Chapter 9
Product-Service Systems (PSS)

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9.1 Motivation and Context

Imagine that you are, for example, a traditional supplier of capital assets such as forklifts. Other companies will purchase the forklifts and use them on their shop floor to move certain materials. This relationship is classified as Business-to-Business (B2B), as your customer is a company that uses your product to offer solutions to other customers.

The typical characteristics of a business of this nature are:

- Your revenue varies according to the time of the year, as your market may be seasonal;
- You want to sell more and more forklifts. Otherwise, your revenue would run out. Thus, you supply high-quality forklifts with scheduled obsolescence to ensure that your customers will buy more forklifts in the future;
- Many times, technical assistance is offered by third parties, as you are not concerned with this aspect of your business;
- You may have never thought about what environmental impacts your forklift truck might have during its life cycle (i.e., production, use and end-of-life).

Now think about the implications of those characteristics for your customer, who buys the forklift. He needs to invest initial capital, provide maintenance (or request technical assistance) and, after a while, change the forklift.

Keep this context in mind, but let us change the focus of our analysis. A forklift is depreciated over time, and it generates costs regarding maintenance. However, there is a significant period where the forklift is available but not in operation. Then, the

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costs are diluted in a shorter operation time than possible, making the product less advantageous for the customer.

Let us now look at this case from the perspective of environmental impacts. Think that, from time to time, your customer will have to discard the old forklift and purchase a new one due to scheduled obsolescence. This will lead to a continuous generation of waste from forklifts whose lifespan could be extended. And what about the parts that are replaced throughout the life cycle every time we do maintenance? Usually, the parts are discarded, and, in a few cases, the material is recycled. However, only a few components replaced during maintenance actually wore out. The company could reuse what has already been produced to manufacture a new product, reducing manufacturing costs and the business model's environmental impact.

Some of those reflections are related to significant changes in the way of doing business. Have you thought about why some industrial segments are undergoing a business revolution, such as the music and video industries, for example? Streaming technology and people's connectivity enabled opportunities not even imagined years ago.

There is also a revolution in the transport and hotel markets. You must know that the largest company providing individual mobility does not have any vehicles in its assets. As well as the largest people hosting network does not have any accommodation properties.

Given all these examples, we may question ourselves about:

- leaving the traditional business model, which is based only on selling products;
- focusing more and more on the customer but, at the same time, considering other stakeholders who could impact the business;
- utilizing the potential of new technologies; and
- ensuring new solutions to be economically, socially, and environmentally sustainable.

The answer that fits all these questions is: leaving the paradigm of being a product supplier and becoming a service provider that uses the product to deliver what the customer/user wants or needs. A system composed of this product and its associated services is called a Product-Service System (PSS).

To become a PSS provider, a company that works in the product-oriented paradigm must go through a transformation process known as servitization. In this process, you must mainly change your mindset in order to reinvent the way you do business, which often requires innovations in the products themselves and in the way you relate to customers and other stakeholders. In addition, as we all share the same planet and live in society, this paradigm shift must have fewer negative impacts on the environment and society. We must mind the dimensions of sustainability so that, for example, the social impact does not increase with solutions in which labor relations become unregulated without protecting the minimum dignity of people.

9.2 Goals

Within the context presented, this chapter aims at presenting the basic concepts about PSS, as well as some related concepts and success cases in PSS, so that you can:

- know the potentials of adopting this approach and the challenges that impact this adoption;
- relate PSS to other approaches focusing on Life Cycle Engineering and Management (LCEM), which is the central theme of this book;
- know how to develop a PSS in practice.

9.3 Definition of PSS

The term product-service system has been formally introduced by Goedkoop et al. (1999) as "a marketable set of products and services capable of meeting, together, the needs of a user" (Goedkoop et al. 1999). Products and services are combined in a system, which is a collection of tangible and intangible elements organized around interactions through a set of common goals to be achieved (Cavalieri and Pezzotta 2012; Goedkoop et al. 1999). The services are provided through products developed in a context in accordance with the practices in use by customers (Tan 2010).

There is no standard definition for PSS yet, which depends on the focus of analysis in the research field (Mougaard 2015). However, the existing definitions may cover different aspects, including the concept of system, customer needs, tangibility and intangibility, networks and infrastructure, social aspects and partnerships, and environment impact (Annarelli et al. 2016). The term PSS is used by the research communities of information systems, business management, operations management, marketing, service sciences, engineering, and design (Boehm and Thomas 2013; Lightfoot et al. 2013). However, several terms have been used in the literature to refer to PSS, as illustrated in Fig. 9.1. The font size of the terms in this figure represents the frequency with which each term appeared in the literature review.

In this chapter, we will use the following definition: **PSS is an integrated product and service offering, which delivers value to customers through the value creation components of an innovative business model that considers the needs of stakeholders. The value creation components of the business model are the processes, resources, people, and partners in the value chain. Resources include the technology and infrastructure applied to create value**.

9.4 Types of PSS

A PSS can be classified into typologies in order to allow that, through the descriptions of possible PSS variations, researchers and organizations can predict PSS behaviors

Fig. 9.1 Terms related to PSS. *Source* Authors

and make adequate decisions (Park et al. 2012). The PSS classification can also be useful for defining the business model (Reim et al. 2015). The most widespread typology in the literature is proposed by Tukker (2004). This tipology is presented below.

Tukker's (2004) classification defines three categories, which are illustrated in Fig. 9.2:

- Product-oriented PSS;
- Use-oriented PSS;
- Result-oriented PSS.

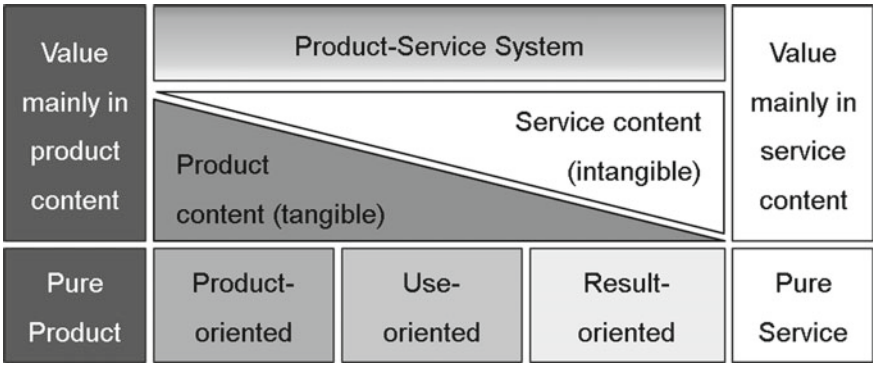


Fig. 9.2 Types of PSS. *Source* Adapted from Tukker (2004)

In a product-oriented PSS, the supplier traditionally sells the product, offering and charging for additional services that guarantee the product's functionality, usability, and durability. A typical example is cars. We buy a car and, therefore, we own the product. However, during the car's life cycle, we still pay for maintenance and repair services offered by the car supplier, besides taxes regarding the vehicle ownership.

