

Towards an amended Product-Service System typology

A conceptual and empirical research into the main elements of an amended Product-Service
Systems typology to classify Servitization Business Models

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Preface

In front of you lies the master thesis “Five Product-Service System orientations for Servitization Business Models”. This thesis is written as a completion of the master program in Strategic Management, a specialization of Business Administration at Radboud University in Nijmegen.

Selecting the subject turns out to have been easier than expected because I had encountered already different types of Product-Service Systems and Business Models several times during my study at the University of Applied Sciences (HBO). In contrast, the process of writing my thesis was more challenging for me, however, now I can say I am satisfied with the end result.

This preface offers a good opportunity to express my gratitude to the following people. First, I want to thank the supervisor of this master thesis, my mentor Prof. Dr. Jan Jonker, who helped me tremendously during the research and writing process. His adaptability to give me completely digital support during this research is admirable and I am convinced that he will be missed when he retires.

I would also like to thank my peers from university whom I met during two years of studying at the Radboud University in Nijmegen. Their help and company pulled me through hard times in the library full of study. Moreover, in the past two years, they challenged my ideas and beliefs, sometimes resulting in transforming them. I want to give special thanks to Stef van Bakel, who regularly provided this master thesis with feedback and went through it with me in order to achieve the best possible result.

Tom van der Heijden
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Abstract

Nowadays, services seem to dominate the business landscape, more and more companies want to offer services instead of, or in addition to, their product offerings. Adding services to a product to gain a competitive ground is a concept that is established as 'servitization'. The additional value of servitization is taken from multiple aspects which can be narrowed down into financial, strategic, marketing, and sustainable incentives.

This last incentive is gaining increasing support from a wide range of stakeholders, and sustainability is increasingly being imposed by law and regulation. Society as it is known is changing and people seem to attach less value to the ownership of goods, which has resulted in the concept of Product-Service System (PSS). The foundations for this concept come from Stahel (1982) which argued that not the product itself, but the performance should be sold, this idea is already known and presented as the functional, service, or performance economy. A PSS is the combination of tangible products and intangible services in order to fulfil the customers' needs.

Using the initial typology of Tukker (2004) in the form of a conceptualization of PSS, this research presents an amended PSS typology with three main elements. These elements are (1) the three spectra; product, PSS and service, (2) the PSS pathways and (3) the PSS orientations. The amended PSS typology is validated and illustrated through the insertion of Servitization Business Models, of which the definition is as follows; "A Servitization Business Model consists of a service-centric business model, in which multiple values are created due to implementing servitization." After validating the amended PSS typology, the following five PSS orientations are included: (1) integration oriented PSS, (2) product oriented PSS, (3) service oriented PSS, (4) use oriented PSS and (5) result oriented PSS. The amended PSS typology additionally introduces PSS pathways such as servitization, deservitization, servitization of products and productization of services within the conceptualization. Furthermore, it involves other spectrums, namely 'pure product' and 'pure service', besides the PSS spectrum in order to determine the position of PSS.

Keywords: Servitization, Functional Economy, Servitization Business Models, Business Models, Product-Service System, PSS

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1 Introduction

Society as we know it is changing in several ways. New generations have other wants and needs and more people are realizing that a change in the way we consume today is necessary (Jonker & Faber, 2015). The consumer society is transitioning, partly due to the increasing recognition for the need for a sustainable future (Cohen, 2014; IPCC, 2014; Stocker et al., 2013). As a result, several trends are emerging to propose a more sustainable future (Jonker & Faber, 2015). One of these trends is the transition from solely selling products, to delivering services both solely and as an addition to a product. This trend received increased recognition after an article from Vandermerwe and Rada (1988) and is called ‘servitization’. Servitization can be seen as the starting point for companies to involve more services into their products and involving products into their services. A concept that emerged from servitization, is called Product-Service Systems (PSS), which is the main focus of this master thesis.

1.1 Servitization

Services have been grown significantly; more and more people tend to use services instead of buying a certain good. For instance, the use of the service ‘public transport’ was playing an important role in replacing the private car (Wootton, 1999). According to Vandermerwe and Rada (1988), it is no longer valid to draw distinctions between products and services, they are developing into a combination of both. Also, they state that corporations throughout the world are adding value to their core product through the addition of services and presented the concept of ‘servitization’. Servitization is the combination of products and services, to add value and gain competitive ground (Baines, Lightfoot, Benedettini, & Kay, 2009; Doni, Corvino, & Bianchi Martini, 2019; Lightfoot, Baines, & Smart, 2013; Vandermerwe & Rada, 1988; Zhou, Yan, Zhao, & Guo, 2020). Previously, organizational leaders were not implementing services within their organization, partly due to the lack of knowledge, now they are encouraging their organizations to add services to their core business (Vandermerwe & Rada, 1988).

