production and sale of goods to the creation of delivery channels and preparedness for the delivery of services.

This paper will focus on issues related to the first three conditions listed. We will present a set of opportunity parameters, which we believe are generally applicable for guiding companies in the formulation of strategies and objectives in the process of shifting from product to product/service-orientation. The presented parameters are mainly extracted from analysis of existing PSS cases from industry and concept work conducted in study projects at DTU throughout the last 2 years.

2. Governing mindset concerning the understanding of PSS

Our approach to service-oriented product development originates from the domain theory for technical systems [Andreasen 1980] and a product-life understanding based on the theory of dispositions [Olesen 1992].

2.1 Nature of a PSS

A company shifting from product-orientation to product/service-orientation adopts a strategy, where the focus of activity no longer is limited to the physical artefact produced (e.g. a car) but expands to enclose all activities which in general aid the purpose of use of the artefact (e.g. transportation, maintenance, driving, commuting etc.). This shift puts the customer and his activities at the centre of consideration.

Due to this change in focus, the company can approach the customer with a number of offerings, which need not be bound to the artefact itself. The company can enhance the product experience by service offerings, or may change the way in which the stakeholders involved in the identified activities interact, in order to optimise the value creation in these activities. In the car example, this could be the offering of service-subscriptions and mobility-guarantees, the organisation of car-sharing systems or offering of driving-courses to enhance the drivers' abilities.

Shifting to a product/service-oriented strategy means building closer relationships to the company's customers, analysing their specific needs and offering services or supplementary goods, which can enhance utility and performance of the products service life.

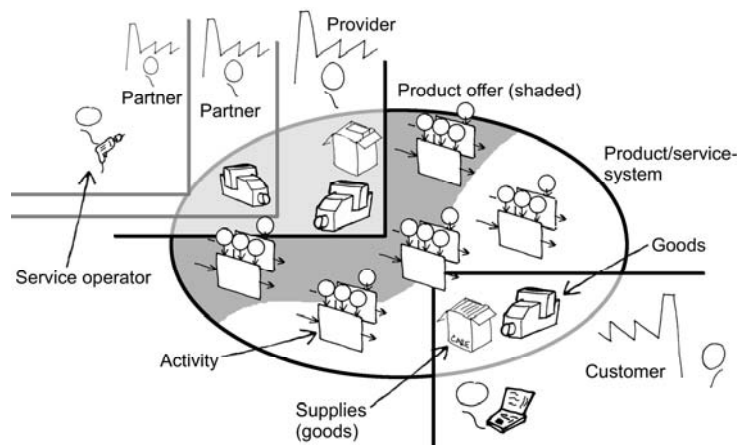


Figure 1. Elements of a PSS

In the definition of a PSS-solution the company identifies a range of activities of their customers, which will be supported by company offerings. Considering the example, a car owned by its user, the PSS can be defined as covering all activities throughout the car's life cycle within the ownership. The covered activities could be e.g. driving, refuelling, cleaning, repair... Note however, that the activities in the PSS need not necessarily be connected to a single physical good, although they often will be.

The provider company (as we choose to call the company that is offering a solution to a customer/user) builds a relationship with the customer, offering support within the identified sphere of activities. This support can include the delivery of goods (often also the initial transfer of central goods which subsequently are supported), the supplies, services, management, knowledge etc. We choose in this paper to call the collection of offerings by the provider 'product offer'. The provider might deliver part of the offered services using partners. The concepts are illustrated in Figure 1.

The presented model for PSS development and operation leaves three important dimensions to be understood, in an attempt to create sustainable concepts for product/service-oriented business models:

- The provider's development and delivery systems necessary for supporting the PSS.
- The customer's development and activity systems setting the context for the definition and operation of the PSS.
- The benefits provided by the PSS in itself in terms of the performance in delivering value to customer, provider and other stakeholders alike.

Now we have understood the nature of PSS, we can begin to discuss an important opportunity (and also requirement) for PSS development. Namely shifting focus from the physical artefact to the desired activity.

2.2 Shift of focus from good to activity

By applying the principles of the transformation domain view [Andreasen 1980] on PSS, the creation of value for the owner of the activity moves to the centre of attention. The servicing activities supporting the customer in his activities can be regarded as a parallel transformational process, delivering additional values to the core activity of the customer. These parallel activities are illustrated in the following figure.