In a use-oriented PSS, the provider owns the product and does not transfer its ownership to the customer after the transaction. The provider must maximize the product use phase by developing robust products to extend their life cycle, reducing maintenance and remanufacturing costs since they are under the provider's responsibility. The commercial transaction can be carried out through:

- Product leasing: the customer pays a regular fee for using the product over a given period. This is the case of the automotive industry in the B2B relationship. A company in need to use automobiles does not purchase them. The company pays for using them, and, at the end of a period, it may purchase the product for a residual price. A variation of this type of PSS is when the customer returns the product to the provider at the end of the use phase. This is the case of "Brastemp pure water," which presented in the "PSS cases" section of this chapter;
- Renting/sharing: similar to leasing, the customer pays a fee for using the product in a given period. The difference is that, in this case, the use of the product can be shared by more customers. This is the case of equipment rentals, such as cranes in the construction industry or forklifts for factories. The most popular examples of this type of PSS are the rental/sharing of bicycles, scooters, motorcycles, and automobiles in large cities. In the "PSS cases" section of this chapter, you can consult the case of "Beepbeep";
- Product pooling: it is a particular case of rental business model in which different customers use the product simultaneously, dividing the payment among themselves. This is the case of the Uber pool, where, through the app, more than one person can use the same vehicle, sharing the costs for transportation.

In a result-oriented PSS, the provider sells a result or performance from the product use. The provider owns the product and can customize different services associated with the value offer, which can be subdivided into:

- Activity management: The client outsources some activities to the provider, who takes responsibility for delivering the results of that activity. One example is the "JBT Foodtech" case presented in this chapter's "PSS cases" section. It occurs when the provider is responsible for operating the equipment and achieving the customer's desired results.
- Payment per service unit: The customer pays for a result that the product provides through its use. This is also the case for "JBT Foodtech" presented in this chapter's "PSS cases" section. But here, the customer is the one who operates the equipment. Payment is based on the number of oranges processed;
- Functional result: The provider negotiates with the client to deliver a functional result that adds value. The provider charges a fee for a functional unit and is

completely free to decide how she/he will deliver this result. This is the case of companies that provide, for example, a temperature in a given room or environment. The provider fully controls the air conditioning heating or cooling system and ensures a given temperature to be kept continuously. Another example is when the provider offers a good harvest to a farmer, being responsible for applying pesticides, monitoring the plantation, etc. In the "PSS cases" section of this chapter, we present the case of "Pay-per-lux - Philips," in which the customer pays for lumens that she/he received in the lighting of his facilities.

Despite the popularity of Tukker's typology (2004), its application depends on the individual interpretation of each scenario, which results in ambiguity and confusion. This is mainly due to the typology being purely descriptive and based on PSS examples without defining more specific criteria for comparison. There are other ways to classify a PSS, but since Tukker's typology (2004) is the most known and used, this chapter limits its scope to this typology. For other typologies, see the publications of Roy (2000), Van Halen et al. (2005), and Meier et al. (2010).

We have already presented the basic definition and types of PSS. Although many proposed PSS definitions in the literature state that PSS is related to sustainability, a PSS is not necessarily sustainable unless conceived to be so (Barquet et al. 2016a). Note that we do not cite sustainability in the basic definition we have presented. Therefore, we will now explore the definitions that link PSS to sustainability and define what a sustainable PSS is.

9.5 PSS and Environmental, Social and Economic Sustainability

The most cited sustainable development definition was published in a report produced by the World Commission on Environment and Development (WCED) in 1987, with the title "Our common future" (United Nations 1987). It defines sustainable development as "development that meets the current needs without compromising the ability of future generations to meet their own needs" (United Nations 1987). This concept of sustainable development has evolved to define the three pillars of sustainability known by the acronym TPL (Tripple Bottom Line), which define three dimensions of performance measurement: environmental, social, and financial (Slaper and Hall 2011). These three pillars are equivalent to the three sustainability perspectives: environmental, social, and economic (Vezzoli et al. 2018).

From the environmental perspective, the concern is to reduce the greenhouse effect impacts, ozone layer depletion, eutrophication, acidification, fog smoke, toxic emissions, and other types of pollution. The **social perspective** considers equity, social cohesion, and equitable distribution of resources based on the "principle that everyone has the right to the same access to global natural resources." One of the central issues in this perspective is the eradication of poverty due to poor distribution and armed conflicts that occur in the world (Vezzoli et al. 2018). The **economic**

perspective is broader than the financial one defined in TPL, which aimed only at achieving profit in its original version. The principle of this perspective is that the production and consumption development model must be guided by the environmental conditions and the search for social equity, i.e., this perspective is associated with the other two perspectives of sustainability. Economic value goes beyond financial value and competitiveness.

In his provocatively entitled book "Cannibals with forks: The Triple Bottom Line of 21st Century Business", Elkington explores paradigm shifts in seven dimensions[1] for a sustainable future (Elkington 1997). In the "value" dimension, he states that new values are globally emerging in the direction of sustainability. However, several managers still believe that businesses must pursue the creation of economic value without considering social or ethical values. In this context, PSS development has the potential to balance these aspects of sustainable development.

Initially, the concept of PSS emerged directly related to sustainability. According to Mont (2002), the adoption of PSS must minimize the production and consumption environmental impact. The author defines the PSS as "a system of products, services, relationships and support infrastructure that is developed to be competitive, satisfy the needs of consumers and have a lower environmental impact compared to traditional business model." The PSS approach may reduce environmental impact mainly because the product belongs to the service provider in some cases, who is interested in making the product last longer (Manzini et al. 2001).

However, few companies are committed to sustainability when adopting the PSS approach. Although sustainability is at the origin of the term PSS and its potential to reduce environmental and social impacts, several applications are currently not sustainable, and many studies do not consider sustainability (Tukker 2015). The PSS approach does not guarantee environmental and social improvements if it is not specifically designed for this purpose (Tukker 2015; Tukker and Tischner 2006). In other words, PSS is not a panacea for sustainability issues, and offering a PSS is not always better than selling products (Tukker 2015). Achieving sustainability depends on a profound transformation of the business model towards this goal.

If there is no paradigm shift, the PSS will not be sustainable. For example, the lifespan of shared products is shorter than in traditional cases, as users do not take good care of the product (Tukker 2015). Another example is the bike-sharing solutions in China. In some cities in China, bike-sharing solutions multiplied due to a government policy to reduce car use. However, many of those providers had insufficient financial returns. This deregulation created cemeteries for thousands of discarded bicycles, leading to a major environmental impact.

Today, we differentiate PSS from sustainable PSS (Barquet 2016b; Bacchetti et al. 2016), also known as S-PSS. In 2002, Manzini and Vezzoli stated in a study published by UNEP (United Nation Environment Program) that PSS does not necessarily lead to sustainable solutions. Still, it has the potential to support sustainability (Manzini and Vezzoli 2002).

[1] The seven dimensions that will undergo paradigm shifts in the future are: market, values, transparency, technology in life cycle, partnership (value chain), time, corporate governance.

Therefore, this chapter defines **sustainable PSS as a PSS[2] that aims to obtain environmental and social benefits and the economic benefits to the PSS provider and all stakeholders** (Manzini and Vezzoli, 2002; Bacchetti et al. 2016; Vezzoli et al. 2018).

In this chapter, it is essential to mention the circular economy approach, which is increasingly discussed in many forums and is increasingly being adopted by companies. We will discuss the circular economy concept by comparing it with sustainability and analyzing its relation to the PSS.

Circular Economy is a regenerative system in which resources, waste, emissions, and energy loss are minimized by slowing down, closing, and narrowing the cycles of materials and energy. This can be achieved through robust product designs with long life, maintenance, repair, reuse, remanufacturing, reconditioning, and recycling (Geissdoerfer et al. 2017).