A variety of studies indicate that services contribute to higher sales while still providing better profit margins than selling goods (Baines & Lightfoot, 2015; Gebauer, Fleisch, & Friedli, 2005; Neely, 2008; Oliva & Kallenberg, 2003; Vandermerwe & Rada, 1988; Wise & Baumgartner, 1999). Other reasons for the transition to servitization in both manufacturers and service companies are; deregulation, technology improvement, and pressure from competitors (Vandermerwe & Rada, 1988). Organizations, wherever in the distribution chain, are focusing more on the end-user than before. Therefore, the driving force of servitization is the customer,

who is increasingly demanding services. However, customers do not want fewer products, they want services that help them with those products. A typical example is that 5 of the 8 big accounting firms in the UK, are calling themselves international business advisors. The others (3) call themselves accountants (Vandermerwe & Rada, 1988). This shows, that services are being added to help the customers with the initial products.

Due to servitization, an ongoing correspondence is created between the provider and the customer. In this way, several incentives and advantages are created. The first is the financial incentive, since services generally have higher profit margins and stability of income. Second is the strategic incentive, as the competitive advantage increases due to offering more value in the form of a 'full package'. Besides, servitization can be used for marketing purposes, which is the third incentive, since the provider can bond more with the customer and enter a longer and closer relationship (Baines et al., 2009). Apart from using servitization to add value to the organization, there are also suggestions that this can enhance sustainability. Therefore, a fourth incentive can be added, namely the environmental incentive (Neely, 2008). Doni et al. (2019) conclude that servitization could make the production system more sustainable, and the study confirms the fact that repair and maintenance services are extending the product life. In this way it actually can reduce the environmental impact (Brouillat, 2009; Doni et al., 2019). For this reason, servitization and its associated systems are often connected to 'sustainability'.

All of the above considered, it can be concluded that servitization brings ideas for a new kind of economy to the table, which may, or may not be the starting point towards a more sustainable society.

1.2 The functional economy

Stahel (1982) already stated that the current economy is too linear, where he recognized the need to close the loop. After this research, several new economies are presented, for example the ones that Jonker and Faber (2015) summed up in what they call the 'WEconomy'. The WEconomy is the label they give to six trends and one wildcard which are: the circular economy, the functional economy, the bio-based economy, the collaborative economy, the sharing economy, the self-production or 3D economy and the last, which is more of a wildcard; the Internet of Things (IOT). Although these economies all have the potential to enhance sustainability, Jonker and Faber (2015) made clear that their origin cannot be linked to sustainability. Moreover, Jonker and Faber (2015) described the trends (economies) as highly intermingled. Thus, the sharing economy is often referred to as the collaborative economy, even

though they are not entirely the same. One of the economies they describe is the functional economy, which is, according to the research of Stahel (1997), considerably more sustainable than the present economy.

The functional economy is “one that optimizes the use (or function) of goods and services and thus the management of existing wealth (goods, knowledge, and nature)” (Stahel, 1997, p. 1).

Within this economy, the objective will become “to create the highest possible use value for the longest possible time while consuming as few as material and resources as possible” (Stahel, 1997, p. 1). As the functional economy is selling the function of goods, instead of the ownership of goods, they combine the product with a service so that customers can use the goods in return for a fee.

The functional economy is the next step of providing the previously discussed concept servitization, since services not only are being added to organizations, this will become their main activity. Therefore, the functional economy is often referred to as the service economy (Mont, 2002), since the service economy focuses on the optimization of the utilization, and thus the performance, of goods (Stahel, 1998). For this reason, both the service economy and functional economy is often called the performance economy (Jonker & Faber, 2015). Within the functional economy, the products that can no longer serve their function, will be remanufactured and dismantled. This is because the products remain in the possession of the manufacturer. Also, in this way a financial incentive is created for the manufacturer as they ensure that their product last longer. Moreover, manufacturers know what resources are used in the goods and thus are more able to remanufacture them than other individuals. This could result in less waste, and thus the functional economy could be a sustainable economy (Stahel, 1997).

1.3 Product-Service Systems

Stahel (1998) took ‘servitization’ one step further and presented a concept which proposed to sell the performance of goods instead of the ownership of goods. In this way, the liability for waste stays within the organization instead of transitioning it to the customer, which could enhance the efficient use of waste within the lifecycle of a product. The idea to sell the performance of goods instead of the ownership of goods is the ancestor of Product-Service Systems (hereafter called PSS). The first definition given is the following: “[A PSS] is a marketable set of products and services capable of jointly fulfilling a user’s need.” (Goedkoop, Van Halen, Te Riele, & Rommens, 1999, p. 18).

Although several researchers acknowledged this as the general definition for PSS (Baines et al., 2007; Beuren, Gomes Ferreira, & Cauchick Miguel, 2013; Corvellec & Stål, 2017; Hernandez, 2019a; Mont, 2002), some have given their own interpretation to this concept. Manzini and Vezzoli (2003) mention PSS as an innovative strategy, while Baines et al. (2007) call it a special case of servitization. However, one study acknowledged the definition given by Goedkoop et al. (1999), and decided to elaborate this into the following definition; “A PSS can be defined as consisting of tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific customer needs” (Tukker, 2004, p. 1).