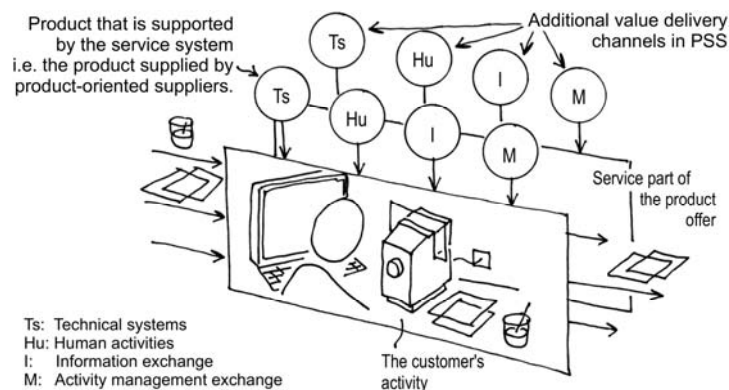


Figure 2. PSS activity as transformation systems, adapted from [Hubka & Eder 1988]

When developing product offers with the aim of optimal value creation for the customer in an activity system, as illustrated, it becomes obvious that the provider of a PSS has more channels of value-delivery compared to a product-oriented company, which only delivers the basic good. Furthermore, there is no apparent difference between the value created by goods and the value created via the additional channels, seen from the customer's viewpoint. Consequently the provider of a PSS has more degrees of freedom for the development of product offers, thus yielding superior value compared to product oriented goods. On the other hand the provider of a PSS must be able to deliver the services promised to his customers, demanding an appropriate operational setup or alliances with supporting partners.

2.3 Separating life cycle considerations into product-based and relationship-based

The above activity-based understanding of value creation can now be combined with product life cycle understanding. Due to a shift in focus from the basic good to the support of a transformational activity, two life cycle scopes become visible:

- The technical life cycle of the supplied good, which will usually be at the centre of the product offer issued to customers.
- The developing relationship life cycle between provider and customer, which exceeds the lifespan of individual technical goods.

2.3.1 Product based life cycle understanding

The product based life cycle understanding is based directly on the theory of dispositions [Olesen 1992]. While the goods in the PSS pass through their individual life cycles, a sequence of different activities will be performed.

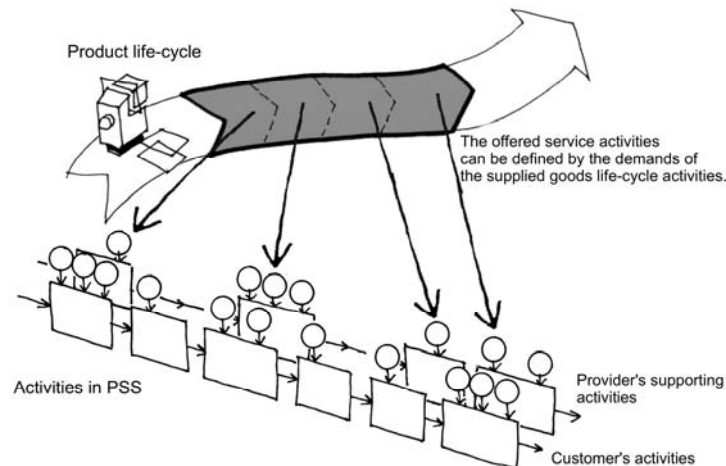


Figure 3. PSS activities supporting life cycle of supplied good

Knowledge of the activities common to these life phases aids in the development of supporting service-systems, since the direct support of supplied goods (and connected transformations) is one of the obvious strategies that PSS development can be based on. Figure 3 illustrates the line of reasoning in this approach. The curved arrow represents the expected life cycle of the supplied good (indicated on the left part of the arrow). Based on the knowledge of the expected life cycle activities, the provider develops a palette of supporting offers, which are operated in parallel to and assist the customer's activities throughout the products service time. The sequence of performed activities involving the customer, the provider and the supplied good is illustrated by the sequence of parallel transformations (see also Figure 2) shown in the lower part of the figure.

2.3.2 Customer relationship life cycle

As stated earlier, the servicing relationship to specific customers can exceed the lifespan of individual supplied goods. In order to continuously create value, the relationship must be maintained and the provider must align their operations to match the development of the customer's needs.