The circular economy aims at keeping products, components, and materials at their peak of value and usefulness for longer. It is possible to say that the most important point among the principles and concepts in the theme of Circular Economy is the existence of a systemic view of activities that is no longer focused on the process but the system as a whole (holistic view). This integration will link the economic gain with sustainability and bring non-specific solutions, but connected in the whole process. These can no longer be planned in isolation, and must now add value to all parts of the chain in new ways of connections and business (Blomsma and Brennan 2017). This way, the circular economy can be treated as a strategy to achieve sustainability. Circular business models add to the sustainable business models the characteristics related to the material and energy cycles mentioned in the definition of circular economy (Geissdoerfer et al. 2018b).

According to the mentioned definition of circular economy, we can define a circular PSS as a PSS inserted in a regenerative system in which resources, waste, emissions, and energy loss are minimized by slowing down, closing, and narrowing the material and energy cycles.

However, a company can adopt the principles of "closing the cycles" of Circular Economy and, even though, not achieve sustainability if, for example, its employees work in poor working conditions (Geissdoerfer et al. 2018a). Closing the loops strategies have already explicitly been part of several sustainable development approaches. Many other circular economy strategies also already existed implicitly in the concept of sustainability, such as slowing down, narrowing the cycle, and minimizing resources, waste, emissions, and energy loss. However, sustainability still is more comprehensive and consolidated than the circular economy since it considers TPL, among other concepts. Thus, in this chapter, we will only deal with the concept of sustainable PSS.

The considerations over the material and energy cycles show the importance of dealing with the PSS life cycle concept. Therefore, in the next section, we will discuss the relationships of PSS and Life Cycle Engineering and Management.

[2] Consider the definition of PSS on the previous section. This definition is complementary.

9.6 PSS and Life Cycle Engineering and Management

A sustainable PSS must consider the aspects discussed in the previous section and, of course, the life cycle. A PSS life cycle has two perspectives: information and material (Fig. 9.3).

The information perspective considers the acquisition, creation, control, updating, storage, and disposal of information at all stages of the PSS material life cycle and involving all processes. Even before the material cycle begins, the first phases of the information cycle involve managing the innovation, developing, and implementing the PSS. The material cycle is repetitive and occurs after the development of the PSS is completed and its production is released (Pieroni 2017). The material cycle begins with the extraction of raw materials, production, distribution, and use of PSS and ends with the application of end-of-life strategies (Pieroni 2017). The two perspectives can be classified into three major groups (Fig. 9.3):

- Beginning of Life (BOL)
- Middle of Life (MOL)
- End of Life (EOL).

In use-oriented and result-oriented PSS, according to Tukker's (2004) classification, the provider is the owner of the physical product. Therefore, to increase the use of the asset, the provider will attempt to incorporate more robust products. Robust products may be achieved by carrying out projects oriented to remanufacturing. It

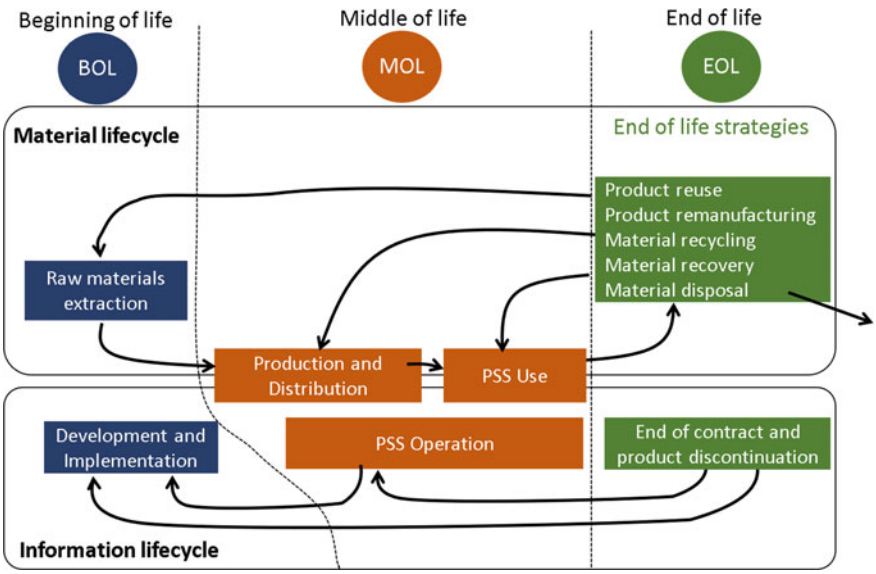


Fig. 9.3 PSS life cycle phases according to two PSS perspectives: material and information life cycle. *Source* Adapted from Pieroni (2017)

makes it easier to bring the product back through reverse logistics (since the provider owns the product) and remanufacturing, enabling the company to reuse the product for other customers. For more information on this, see Chap. 12: Green Supply Chain Management in this book.

Now that we know the definition of PSS and sustainable PSS, as well as the phases of their life cycle, we will present the benefits and barriers of this new approach.

9.7 Benefits and Barriers

Initially, we will present the benefits that a supplier or provider has when adopting the PSS approach and the benefits for customers or users, the environment, and, finally, for the government and society. Then, we will present the barriers that need to be overcome for the implementation of the PSS.

One benefit is **market growth** (Manzini et al. 2001). With PSS, the customer does not need to purchase a product (in the case of use-oriented and result-oriented PSS), obtaining the complete solution of services and products by a much smaller monthly disbursement (Tukker 2004). The sale is no longer seasonal, and the provider receives **recurring revenue**. This generates **greater predictability and long-term cash flow stability** (Alonso-Rasgado et al. 2004; Zancul et al. 2016).

The PSS solutions require greater interaction between customers and provider, generating frequent **feedback** from customers, what creates **long-term relationships** between those involved, **making it easier to obtain information for improving products and services**. This closer relationship can impact **customer loyalty, ensuring the sale of consumables**.

Other benefits of the increased information flow between customer and producer are **opportunities for incremental innovation** as obtaining **frequent feedback** makes it easier to solve customer problems. In addition, **technical assistance can be optimized** as there is better communication with the product user and control over the product through traceability and monitoring. Thus, there is **greater knowledge of the product in the application environment** (Wang et al. 2011) and a greater **guarantee of correct operation of the product** (Tan et al. 2010).

Finally, one can have a **better brand value, improving the organization's image** for customers and other stakeholders (Wagner et al. 2013). For cases of sustainable PSS, the provider must meet the agreed service level and avoid/reduce environmental and social impacts. In this case, **the company's image becomes efficient** (quick response) and **sustainable** (Baines et al. 2007). In cases of sustainable PSS, the provider must **comply with environmental legislation**.

In cases of result-oriented PSS, as in the "pay-per-lux - Philips" case, the PSS provider manages a function provided for the customer. It creates an intangible value linked to the offer, making it a **differential oriented to the customers' needs**.

The main benefit for the customer is **higher satisfaction** due to perceiving more value through PSS solutions (Tukker 2004). This point may also be linked to the **elimination of responsibilities attached to product ownership**, i.e., depending on

the type of PSS, the customer is no longer responsible for the repair, maintenance, and disposal of the product (Barquet et al. 2013). If the customer does not purchase the product and pays only for its use, function, or result, he **does not need to pay a high purchase price**. Thus, he can take advantage of the product and its associated services **since there is no need for high investment**. Instead, the customer can make **smaller, predictable payments according to the usage**.