As Goedkoop et al. (1999) already mentioned, the extent to which the product and service components are present, varies from case-to-case. Hence, they state that the ecological potential of the PSS should be judged case by case. Although the myth that PSS equals sustainability is disproved, it is commonly known and agreed that PSS has the potential to enhance sustainability (Mont, 2002; Tukker & Tischner, 2006). This could be the reason that PSS and servitization are gaining attention and ground within the practical (business) field. The conceptualization of Tukker (2004) makes a distinction between several categories, which are distinguished by the extent to which the product and/or service components are present. These are product-oriented PSS, use-oriented PSS and result-oriented PSS, and have eight underlying archetypes, which subdivide the PSS orientations. Going from left to right, more services are applied in the organization, which, according to Baines et al. (2009) is called servitization. The PSS typology of Tukker (2004) is elaborated in-depth in chapter three.

Although PSS and servitization is regularly connected to the functional economy, it can be connected to other economies as well, such as the circular economy (Henry, Bauwens, Hekkert, & Kirchherr, 2020). The possibilities of the concept therefore are present in all kinds of economies, which makes them applicable in several ways. Also, applying the PSS to different economies provide multiple perspectives where more different interpretations and business models are possible.

Nowadays, several organizations have applied and are applying PSS in their business models. Although the eight archetypical PSS types were good starting points, a variety of new Product-Service Systems, business models, and concepts are emerging. For that matter, the typology of Tukker (2004) is a conceptual one, which is not elaborated to specific business models from the today's economy.

1.4 Business models

The fact that Business Models (BM) mostly are outlined superficially in PSS related literature (Beuren et al., 2013; Reim, Parida, & Örtqvist, 2015), is remarkable since BM is such an old concept within the organizational literature (Ferdinand, 1954). Literature concerning BM has seen a tremendous rise over the past 30 years, with more than a thousand publications per year for over the last 15 years (Zott, Amit, & Massa, 2011). As more studies are describing BM, several forms of BM definitions arise, even though the essence is often the same. In fact, in most definitions of BM value creation is one of the core concepts, if not the core concept. It mostly states that value creation is needed within a BM in order to have a reason for existence (Casadesus-Masanell & Ricart, 2010; Lüdeke-Freund, 2010; Magretta, 2002; Osterwalder, Pigneur, & Tucci, 2005; Teece, 2010; Zott et al., 2011).

According to Geissdoerfer, Savaget, Bocken, and Hultink (2017), the traditional, linear business model is an unsustainable approach to the consumption and production of goods. This is where multiple value creation (MVC) comes into play, a concept where the connection is being made between monetary (or economic) value and social and ecological value (Jonker, 2012). As current business models face great challenges in integrating MVC into their BM, the concept of New Business Models (NBM) is proposed, focusing on the creation of multiple value (Jonker, 2012, 2016; Jonker & Faber, 2015; Jonker & van der Linden, 2013). Implementing 'servitization' as described earlier into the BM (either BM in general or NBM) will be referred to as a Servitization Business Model, which is the focus within this master thesis when it comes to BM.

1.5 PSS, Business models and their overlap

This master thesis describes both PSS and BM. There are many studies that use these concepts as synonyms (e.g. Gaiardelli, Resta, Martinez, Pinto, & Albores, 2014; Hernandez, 2019b; Reim et al., 2015; Tukker, 2004). The degree to which PSS and BM are the same, or differ from each other, is not further explained in many of these studies. Some other studies do point to the differences and similarities between the two concepts. The study of Evans et al. (2017) is one of them, this study indicates that PSS is a system that help a BM become more sustainable, and thus that PSS enables a BM to undergo an innovation towards a more sustainable BM.

In contrast to PSS, BM is considered to be a larger whole and an all-embracing concept when it comes to the characterization of an organization. A PSS has a smaller scope, as it is a collective term for an applicable system to interpret the BM building blocks by combining

products with services, or the other way around. This is confirmed by Barquet, Cunha, Oliveira, and Rozenfeld (2011), which state that PSS is a system rather than a kind of BM and argue that a BM makes use of a PSS instead of being an interchangeable synonym. In addition to this, Barquet et al. (2011) identify specific requirements and present PSS as a certain embodiment of the specific BM building blocks of Osterwalder and Pigneur (2010).

As shown in Figure 1, the overlap of PSS in BM is significant, whereas the interpretation of the BM building blocks is seen as the overlap. The two circles indicate the differences between the concepts, and the size of the circles indicate the influence they have on each other. As already stated, BM is larger and more comprehensive than the PSS concept. However, the concept of PSS involves more than just the application in BM, this will be explained later.

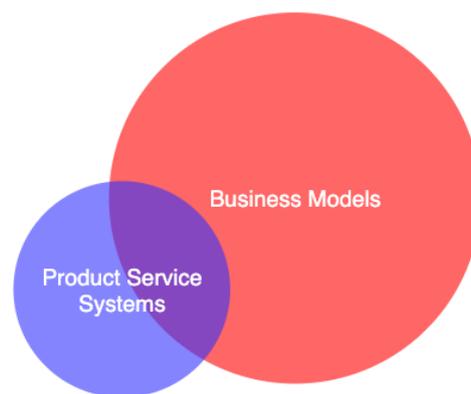


Figure 1 - PSS vs Business Models

Along with Evans et al. (2017) and Barquet et al. (2011), other studies agree that a PSS is indeed something different than a BM. They argue that PSS is an integration, input, option or important element of a BM (Kim, 2020; Neely, 2008; Van Ostaeyen, 2014; Van Ostaeyen, Van Horenbeek, Pintelon, & Duflou, 2013). A BM dives in deeper into the elements of an organization as an accumulation of nine building blocks that together form a BM (Osterwalder & Pigneur, 2010). However, a BM entails several building blocks and is more a collection to identify what an organization exactly does, than just a system that an organization uses.