In Figure 4 the continued relationship between customer and provider is sketched. Throughout the relationship life cycle, several goods are delivered to the customer and supported throughout their individual life cycles. The figure is expanded in the time domain, compared to Figure 3. Thus the customer's sequence of supported activities becomes the focal point of development. Due to the regular interaction associated with the customer's activities, the provider gains insight in the developing needs of the customer and the operational state and condition of the supplied goods. Thus the provider can anticipate and act accordingly to the changing needs of the customer. Furthermore, the provider might take supplied equipment back and reuse it in other customer relationships, since the continuous interaction leaves the company with reliable information about the condition of goods and possibilities of reuse and remanufacturing.

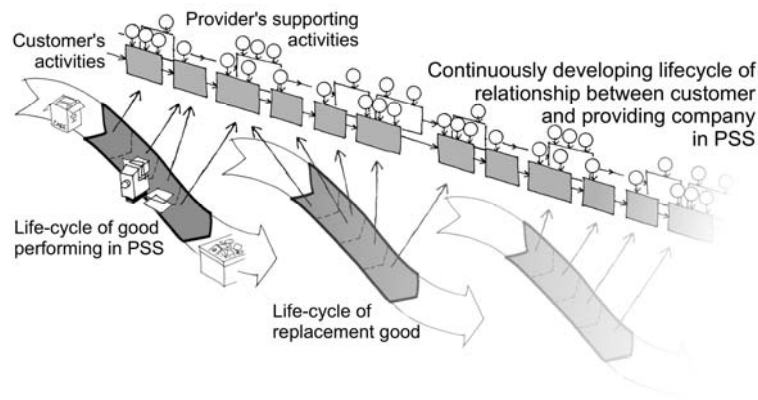


Figure 4. PSS life cycle of customer relationship

3. Opportunity parameters in PSS-development

In our paper we introduce the term “opportunity parameter” as an important term that describes new areas of possibility in a governing value system (be it economical, business-wise, environmentally etc.). Opportunity parameters arise by taking a PSS-approach to business creation (as opposed to a traditional product-approach). An opportunity parameter for PSS can be identified, if the combination of physical product and service provision yield benefits for one or several stakeholders in the governing value system, which a simpler non-integrated system would not be capable of delivering. The presented mindset and understanding of PSS leaves many opportunities for promising developments within a product/service-oriented strategy. To make the models operational, we have defined some specific opportunities arising from the shift towards a product/service-orientation of the company.

3.1 Identified opportunity parameters

The opportunity parameters presented in this section have been identified by analysis of known PSS-businesses, partly based on generally available information, partly extracted from information collected in discussion with key staff of the providing companies.

3.1.1 Augmentation of core deliveries by extending delivery scope

The use value perceived by the customer depends strongly on the optimal utilisation in operation. The providing company in a PSS has degrees of freedom to augment and enhance the value creation by actively delivering additional services and guiding the customer in his activities. Added value can be delivered to the customers by defining a PSS for the utilisation of delivered goods, and supporting it by including key activities in the scope of the product offer.

Examples: Apple Corp. supports the use of the iPod music player by integrating a web-based music shop into the music management software.

Component manufacturer and procurer, Danfoss delivers operational data and training material to customers in retail refrigeration, enabling them to utilise their refrigeration systems better [Matzen et al. 2005].

3.1.2 Resource optimisation by operation and life cycle management

By supporting other activities in the PSS surrounding the central delivery, a provider can help the customer to optimise his operations. This opportunity parameter builds on the fact that the provider has a larger insight in the product/PSS and its life cycle than they traditionally expose to the customer. The idea here is to broaden the contact surface to the customer by supporting the customer’s activities in a broadened cycle.

By retaining ownership of the delivered goods, the provider can reuse them (directly or remanufactured) in subsequent customer relationships. Hereby the life cycle performance of assets may be optimised.

Examples: Danfoss offers training, monitoring and a servicing organisation on alert, in order to optimise the operation performance of retail refrigeration plants [Matzen et al. 2005].

BT trucks utilise a rental system to enable the reuse of forklift trucks across different customer relationships [Östlin et al. 2005].

3.1.3 Alignment of interests by focus on value creation

Making the transformational activities of the customer the centre of attention, the interests of customer and provider are aligned. Hereby focus is put onto the value creation in the PSS, enhancing the experiences of all stakeholders. The delivered products are subordinate to the objective of supporting the activities of the customer.