In the Service Level of Agreement (SLA), there may be a clause about maintaining the product in good condition. This kind of contractual clause brings **less risk of stopping** the operation of the product since it may guarantee a certain level of availability of the product and preventive maintenance.

Another benefit would be **access to several services**, payment methods, and options in the market due to the different types of PSS in the market, also related to the different levels of customization of the solution offered to the final consumer. The PSS differential is the possibility of its **customization to meet the specific needs** of every client (Annarelli et al. 2016).

The main environmental benefit is **reducing the use of natural resources** (Cook et al. 2006; Annarelli et al. 2016). This benefit is perceived when the provider adopts a more sustainable approach (Reim et al. 2015), i.e., when the provider designs products with extended durability (more robust) and recyclability. Doing so ensures the possibility of product reuse, repair, reconditioning, and remanufacturing, according to some end-of-life strategies that will be addressed in Chap. 12: Green Supply Chain Management (Cook et al. 2006; Annarelli et al. 2016). Consequently, there is an **increase in the product's life cycle** since the design does not aim at programmed obsolescence (Cook et al. 2006).

Finally, this type of PSS **"dematerializes" products and uses fewer resources**, as customers perceive the value of services and alter the system's life cycle planning (Cook et al. 2006), allowing for a high **environmental gain**.

However, one of the biggest challenges is changing the mentality necessary to make this business model viable both from the perspective of the provider and the customer, who is used to owning the product (observe the barriers to the adoption of PSS). All stakeholders involved (providers and customers mainly) must have a life cycle-oriented mindset.

Shifting to PSS generates **minor problems and costs for providers**, which are related to assuming the responsibility for purchasing, using (i.e., providing the function), replacing, and maintaining products. However, taking this responsibility ultimately benefits society. Shifting to PSS also generates **more jobs in the service sector** (Mont 2002) as the chain of service providers around the PSS requires more people deliver value.

Extending the product life cycle requires **efficient management of solid waste** (Mont and Lindhqvist 2003), resulting in environmental benefits. The society also benefits from a **more environmentally sustainable economy**, for to achieve benefits related to other sustainability perspectives, there must be incentives (governmental and cultural) such as the option to stop using a car and start using a bicycle to go to work every day. In this example, the creation of bicycle path infrastructure is a factor that encourages the use of bicycles. The government needs to promote sustainable

lifestyles and consumption patterns through **public policies** (Manzini et al. 2001) in order to obtain benefits for society, making it more sustainable. An example is stimulating the use of electric cars and discouraging individual cars at certain times (rotation) and locations (traffic tax in cities' downtowns). Furthermore, the users' mindset should be a stimulus itself for using more sustainable solutions.

After presenting the main benefits associated with the use of PSS, we will present the main barriers.

The main barrier is **product-oriented culture** (Tan 2010; Barquet 2015) and **consumption attached to product ownership** (Baines et al. 2007). This barrier is easily seen in the context of emotional attachment with objects and luxury products. For example, owning a Rolls-Royce car is a sign of status and power. Potential buyers of a Rolls-Royce would hardly shift from owning a car towards a use-oriented service. Furthermore, there might exist internal **strategic conflicts** from choosing between selling more products and increasing the product's lifespan along with providing services. In addition, the complexity of a PSS may lead to legal issues since the law may have gaps regarding the characteristics of this kind of solution (Hojnik 2016). Finally, **there are no or few incentives in the governmental sphere to create environmentally better solutions** (Mont 2002).

Other barriers related to research and work in the PSS area are: the **fragmentation of researches** in PSS (Baines et al. 2017), which are not focused on practical application (Martinez et al. 2010). PSS studies are numerous, always presenting "new" approaches but **without consolidating practical PSS development and implementation methodologies**. Part of these difficulties stems from the **lack of consensus on PSS definitions** and proven business models. We also note that many PSS implementations are not yet delivering the expected financial return.[3]

In Fig. 9.1 of this chapter, when we present the definition of PSS and the related terms, we realize that the term servitization stands out right after PSS. This term has been created by Vandermerwe and Rada (1988) even before the formalization of the term PSS. Today it is a consensus that this term represents the process of transforming a company so that it becomes a PSS provider. Servitization, therefore, involves the innovation of the business model. For this reason, the next section discusses the relation between these concepts.

9.8 PSS, Servitization, and Business Model Innovation

Servitization is the process that creates additional value by transforming a traditional business model into one that offers PSS (Martinez et al. 2010). A business model defines the mechanisms for creating, delivering, and capturing value by the company (Osterwalder and Pigneur 2010). Servitization implies changing an existing business model to a new one (Baines et al. 2017; Martín-Peña et al. 2017), i.e., servitization is

[3] Search the internet for the car2go case, which is no longer applied in several cities due to lack of financial return.

directly related to the business model innovation. Such a concept involves creating a completely new business model or redesigning an existing business model in already established organizations (Bocken et al. 2014).

The PSS development can also lead to the business model innovation. The difference between servitization and PSS development is in the scope of these approaches. If the company does not have the mindset and culture of offering services, the business model transformation starts with a servitization process by aimed at creating its first PSS offering. Within the context of Life Cycle Engineering, the resulting PSS should be sustainable. For this, during the PSS development, ecodesign strategies, tools, and methods should be used (which are presented in Chap. 8: Product Ecodesign). In addition, the impact of the PSS should be evaluated throughout its life, i.e., it is necessary to predict the impacts of the PSS and try to minimize them during the development phase. One way to assess the PSS in operation is using the LCA technique - Life Cycle Assessment (see Chap. 3: Life Cycle Assessment (LCA)—Definition of Goals and Scope).

Any transformation based on the business model innovation should be placed in the context of change management (see Fig. 9.4), as it deals with the most determining factor for the success of any transformation and, therefore, of servitization: people.

In short, servitization can be considered a business model innovation. Like any transformation, servitization should be placed in the context of change management. Servitization covers the PSS development and is focused on changing the companies' mindset and the culture of a product orientation to become a PSS provider. After the paradigm shift is already incorporated into the organization's culture, the creation of new PSS occurs through the process of developing a sustainable PSS. The development process should incorporate the ecodesign and the life cycle assessment approaches.

After knowing the servitization and PSS theories, a question remains: how to follow the path of servitization? To answer this question, we present below a

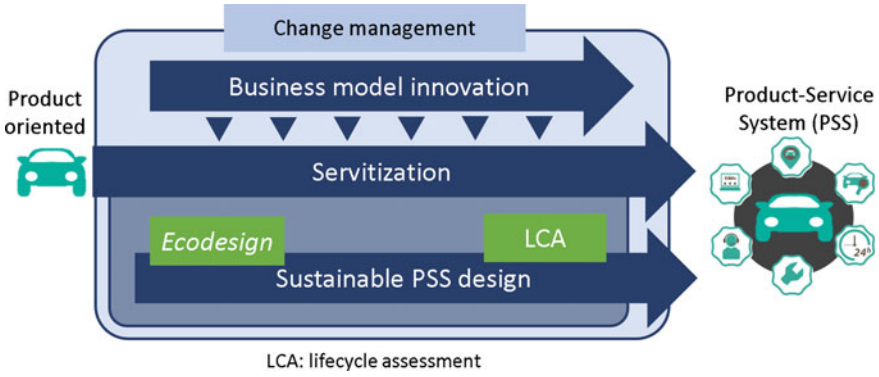


Fig. 9.4 Conceptual view of the relationship between change management, business model innovation, servitization, and PSS development. *Source* Authors

servitization methodology, which follows the concept discussed in this section of integrating the approaches illustrated in Fig. 9.4.