All in all, it can be concluded that both concepts have a lot to do with each other, but the concepts are certainly not interchangeable. PSS can be used to raise BM to a higher sustainability level and BM's are used to make PSS applicable. The overlap of both concepts lies in the PSS interpretation of BM building blocks.

1.6 Problem statement (Research Gap)

Nowadays, services are beginning to dominate the world, organizational leaders are encouraging their employees to adapt services to gain more value and competitive ground (Vandermerwe & Rada, 1988). In addition, the European Union is currently increasingly introducing a so-called Extended Producer Responsibility (EPR) on several product groups. This regulation makes producers responsible for their products for a longer period of time, which is ensuring regulatory authorities that a boost is given to the sorting, reuse and recycling of raw materials (European Commission, 2014, 2020). Therefore, several business models and systems are discovered and implemented. One of them, will be the focus point of this master thesis. The Product-Service System, which is an important system within the functional economy (Jonker & Faber, 2015), is conceptualized by Tukker (2004). This conceptualization has gained increased interest in the research field in the past 15 years and made a large contribution to the academic literature about the combination of products with services. The idea of Product-Service Systems is embraced, and more and more organizations tend to adopt this into their business model. However, although several systematic literature reviews have been conducted on PSS (Beuren et al., 2013; Mont & Tukker, 2006; Tukker, 2015; Tukker & Tischner, 2006), there is none that applies it in a revised conceptualization that includes servitization business models from the practical field. The state of play has to be drawn up in order to achieve a revised conceptualization of PSS Tukker (2004) and close this gap in the literature. To empower this revised conceptualization and increase its robustness, it needs to be validated and worked out with servitization business models from practice.

1.7 Objective and Research Question

The central concept in this master thesis is 'Product-Service Systems', which is abbreviated to PSS. Based on various developments in society, such as sustainability, extended product responsibility and the shifting of consumer wishes and needs, this concept is receiving more and more attention. The conceptualization of Tukker (2004) visualized the possibilities within the PSS concept, it received support from several studies and is now being used as a starting point for this research. This master thesis is explorative in nature and will use the extended literature review to propose an amended PSS typology. To validate and increase the robustness of the amended PSS typology, two concepts are merged; Product-Service Systems (PSS) and Servitization Business Models (SBM). Hence, the objective of this master thesis is to propose

an amended PSS typology. In order to achieve this objective, the following main research question is formulated:

What are the main elements of an amended Product-Service Systems typology enabling it to classify Servitization Business Models?

The main research question is supported by the following sub-question:

How can an amended Product-Service Systems typology be used to classify Servitization Business Models?

1.7.1 Typology development

The typology which is presented by Tukker (2004) as a conceptualization of PSS is the starting point of this master thesis. This will be elaborated and analyzed thoroughly to, in the end, create an amended typology including empirical cases. Hence, the end result gives an amended typology of PSS, which in its form is similar to the conceptualization of Tukker (2004). The state of play of PSS, is used to create a revised conceptualization. Therefore, the last step in the literature study, synthesizing the gathered literature, is done by making a typology of the central concept. A typology is ‘the classification of observations in terms of their attributes on two or more variables’ (Babbie, 2019, p. 179). The concept of typologies is closely related to taxonomy concepts. Taxonomies are presented list-wise and show the concepts along a continuous scale. This makes that the concepts presented can be listed in order. Typologies, on the other hand, separate a set of items by conceptualizing it in a multidimensional way. Typologies basically are multidimensional taxonomies (Meredith, 1993; Smith, 2002). Also, typologies present concepts rather than empirical cases, which is the case at taxonomies (Smith, 2002). However, in this master thesis empirical cases are added for verification and illustration of the amended PSS typology. This is elaborated further in chapter four, where the methodology of this research is described.

1.7.2 Scientific Relevance

After the conceptualization of Tukker (2004), a lot of attention was devoted to PSS and this typology is recognized more and more every year. Given that this conceptualization was released in 2004, it has lasted for 15 years. Therefore, it is unclear to what extent this typology still obtains scientific ground. It is worthwhile to map out the criticisms the conceptualization received and the developments it has gone through in recent years. Therefore, this master thesis identifies various criticisms and developments surrounding the entire PSS concept with the

focus on the three key concepts; business models, value creation and servitization. These criticisms and developments are used to revise the existing conceptualization and both update and upgrade the typology. Furthermore, PSS literature is often linked to the ‘business models’ concept. Unfortunately, this connection is most of the times superficial (Beuren et al., 2013; Reim et al., 2015). Therefore, the PSS, as presented by Tukker (2004), is merged with servitization business models in this master thesis in order to connect the two widespread concepts with each other. This research can therefore be a starting point for future research which are studying PSS and business models.