Example: By positioning the company as internal sub-supplier of surface finishing in the car manufacturing industry, DuPont shifts focus towards optimal surface quality instead of volume of sold paint [McAloone & Andreasen 2004].

3.1.4 Flexible delivery by asset management across customers' relationships

By supporting customers' activities by the delivery of services instead of goods, flexible reallocation of activities is made possible. Alternatively the provider of a PSS has the opportunity to reallocate goods between different customers, if the ownership of delivered goods is retained.

Examples: BT trucks utilise their rental system to flexibly reallocate forklift trucks between customers with changing needs [Östlin et al. 2005].

In car-sharing systems, the support of transportation needs is performed by a planned sharing of cars between different customers, enabling the flexible reallocation of cars between a number of users.

3.1.5 Economic flexibility by rearrangement of business models

The rearrangement of business models towards payments per use or time makes the cost structure of the enclosed activities transparent for the customer. By rearranging the cost structure in respect to value creation activities in stead of ownership transfer, new customer segments can be convinced to participate in a PSS.

Example: In car-sharing systems, the fixed cost of car ownership is divided between participating users in the PSS. Hereby a segment of users with a lower level of transportation needs can be convinced into participation, compared to full ownership of a vehicle.

3.1.6 Focusing of activities by clear responsibility division

By configuring the product offer to clearly take responsibility of all activities connected to the PSS, the customer can focus on his core competencies.

Example: By positioning the company as internal sub supplier of surface finishing in the car manufacturing industry, DuPont clearly takes full responsibility for the painting. The car manufacturer thus can focus on their core competencies [McAloone & Andreasen 2004].

3.1.7 Risk reduction by taking advantage of technical and operational knowledge

By offering a reliable delivery system supporting the PSS, risk is reduced for the customer. Due to the provider's technical and operational expertise within the scope of delivery, risks are reduced, and insurance cost for the provider will be substantially lower.

Example: Danfoss is offering technical insurance of operation to their customers in the retail refrigeration segment. Due to the close monitoring and maintenance services offered, the risk of breakdown is reduced substantially.

3.1.8 Expansion of field of activity by bundling and integration of offers

By focusing on the customers' activities and the relationship life cycle, the provider can expand the scope of delivery and the PSS to enclose more and more activities of the customers, as the PSS develops. The PSS setting allows for a gradual expansion of delivering activities.

Example: Danfoss is expanding the scope of delivery in their refrigeration PSS by offering management of other technical installations in supermarkets. Throughout the development of the PSS, new offers can be implemented, expanding the PSS while experience is gathered.

3.1.9 Information sourcing by monitoring of activities

The provider in a PSS can gather valuable information on the activities within the PSS, as well as customers' activities in other fields that might be included in later developments of the product offer.

Example: Toshiba Medical operates PSSs managing the technical equipment of hospitals. The technical equipment manufactured by Toshiba Medical itself covers mainly imaging equipment. By managing competitors equipment within the PSS, valuable information on competitors' performance and opportunities for new Toshiba Medical developments become visible.

4. Discussion of results

The identified parameters are the first in a long list of opportunity parameters; the list is by no means exhaustive. The work of collecting examples and analysing their performance is still ongoing. Not all of the presented opportunity parameters are linked to the dimensions of the presented mindset. This augments the fact that the mindset and models for the understanding of PSS have to be refined and integrated, also with models of other dimensions within PSS.

Opportunity parameters point towards a series of areas for potential focus during the development of a PSS. It is interesting to see from the industry cases we have studied, that a PSS developer is not necessarily a traditional product developer. It would be interesting and rewarding to go into depths and attempt to identify who (in an organisation) sits around the table when conceptualising and developing a PSS. Any opportunity parameters – if developed into a set of normative development proposals – should be shaped and translated for the developers which will work on the implementation in the company.

The presented opportunity parameters are mainly found in industrial B2B business models, and it is yet to be defined whether they are generally applicable or whether their use is confined to specific activity spaces.

5. Conclusion

In this paper, a number of opportunity parameters have been presented, that point toward beneficial PSS application spaces. The presented opportunity parameters can guide companies to choose appropriate objectives according to their context and environment, when shifting towards a product/service-oriented strategy.

In order to turn the strategies into concepts for concrete development, we believe the presented models and mindset are central for developers of product/service-systems.

In our further work we will continue to develop, document and categorise opportunity parameters arising from a product/service approach to business development, in order that we can support the development of this through robust approaches.

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