9.9 Servitization Methodology

The servitization methodology aims to help companies that wish to transform themselves from product suppliers into PSS providers. It can also be used for the development of a new PSS within the organization. As the name implies, it is a methodology, i.e., a collection of methods. The methods of this methodology are organized by activities that are grouped according to a common objective. The methodology activities can be combined in different ways depending on the characteristics of the servitization project to be developed. This fact makes the methodology flexible. The selected activities are associated with the most appropriate method(s), that may also be selected.

In this section, the main characteristics and groups of activities that enable the implementation of the servitization methodology will be presented. For more details, you can access the methodology's online content.[4]

In Fig. 9.5, it can be seen that the activity groups are placed in two planes. In a plan, there are the change management and project management activities because these activities permeate the entire process of servitization and relate to all activities.

Change management creates the conditions to prepare and motivate people who make up the organization (as well as the partner organizations) in relation to servitization. Change management activities are integrated with project management activities. Each servitization can be considered a project with well-established beginning and end. Thus, it is necessary that this project is managed properly.

The activity groups from the other plan in Fig. 9.5 are described below.

The business analysis assesses the organization's current business external and internal environments to identify trends and map the company's current situation. Also, this activity should be performed to understand other important aspects related to the business, such as value chain, market, competitors, technology, legislation, and stakeholders. Business analysis should preferably be carried out continuously through parallel business processes, such as market analysis, market intelligence, technological prospecting, technological surveillance, among others. It provides subsidies for strategic planning and servitization itself. A good practice is to synthesize the information from these analyzes into a *roadmap*, known as a *technology roadmap*, to interrelate technology, product, and market on a time scale.

In the context of this methodology, strategic planning involves the establishment of actions and organizational goals in relation to servitization. It is in strategic planning that you decide to go through servitization.

[4] The servitization methodology is available online through the link http://www.pdp.org.br/servmtd/ and is one of the methodologies derived from the innovation flexible methodology (http://www.flexmethod4innovation.com.br/).

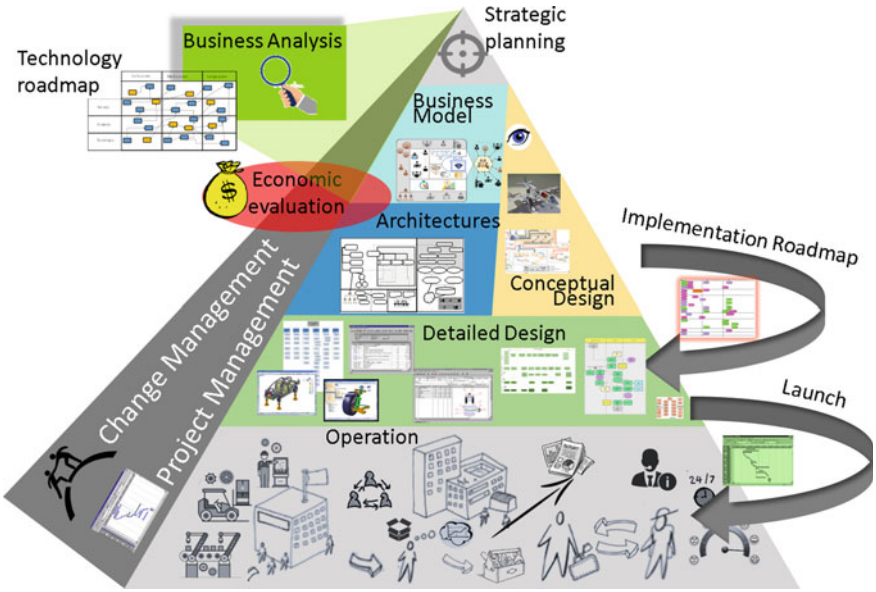


Fig. 9.5 Hierarchical perspective of the servitization methodology. *Source* Authors

The value proposition involves the definition of a market segment, the identification of who the stakeholders are, the understanding of their needs, desires, pains, problems, market and technological opportunities, as well as the understanding of legislation barriers. This activity group also involves the use of creativity techniques to create PSS value propositions based on the information collected previously. The value proposition brings the characteristics of the solution (product and service offering) that can potentially deliver value to stakeholders. More than that, the value proposition should explicit the potential benefits that can be perceived by the stakeholders. However, the entire solution needs to be designed to allow systems, services, among other dimensions of the solution, to be structured (architecture) and detailed (detailing). This conception of the solution is performed through conceptual design. This design is detailing carried out in parallel to the value proposition, when necessary. Conceptual design represents products and services with a level of abstraction that does not fit the business model, as it goes beyond the sticky notes. For the design of services, systems maps, personas, empathy maps, journeys maps etc. can be used. Some representations overlap with the PSS architecture. When we adopt the current physical product and just want to add services to the product offering, the conceptual design of the product does not occur because it already exists. However, it is necessary to analyze whether the characteristics of the current product are suitable for servitization.

The activities of defining the main elements of the business model that create, deliver and capture value are based on the previously established value proposition. Tipically, the business model representations (such as the Canvas proposed by

Osterwalder and Pigneur 2010) used include the value proposition. In the case of the servitization methodology, the value proposition is separated, allowing us to move from the value proposition directly to the detailed design when we are not going to change the business model. The two frames used to represent the value proposition and the other elements of the business model are complementary. The business model may have multiple levels of abstraction and the most popular level used is only superficial. In other words, we consider that the business model representation needs a more detailed level of abstraction (and not only with sticky notes). The PPS can be better specified before moving on to the detailed design of each of the elements. This is usually done in the development of the PSS architecture.

During the PPS development, several artifacts, whether tangible or intangible, should be developed. As part of a systemic solution, such artifacts cannot be developed independently. The solution needs to be observed from the perspective of a system. The PSS architecture is the intermediary element between the concept and the detailed desing. It allows the solution development to be managed in an integrated way as a single system. It can be seen as a turning point in the development. Even in architecture, the solution is always conceived as a system – a concept where the set of artifacts meets the needs of stakeholders. However, during the detailed design, different professionals will be needed to develop each PSS artifact. For example, service designers will be able to design PSS services in detail while programmers will be asked to develop the code for the necessary PSS software, and engineers will design the hardware that makes up PSS. In this detail, it is necessary to ensure that the artifacts will not be developed completely independently, but respecting the interfaces and interactions between the artifacts that will guarantee that the solution will follow the proposed concept (Rozenfeld et al. 2018). The PSS architecture represents the elements of the solution in an interconnected way, associating their functions with them. If the solution architecture is very complex (which is usually the case with solutions like PSS), it can be divided into layers, such as product, service, infrastructure, among other possibilities, according to the solution under development.

The economic viability analysis aims to assess the economic and financial characteristics of the business models generated, resulting in indicators used for decision making. The basic input for the economic viability study is the initial information specified in the business model. That information allows to estimate revenues and costs. It evolves iteratively as the solution is detailed. Economic viability allows us to select alternatives, optimize or simply discontinue the PSS development. In the case of PSS, one of the great financial advantages is obtaining recurring revenues. However, if the value of the asset is very high, making its implementation as PSS unfeasible, a PSS installation fee should be charged to offset the value of the fixed asset.