1.7.3 Practical Relevance

The PSS conceptualization, which is the starting point for this master thesis, has made servitization more applicable in practice and easier to classify. The rising demand of sustainable and circular solutions in the organizational context have increased the extend of servitization in the practical field with as a result, business models to adapt PSS in their organization. Since there is little to none research done to connect PSS with business models, this research is going to contribute interlinking the two main concepts of the master thesis. PSS, together with servitization, helps the practical field to create a more sustainable and circular organization. Therefore, several new forms of PSS have been introduced, which have not yet been included in the conceptualization of Tukker (2004). The extended literature review performed in this master thesis not only elaborates the conceptualization from Tukker (2004) into an amended PSS typology, it makes it easier for the practical field to set the PSS typology to their hand and fill in their business model. For that reason, the result of this research not only serves as a tool for companies to identify, orient, and apply (more) servitization business models in the organization, it also makes it easier for them to contribute to sustainability by implementing more servitization business models within their organization.

1.8 Thesis outline

This thesis will answer the research question by means of seven chapters. In this chapter, chapter one, the introduction to this research is given. The main concepts of this master thesis are presented, and the cause and relevance of the problem is described, this includes how the problem is framed within literature and what the objective and research question for this research are.

Next, the concept Servitization Business Models is being elaborated. In chapter two answers are given to what SBM are, how they work and what their essence is. To do so, first a thorough definition of Business Models in general is clarified. Also, the characteristics of SBM are given, what is done in order to give an answer to the sub-question of this master thesis.

In the third chapter, the PSS conceptualization of Tukker (2004) is specified into depth. The development of Product-Service System over the past couple years in literature is mapped out and elaborated on in the form of criticisms and developments of the PSS conceptualization of Tukker (2004). The conclusion of this chapter is presented into an amended Product-Service Systems typology.

The fourth chapter describes the research methodology. Here, the objective, method and research design are described, the way data analysis is performed is explained as well as the reliability, validity and integrity. This chapter is completed with the limitations for this research.

Chapter five contains the research analysis and the interpretation of the results. The illustrative cases are analyzed here Based on the cases described, the results are presented and interpreted in the next chapter.

The chapter thereafter, chapter six, synthesizes the illustrative cases into a summarized overview which is used to fill in the cases into the amended PSS typology. Moreover, it describes the findings of the data analysis of chapter five and presents the reflections and limitations of the amended PSS typology. This chapter lays the foundations for the conclusions and discussion, followed in the next chapter.

Chapter seven gives the overall conclusion of this master thesis by giving an answer to the main research question, along with the sub-question. This chapter also contains the discussion, where reflections and limitations are described and suggestions for further research are given.

2 Business Models

This section discusses the theoretical background of business models. It covers the central definitions and form the body of knowledge to define the concept and associated characteristics. The main goal of this chapter is to give a thorough definition of the concept ‘Servitization Business Models’ (SBM), in order to answer the sub-question: ‘How can an amended Product-Service Systems typology be used to classify Servitization Business Models?’. To define SBM, this chapter will start with a clarification of business models in general and point out the most important elements of the business model according to literature. Next, the concept of value creation is discussed, as this is highly critical in a business model. Elaborating on value creation, multiple value creation is defined and described. Further on, the concept ‘new business models’ is described, to describe Servitization Business Models thereafter. This last paragraph is answering the central question in this chapter.

2.1 Business Models

The concept of business models has been used for many years in both academical and non-academical literature (Zott et al., 2011). This section will focus on the academic literature on business models. The first notion was received from Ferdinand (1954), after which it has evolved in different definitions and forms. In business model-related literature, several researchers agree that there is no generally accepted definition (Johnson, Christensen, & Kagermann, 2008; Linder & Cantrell, 2000; Magretta, 2002; Osterwalder et al., 2005; Stubbs & Cocklin, 2008). Therefore, many of them have altered existing definitions and formulated their own. The result is that many definitions are circulating, that do not differ very much from each other. For example, Magretta (2002) defines business models as stories that explain how organizations work, while Amit and Zott (2001, p. 19) describe business models as "the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities". Others argue that business models are "the heuristic logic that connects technical potential with the realization of economic value" (Chesbrough & Rosenbloom, 2002, p. 1). Moreover, Johnson et al. (2008, p. 52) state that business models "consist of four interlocking elements (customer value proposition, profit formula, key resources and key processes), that, taken together, create and deliver value". And even more, Casadesus-Masanell and Ricart (2010, p. 196) formulate business models as “the logic of the firm, the way it operates and how it creates value for its stakeholders”. They claim that the business model addresses two fundamental issues which are combined about how an

organization earns money. These two fundamental issues are; how it identifies and creates value for customers and how it captures some of this value as its profit in the process. Also, Zott et al. (2011, p. 42) describe business models as “a system of interconnected and interdependent activities that determine the way the company does business with its customers, partners, and vendors”.

One of the most dominant and widely accepted conceptualizations of business models is created by Osterwalder and Pigneur (2010). They define a business model as one that “describes the rationale of how an organization creates, delivers and captures value” (p. 14). The created conceptualization is called the ‘business model canvas’. Here, they defined nine building blocks which are used to describe a business model: key partners, key activities, key resources, value proposition, customer relationships, channels, customer segments, cost structure, and revenue streams.