A PSS solution can require a lot of adaptations and changes in an organization. Those changes are not always feasible in the short term. Thus, it is recommended to split the solution implementation for it to be evolutionary, implementing a simplified version (such as an MVP: Minimum Viable Product) as soon as possible so that it can be tested. The implementation roadmap represents the main results that must

be achieved during servitization, demonstrating how the solution will evolve from MVP to the final solution.

Detailed design activities involve the detailed development of all the elements that make up the PSS. At this time, the development of the elements can be separately assigned to professionals specialized in each type of technology: software, hardware, processes, services, infrastructure, among others. These professionals will detail and test the elements while respecting the integration requirements derived from the architecture. This is important to allow that the final solution to funciton as a system. Obviously, existing artifacts do not need to go through this process. For example, in a case of servitization based on a pre-existing product, the parts of the product do not need to be detailed again (except for possible modifications). The detailed design will provide all the information necessary for the company to implement the PSS, including production processes, service provision, among others.

The launching activities aim at starting the value chain operation, which involves the final acquisitions, installation of machinery, people training, establishment of the necessary partnerships not yet been defined in previous steps, approval of processes, issuing of the necessary certifications, among others.

The operating activities involve those required during the PSS's middle of life (MOL) to ensure that the solution is properly offered. It includes continuous improvement of the PSS based on stakeholder feedback and the evolution of the solution according to the roadmap. At the end of life (EOL) of the PSS, strategies are triggered, such as product reuse and remanufacturing, material recycling, recovery, and disposal.

BOL, MOL, and EOL have economic, environmental, and social impacts associated with them. As in a product's life cycle, it is interesting to predict, measure them and work to reduce negative impacts. Clearly, the PSS has other dimensions that need to be considered in addition to the product, such as services, infrastructure, etc. as previously mentioned. Thus, there are techniques adapted to assess the solutions' sustainability. One of them is the guide for assessing the environmental performance of PSS proposed at the Technical University of Denmark (Kjaer et al. 2017). However, there are several other techniques to assess the sustainability of a PSS. Usually, those techniques are based on the LCA and focus mainly on the economic and environmental dimensions (Doualle et al. 2015). The main difference between performing LCA for a pure product and for a PSS is that, in the case of a PSS, the support processes and systems need to be included in the analysis in addition to the analysis of the product itself. We should consider that the support services, processes, and systems have material flows and, consequently, the potential to generate environmental impact (Kjaer et al. 2017). A point of attention for applying the LCA to the PSS is the proper definition of the scope to be analyzed and the level of detail desired, since the complexity of a PSS combined with an excessive level of detail can make the analysis unfeasible (Kjaer et al. 2017).

Each of the groups of activities for servitization has challenges to be overcome. It is difficult to say which activity is the most challenging, as it depends on the know-how that the company has, its previous experience, and the PSS which is being developed. A company that knows its customers very well, keeping them in constant

contact to understand their needs and get feedback on solutions, will find the design of value proposition easy. On the other hand, a company approaching an entire new market segment can spend a significant amount of resources and time to accomplish the same acticity. Likewise, if the PSS is based on a higly complex technical product (such as an airplane turbine, for example) and with highly complex services (such as predictive maintenance based on remote sensing), the defining of the architecture and the detailed design will spend much more time and resources compared to a PSS with low complexity products and services (such as a monthly supply of office pens based on a predefined demand). However, one factor that is constantly reinforced by companies providing PSS is the need to establish service levels that are achievable (is it possible to guarantee that a machine will be running in 99% of its working time?). Also, it is necessary that the service levels are compatible with the risks to be assumed and with the expected profits. Establishing a good service contract has a high impact on the success or failure of a PSS. It is a task that requires a good understanding of all factors of the business model and an investment of people's time, and legal, tax, and technical knowledges.

9.10 Cases of PSS

This section present real cases of PSS in the Brazilian and global markets. The cases evolve over time, which can add new concepts. We, therefore, recommend that you always keep up to date with new cases and new versions of the presented cases. Considering the cases presented, the greatest advantages for the PSS provider are the recurrent revenues, customer loyalty, and the possibility of reaching a market segment that previously did not have the financial capacity to acquire the offerings.

9.10.1 Pure water, Brastemp

Brastemp, a Brazilian manufacturer of household appliances, offers a subscription service for water purifiers. Subscriptions vary depending on the type of purifier and its features. It includes online services in a relationship program for subscribers.

The great advantage is that the customers does not have to worry about maintenance of the equipment and the acquisition of a new one.

9.10.2 Beepbeep

Beepbeep is a Brazilian startup, located in São Paulo, that offers mobility through 100% electric cars (currently only Renault Zoe cars). Through a mobile app, the user can find and reserve a vehicle. The vehicles should be found and returned to

the company's stations, which are distributed throughout the city. Payment for the service consists of an initial fee plus an additional fee per minute of use.

People who cannot afford to buy vehicles get a personalized modality for special cases, combining it with the use of public transport for their daily activities.

9.10.3 JBT Foodtech

JBT Foodtech is a subsidiary of JBT Corporation (American multinational) and specializes in manufacturing equipment for the food processing industry. The product, called Citrus Extrator, is the core of the citrus processing system and is offered as a service. The business model focuses on providing integrated solutions, which also include fruit storage, receipt and handling of fruits, citrus pulp processing, waste processing, among others. During the off-season, the equipment undergoes preventive maintenance. At its end of life, the equipment is returned to JBT, which replaces it with a "new one" to continue to deliver the citrus processing function to the customer. The provider collects the equipment and remanufactures it, reusing 80% of the material.

With this solution, customers (orange juice producers) can only worry about their core businesses. They also do not need to buy the equipment. The solution causes less environmental impact, as a large part of the material is reused.

9.10.4 Meyer Solutions in Printing Technologies

Meyer is a Brazilian company that operates in the B2B market and offers innovative and continuous solutions in print management. It offers the printing service, being responsible for the delivery and installation of equipment, maintenance with specialized technical support, delivery of parts and consumables, and removal of equipment. Instead of selling the printing equipment, the company provides customizable product rentals. This enables the best use of resources and operational security for customers (companies that need image processing, such as medical clinics).

By paying the usage fee, the customer has access to equipment that is always up to date and they do not need to worry about end of life of products. The provider earns loyalty when purchasing consumables.

9.10.5 Pay-Per-Lux—Philips

Philips has a business model whose value proposition is to keep the lighting of the place. Offering the product as a service, Philips is responsible for the entire lighting service, from the solution design, equipment installation, maintenance, and updates

during the service offering. Customers pay a fee for contracting the service and for the lighting consumed, and no longer for the purchase of light bulbs. At the end of the contract, the light bulbs can be returned to the production process. Raw materials are reused, optimizing recycling and reducing waste. The subway system in Washington (United States) was one of the first to adopt this model. This PSS is called by Philips as "light as a service".

This solution reduces the operating cost for the customer, who does not have to worry about having an associated team to purchase the light bulbs and electrical material. This solution minimizes the environmental impact as the provider uses optimized processes and products.