2.1.1 Business models and Business strategy

The concepts business models and (business) strategy are often used interchangeably. However, multiple studies describe the difference between these two. Many of them agree that although these concepts have a lot to do with each other, they are certainly not the same (Casadesus-Masanell & Ricart, 2010; Magretta, 2002; Osterwalder et al., 2005; Teece, 2010). Business models describe how the parts of an organization relate to each other in a systematic way. And therefore, business models are used to describe and present all aspects of what an organization is. An organization’s strategy, on the other hand, shows how a company competes with its competitors (Magretta, 2002). The business model can therefore be seen as “a reflection of a firm’s realized strategy” (Casadesus-Masanell & Ricart, 2010, p. 205), where the business model is the direct result of the strategy. The business model is more comprehensive than a business strategy, but to make a thorough analysis of an organizations competitive advantage, it has to combine both the business model and the business strategy (Teece, 2010). Therefore, the strategy does not need to be described in depth in order to evaluate the added value of an organization. However, because of the high level of interconnectedness, it is advisable to also briefly clarify the strategy of an organization.

2.1.2 Service-centric business models

Business models come in different shapes and sizes. A great deal of the literature on business models is of organizational origin, as is this research as well. However, there are two types of

business models, namely product-centric and service-centric business models (Parida, Sjödin, Wincent, & Kohtamäki, 2014). It is important to make this distinction, as this research will mainly focus on service-centric business models. The two business models are distinguished in table 1, shown underneath. This table is derived from the goods-centered and service-centered dominant logics presented by Vargo and Lusch (2004, table 2). This study argued that these two logics were ‘views’, where one is focused on the sale of products and the other is more about services. They defined services as “the application of specialized competences through deeds, processes and performance for the benefit of another entity or the entity itself” (Vargo & Lusch, 2004, p. 2). These are consistent with the description of Parida et al. (2014); product-centered and service-centered business models.

	Product-centric business model	Service-centric business model
Primary unit of exchange	Goods/Products	Services
Role of goods	Goods are resources and end products	Goods are transmitters that are used as appliances in the value-creation processes
Role of customer	Recipient of goods	Coproducer of service
Determination and meaning of value	Value determined by the producer embedded in terms of “exchange-value”	Value perceived and determined by the consumer on the basis of “value-in-use”
Firm-customer interaction	Customer are acted on to create transactions with resources	Customers are active participants in relational exchanges and coproduction
Source of economic growth	Wealth is obtained from surplus tangible resources and goods. Wealth exists of owning, controlling and producing	Wealth is obtained through the application and exchange of specialized knowledge and skills. It represents the right to the future use of the goods

*Table 1 - Product-centric versus Service-centric business models
Source: adapted from Vargo and Lusch (2004)*

Since this master thesis’ central concept is PSS in combination with servitization business models, this research will mainly focus on the service-centric business models. Therefore, the business models proposed should have at least one aspect of a service included in the business model.

For the purpose of this study, a few main themes are distinguished in order to create a thorough theoretical framework for the business models for servitization. These themes are; value creation (including multiple value creation), new business models, and Servitization Business Models. Which are described in next sections.

2.2 Value creation

The concept at the heart of almost all business model research is ‘value creation’ or ‘added value’. As such, value creation is a concept which is studied in a substantial amount of academic papers. As part of the concept of value creation, the concept of value is being studied.

Several authors have tried to define value and the value of resources. Barney (1991, p. 105) states that a resource is valuable when it ‘exploits opportunities and/or neutralizes threats in a firm’s environment’ and they ‘enable a firm to conceive of or implement strategies that improve its efficiency and effectiveness’. Others distinguish value into use value and exchange value, where use value ‘refers to the specific qualities of the product perceived by customers in relations to their needs and exchange value refers to the price (Bowman & Ambrosini, 2000, p. 3). Haksever, Chaganti, and Cook (2004) define value as “the capacity of a good, service or activity to satisfy a need or provide a benefit to a person or legal entity.” According to them, this definition is broader than the traditional definitions in literature, since it includes any type of good, service or act that satisfies a need. This last definition from Haksever et al. (2004) is therefore more applicable in this study, because this research also focuses on more than just products or just services. Moreover, this definition shows value as the fulfillment of a need or benefit, which is the fundamental idea to apply a PSS, as is explained in the next chapter.

Since ‘value’ is defined, now the concept ‘value creation’ is being elaborated. This concept is defined by Bowman and Ambrosini (2000) as a process where the ‘use value’ and ‘exchange value’ is realized. They argue that it is not possible to create ‘use value’, it is only possible to transform it. This can be done by actions of organizational members, since they combine ‘use values’ to transform them into a ‘new use value’. However, a more applicable definition of value creation for this study is given by Lepak, Smith, and Taylor (2007, p. 182), who define value creation as “the relative amount of value that is subjectively realized by a target user (or buyer) who is the focus of value creation—whether individual, organization, or society—and that this subjective value realization must at least translate into the user’s willingness to exchange a monetary amount for the value received”.