9.10.6 Vigga™

VIGGA™ is a Danish company operating in the textile industry. This company has clothing brands for babys, children and pregnant women. Instead of selling the clothes, the company provides the possibility of renting organic clothes for children and pregnant women in the right size. In this way, parents no longer need to buy different-sized of clothes for their growing children, avoiding the waste of resources and the generation of waste. The company is responsible for collecting used clothes and making a new use available for other children and pregnant women. For this, the company performs quality verification and washing of clothes. This circular solution saves mothers' time, money, and resources.

The customers have access to a greater number of options than they would have if they purchased the product. The product's life and usage are also extended to more than one customer. This tends to cause less environmental impact.

9.11 Final Considerations

The practical application of PSS does not follow the academic evolution. Although there are many initiatives by companies that wish to provide or are already providing PSS offers, there is still a predominance of companies that are structured under the logic of the traditional business model. The biggest barriers lie in the difficulty in financial justification and on the mindset focused on the product ownership paradigm, both from the perspective of the provider and the customer. PSS is a trend. At the same time, it is observed that it is not a "panacea" that will take companies to a new level of competitiveness.

Change management can assist in the incorporation of new skills, capabilities, and behaviors for individuals within the organization towards an integrated development, either internally or among other companies in the value chain. In addition, it is necessary to adopt a new approach to communication and engagement with customers, who are used to owning the products and not paying for the services.

We might highlight the importance of defining the value proposition, which encompasses the product and service offering and its potencial value. We should consider the co-creation of value between the provider and the customer as well as the entire articulation of the value chain. The value proposition needs to make clear the potential benefits for stakeholders and, in particular, for customers. The focus on value is reinforced in the early stages of developing a PSS. However, we should keep in mind that the real value of a PSS is perceived by stakeholders and not only by customers, especially in the design of a sustainable PSS, where law requirements, environmental factors, and communities should be considered.

In the detailed design, after defining the PSS architecture, it is possible to work separately on each of the technologies and elements of the PSS, such as on the hardware, software, on the electronic and mechanical components, specification of services, etc. But until reaching this stage, the PSS representation should integrate products, services and the necessary infrastructure. Logically, the actors and their responsibilities are part of this holistic view of PSS design.

The term "system" of the PSS should also be emphasized. It comprises the entire infrastructure and the value chain. As in many cases the co-creation of value between stakeholders occurs, the PSS design covers the specification of all organizations involved in the development process as well as the configuration of the integration between them. This requires new mindset for those who develop the offerings and a greater integration between the stakeholders in the value chain. We have to put ourselves in the "other's place". Empathy methods are essential in this process. In this context, service and design consultancy, calcutation of operational costs and ownership cost for customers, can be a great competitive advantage for those who offer PSS. The provider would also need to "design" the partners and customers' business models in order to distribute responsibilities and gains. After all, integrated development requires commitment and sharing of risks and benefits in the new ecosystem.

What about sustainability? This is an essential issue in developed countries and is starting to become the order of the day in developing countries. Although sustainable development is a need in the face of climate change and social impacts, the practice of sustainability in developing countries is still more due to international pressure, legislation, and society than to the mindset of the people involved in the servitization process. Once again, the importance of mindset evolution towards the development of a PSS that considers the environmental, social, and economic aspects is highlighted. The servitization/PSS approach is considered one of the strategies of the circular economy and of Life Cycle Engineering and Management.

There are several sustainable PSS initiatives, but this practice is not yet widespread. Even because PSS may cause a rebound effect from users who would not be interested in a lower environmental or social impact of a PSS offering, but who would be focused on the financial benefits and facilities provided. The rebound effect means that users of a PSS will be able to have more resources available, which can be used in activities that cause greater environmental impact. This can make new products purchased (and therefore with all related impacts) to worsen environmental

and social impacts. From the provider's point of view, in most cases, the financial perspective is still the basic condition for adopting the PSS.

An important aspect is to consider regional differences. The same servitization activities cannot be developed in developed countries, which generally have a consolidated manufacturing industry, and in developing countries, whose business capabilities may still be under development. Another factor is the difference between tax laws. We know of some PSS providers that do not use the term PSS because today they rent the equipment as a form of revenue. They say that if they called the business as PSS, they would risk paying taxes on services, which does not happen with rental model. These factors show the importance of offering flexible methodology, which can be adjusted for each case of servitization.

Being able to prototype the PSS in the early stages of development, especially services, is something that needs to be further investigated in order to support the PSS design. This fact is related to the intangibility of services. There are approaches that support product prototyping as a tangible asset. But efforts must be made to develop techniques that support the prototyping of services when integrated with products.

The challenge of achieving the economic viability of the PSS within a new, broader, and holistic logic should go through the definition of new assessment methods. Traditional methods of economic viability are not enough to support the decision of developing or not a PSS. More than that, in addition to the definition of the PSS economic value, it is also necessary to invest in methods which assess the intangible values that the PSS can provide to stakeholders. This assessement should be converted into quantifiable units that show how the benefits can impact the return for the business.

The digitization of manufacturing and products allows the monitoring of products throughout their life cycle, with an emphasis on the use/operation phase, which brings new challenges to the PSS design. Within the 4th Industrial Revolution, known as Industry 4.0, there are many concepts and technology offerings that can be used to develop and operationalize the PSS in a more interactive and intelligent way. During the development of a PSS, we should know the technological solutions that already exist in the market and how they can be used to add value to the stakeholders of a PSS. The use of data analysis (analytics) to know the behavioral pattern of customers and extract guidelines to guide new developments is an opportunity that is still little explored within the servitization context.

Incorporating new approaches proven in practice to PSS design is important to achieve synergy between the best management practices. Especially, incorporating this approach into life cycle management is primordial to achieve the expected benefits by causing the least possible environmental and social impacts, while ensuring financial health for the organizations involved along the value chain.

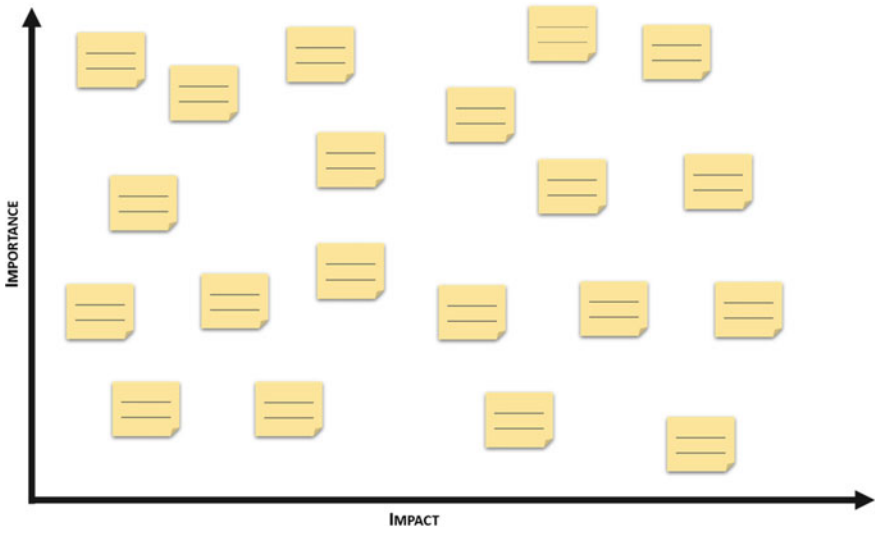
9.12 Proposed Exercises

Beta printers case: Beta is a Brazilian company that develops, manufactures, and sells different printers, including Beta Print H54. Beta Print H54 is a digital printer widely used by marketing agencies and photo stores. This printer accepts different types and sizes of paper. In addition to the machine, the company also offers maintenance and technical assistance services. Last year, Beta experienced an exponential drop in the sales numbers, and they keep dropping that has been repeating in the last months. The company' has carried out market research to understand what has been happening and received feedback from its customers:

- "The machine is expensive and has more features than we need"—freelance photographer;
- "Maintenance takes too long, and we lose customers while the machine is off"—photo-printing shop;
- "Maintenance is expensive"—marketing agency;
- "We love the machine. If it were not so expensive, we could have several machines and increase our sales. Sometimes, we are not able to serve all customers who come to us."
- "We already had a printer, but we had to sell it. Its maintenance was very costly. Currently, we outsource the printing service, which often lacks quality"—photographer.

Coincidentally, the new business manager has just participated in a product development conference on the theme "Product-service systems" and learned more about servitization. He gathered his team and decided to study the possibility of using Beta Print H54 as a basis to create a PSS. You are in charge of:

Exercise 1. Create a stakeholders map: Who would be the stakeholders in the servitization case of Beta Print H54? Think of everyone who somehow participates or influences the solution: customers, potential partners, regulatory agencies, users, etc. Use the model below and distribute the stakeholders according to their degree of importance and impact on the solution.



Feedback: Examples of possible stakeholders:

- Advertising agencies;
- Photographers;
- Photo studio
- Rival companies;
- Customers (photo buyers);
- Development partners

Exercise 2. Choose a stakeholder from the previous exercise and list her/his main problems, needs, and wishes related to photo printing. Then, imagine a solution that can solve those problems and meet those needs and wishes by integrating products and services.

Answer: e.g., Photographers.

- *problems: no money to buy the printing machine / pays too much for outsourcing the service;*
- *need: printing high-quality photo albums;*
- *wish: owning a photo printer;*

Solution: Service - Offering a photo-printing service for the photographer as a use-oriented PSS. The photographer pays a value proportional to the number of photos printed. You might need to add a membership fee or formulate a fixed monthly minimum contract. Maintenance services are under the provider's responsibility (BETA), who must guarantee high-quality printings for the photographer. Product - The printing machine should undergo modifications. It should become modular and customizable to fit each photographer's needs regarding paper type and size. In

addition, sensors and IoT technologies should be installed to control usage, allowing the provider to charge the customer properly.

Exercise 3. Based on the solution that you proposed in Exercise 2, describe the entire life cycle of the solution, considering sustainable alternatives.

Answer.

BOL: Sustainable development / robust product; Create mechanisms to increase usage and availability, and reduce maintenance needs; Develop IOT technologies.

MOL: Offer training for using the product; maintenance.

EOL: Take the product back from the customer after the end of the contract and redirect it to another customer. At the product's end of life, remanufacture it or look for alternatives for better disposal (for example, reuse in another sector, reuse of parts, etc.*).*

Exercise 4. Reflect which actions should be done during the solution development to ensure that the solution is environmentally sustainable throughout its life cycle.

Answer:

The proposed solution should include robust products, which use the minimum possible amount of raw materials. A sustainable solution should also use inks free of potentially hazardous solvent, print photos on recyclable paper, among others. The company must provide services that improve usability to avoid or reduce waste. Also, it is essential to reflect on the end of life, planning remanufacturing, reusing parts, recycling, etc.

Read the case description of the washing service for *Tex* industrial cleaning cloths to answer the three exercises below.

Tex—Industrial Cloth Management is a company that offers cleaning cloths for industries, printing plants, and repair shops. The service includes providing cleaning cloths, washing them after use, and replacing them with new ones whenever necessary. After using the cleaning cloths, the customers should deposit them in specific containers for dirty cloths. After certain periods (specified in the contract), *Tex* removes the dirty cleaning cloths, washes them, and returns them to the customers. Each cleaning cloth performs this cycle 50 times. Despite the low price of cleaning cloths on the market, their disposal costs have increased meaningfully, making *Tex*'s service an attractive alternative. *Tex* uses the most adequate solvents during the washing process, and the water is reused several times along the washing and drying stages. In addition, the oil in the wastewater is used to generate energy at the *Tex* plant. See the service cycle offered by *Tex* in Fig. 9.6.

Exercise 6. Make some commentaries about the business model that structures Tex's PSS. Classify this PSS and describe the case characteristics that justify your choice. Point out the benefits that this solution provides for the customers.

Fig. 9.6 Tex - industrial cloth management

Answer

The service offers greater value to the customer. In Tukker's (2004) *classification, this is a use-oriented PSS. The aspects that justify this answer are that the service provider provides clean cloths for industrial cleaning and is paid for the cleaning and disposal process of used cleaning cloths. The customer does not have to worry about washing or disposing of the cloths, besides always having clean cloths available for use.*

Exercise 7. Analyze the Tex case regarding the advantages of offering PSS over the product sale. Analyze the case from the social, environmental, and economic perspectives.

Answer

Environmental, economic, and social benefits.

Adequate solvents are used in the washing process, while water and energy are reused several times in the washing and drying stages. The residual oils from the washing water disposal are used to generate energy for the Tex plant.

In the case of selling cleaning cloths as a pure product, there would probably not be a concern about wastewater disposal in the washing process. Also, according to the description of the case, disposing of the cleaning cloths would be costly.

If the plant produces its own energy with the residual oils, it needs less or does not need external energy. The residual water is treated in the plant and can be discharged into the common sewer. The cloth washing system is circular.

Exercise 8. Describe the main benefits and barriers (for the provider) of implementing a PSS regarding the two previous cases.

Answer

Case	*Benefits*	*Barriers*
Beta Print H54	*Increase in the number of customers* *Recurring revenue* *Development of robust products* *Maintenance reduction* *Customers loyalty and trust*	*High investment in assets* *Big customers may want to keep the product ownership*
Tex - cleaning cloths industrial washing	*Reduced environmental impact* *Recurring revenue* *Energy production*	*High investment in the washing process infrastructure* *Buying cloths as pure products is cheap* *It requires strict environmental regulations for the disposal of dirty cloths*

Exercise 9. Product-service systems are great alternatives for reducing consumption and are often seen as sustainable alternatives. However, this premise is not always true. See the fictional case below in which resource consumption becomes higher than a product-selling-based business model.

> A telephone company sells communication services by building packages composed of a given amount of telephone calls, internet connection, and SMS texts. Those packages include a new smartphone being offered to the customers. This service is renewed every year, and a new cell phone is provided along, i.e., the customer subscribes to the communication service package and can change their smartphone for a new one yearly.

Describe the problem and suggest solutions based on the whole life cycle of the solution.

Answer

Problem: Changing the device every year increases consumption. If commercialization were in the purchase format, it would not occur since the cost to buy a new device is high.

Solution: Changing the smartphone at no cost when it stops working or charging a fee for the annual exchange — discouraging annual exchange. Another possibility is to keep this smartphone exchange model but reducing the monthly fees for customers with smartphones being used for extended periods (over 1-year-long).

Exercise 10. Based on your daily life, think about a problem that you have that could be solved with a PSS solution. Propose a solution, think about its value proposition, its business model, and its life cycle.

The activity can be carried out in groups. .

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