Within the traditional system maximizing shareholder value is the main objective for the organization. This system is characterized as the neoclassical economic worldview, where social and environmental goals come second after creating economic value (Stubbs & Cocklin, 2008). The role of organizations to maximize profits is changing into a more sustainable approach where social and environmental objectives stand alongside the goal of creating economic value (Lüdeke-Freund, Massa, Bocken, Brent, & Musango, 2016; Stubbs & Cocklin, 2008). Companies now have a more extensive role in society, where stakeholders are getting increasingly involved into the value creation process. This is being elaborated in the concept of multiple value creation (Jonker, 2012; Simanis & Hart, 2011), which is explained further in the next section.

2.2.1 Multiple value creation

The kind of value creation which is linked to business models that emphasize on generating a more sustainable value is referred to as multiple value creation. Multiple value creation integrates social and ecological value with economic value (Jonker, 2012). This concept is sometimes referred to as collaborative value creation, which, according to Austin and Seitanidi (2012) enhances four types of value creation. The first type is ‘associational value’, where collaboration with another company creates value. Second, the ‘transferred resource value’ creates value by the receipt of a resource from a partner. Thirdly, ‘interaction value’ revolves about the value that can be derived from processes that are used to cooperate with partners. Fourth and last is the ‘synergistic value’, this value is based on the idea that both sides achieve better collaboratively in a relationship than they might have done individually (Austin & Seitanidi, 2012). Multiple value creation in this master thesis, is about the integration of both social and ecological value with the economic value, as is proposed by Jonker (2012).

In contrast to the traditional system, where the customer is at ‘the end’ of the value chain, in multiple value creation the customer has a participating role in value creation (Simanis & Hart, 2011). Once putting the idea of multiple value creation into business practice, organizational difficulties occur as efforts are made at the same time to create various sources of value. Mainly since the secret to multiple value creation is the finding of a balance between consumption and usage, thus inevitably balancing value destruction and value creation. There are more and more examples where multiple value creation was the core idea of an organization, where at a later point the goal was overshoot. Think of Airbnb or Uber, where the business model initially

seemed to make vacant apartments or cars more accessible. But over time, only the shareholders' needs were met (Jonker, 2016).

Nowadays existing business models sometimes struggle to establish multiple value creation, partly due to the value of sustainability, which is mostly not expressed in terms of money (Jonker, 2012). However, it is not impossible, since there are already a few cases where multiple value creation has been successfully applied by, for example, reusing production components or second-use or new technologies (Slowak & Regenfelder, 2017). The core of these initiatives is to create multiple value. The problem is that the financial value (the profit) of the company ultimately determines the organization's reason of existence (Jonker, 2016). In other words, the current business cannot implement multiple value creation in their businesses. Therefore, new business models are being developed with 'multiple value creation' in mind, which will be described in the next paragraph.

2.3 New business models

In this section, the concept of 'new business models' is described to enable Servitization Business Models to be defined. New business models (hereafter NBM) in this master thesis, are defined as business models which focus on multiple value creation, rather than focus on the monetary value creation. The traditional business models are centered on transactional thinking based on earning money, which results in *take-make-waste* production models (Lacy & Rutqvist, 2016). To get a clear overview of the differences between traditional business models and NBMs, table 2 underneath distinguishes the NBM from the traditional business model.

Building blocks	Traditional business model	New business model
Value creation	Mostly financial (economic)	Multiple; social, ecological and economic
Economy	Linear ('traditional') economy	Circular economy, closing the loop
Ownership	Possession of goods	Access to (the utilization of) goods
Value chain	Intensive involvement of every actor in the value chain except the end-user	The end-user is central in the value chain
Transaction	Financial based; monetary	Based on multiple forms of exchange

*Table 2 - Important differences of NBMs
Source: adapted from Jonker (2012)*

As mentioned, according to Jonker (2012) multiple value creation is the combination of social, ecological and economic value. Elkington (1998) proposed that the combination of social, ecological and economic aspects refer to sustainability. For that reason, in this master thesis, NBM are seen as a ‘sustainable business models’. Within the concept of NBM, several categories and subcategories occur. This means that NBM are not one of a kind and appear in several forms.

When applying multiple value creation, servitization is useful. The four incentives of servitization, proposed by Baines et al. (2009), contribute to the integration of social, ecological and economic value. The financial incentive, generating more sales and higher revenues, is an economic value. Establishing a longer and closer relationship, the marketing incentive, is linked to the social value. Moreover, the environmental incentive is linked to the environmental value through the suggestion of sustainability that servitization provides.

Examples of NBM which achieved multiple value creation by applying servitization are sharing-, platform- and product-as-a-service business models which all focus more on the utilization of the product than the possession of it (Jonker, 2016). Throughout the next paragraph, a definition for Servitization Business Models along with its characteristics is given.

2.4 Servitization Business models

After noticing that current business models cannot meet multiple value creation, and new business models are a wide-ranging concept, this section is dedicated to describing a kind of new business model, namely ‘Servitization Business Model’ (hereafter SBM). As the name says, SBM refers to the implementation of servitization into a business model. Thus, the first characteristic of SBM stated within this master thesis is the implementation of servitization in the business model. As defined earlier, servitization is ‘the combination of products and services, to add value and gain competitive ground’ (e.g. Baines et al., 2009; Lightfoot et al., 2013; Neely, 2008; Vandermerwe & Rada, 1988). Hence, SBM is a business model which combined products and services to add value and gain competitive ground. Concluded is that SBM is a spin-off of the NBMs. For that reason, multiple value creation is an important aspect of SBM which therefore is another characteristic of SBM. In addition, it can be concluded that when goods are just transmitters that are used as appliances in the value creation process, the business model is service-centric. Therefore, an SBM also is service-centric rather than product-centric. Putting this together, the following definition of an SBM is formulated: A Servitization

Business Model is a service centric business model, where multiple value is created due to the combination of products and services to add value and gain competitive ground.

One of the most important aspects when it comes to business models for servitization tends to be the servitization paradox. This paradox refers to implementing servitization in your organization, which results in decreased performance (Kastalli & Van Looy, 2013; Palo, Åkesson, & Löfberg, 2019). Numerous researches have been extending the work on paradoxes concerning servitization. One of the most recent studies noticed that many businesses come into the servitization paradox because they try to transform the initial business model. However, implementing servitization into an organization should not be about transforming your business model, but about managing both business models parallel. Which is fully in line with Perona, Saccani, and Bacchetti (2017), whom state that it is sometimes better to use multiple business models side by side within a company. Furthermore, implementing servitization into the organization should be done bottom-up, instead of top-down. Reason for this is the fact that the bottom has more customer contact, and therefore are more familiar with the actual wants and needs of the customers (Palo et al., 2019). If we combine these two aspects, it sounds logical that the former business model will not be divested until the performance of the Servitization Business Model is adequate.

3 Product-Service Systems

After reviewing business models and defining Servitization Business Models in chapter two, this section is dedicated to defining and elaborating the central concept of this master thesis; Product-Service Systems (PSS). To do so, this section is divided in several paragraphs. First, the key elements of PSS will be defined, in order to give the definition of PSS in general. Next, the PSS conceptualization of Tukker (2004) is described, which can be seen as the starting point of this research. Subsequently, different perspectives are examined which describe developments and criticisms concerning PSS. To conclude, the state of play of PSS is described in the last paragraph which contains an amended PSS typology.

3.1 Product-Service Systems defined

The conceptualization of Tukker (2004) transformed the definition of Goedkoop et al. (1999) into a conceptual whole with three main categories and eight archetypical PSS business models. Several authors find this conceptualization the most appropriate method to represent the PSS perspectives (Aurich, Mannweiler, & Schweitzer, 2010; Beuren et al., 2013; Geum & Park, 2010; Sakao, Panshef, & Dörsam, 2009). For this reason, the conceptualization of Tukker (2004) is being used as a starting point in this research. PSS helps businesses in three ways to establish new sources of added value and competitiveness. Namely through building unique relationships with clients, faster innovation and using an integrated and customized way to fulfil the clients need. Fundamentally all due to the closer relationship between the client and the organization which a PSS establishes.

In order to ensure a general understanding of the fundamental elements of PSS, they are briefly defined in table 3.

Term	Definition
<i>Product</i>	“A tangible commodity manufactured to be sold. Capable of fulfilling a user’s need”
<i>Service</i>	“An activity (work) done for others with an economic value and often done on a commercial basis.”
<i>System</i>	“A collection of elements including their relations”
<i>Product system</i>	“A set of material products needed to jointly fulfil a user’s need”

*Table 3 - Fundamental Definitions of PSS
Source: Goedkoop et al. (1999, p. 17)*

The definition of PSS given is the following: “A PSS can be defined as consisting of tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific customer needs” (Tukker, 2004, p. 1). Tukker (2004) classifies PSS into three

main categories (product-, use-, and result-oriented services), each of which contains several archetypes. These are further explained in the next sections.

3.1.1 Product-oriented services

The first main category is product-oriented services. Here, the business model is still mainly oriented to product selling, but some additional services are added. In this category, two archetypical business models are presented; (1) product related service and (2) advice and consultancy. Product related service refers to a business model where additional services are offered besides the products, which are needed during the use of products, for instance repair and maintenance contracts. The ‘advice and consultancy’ archetype is proposed as a business model where the product seller also gives advice in how to use the product, like the placement of solar panels, where the salesmen also give advice where to place them for maximum utilization.

3.1.2 Use-oriented services

Use-oriented services is the second main category proposed, which enhances business models where the traditional product plays a central role, however, they are not geared towards selling these products. In this category, the product remains in ownership of the provider. The provider makes the product available in a different form, which sometimes means that the product is being shared by a number of users. The archetypes in this category are; (3) product lease, (4) product renting or sharing and (5) product pooling. Product lease refers to the business model where the user of the product pays a regular fee for the use of the product. The consumer has unlimited access to the leased product. Repair and maintenance costs are for the owner of the product, which is the provider of the leased product. In the fourth archetype, product renting or sharing, the product also remains owned by the provider. Just as product lease, the user pays a regular fee for the use of the product, however, the main difference is that the user does not have unlimited and individual access to the product. The product is thus used sequentially by different users. This is also the main difference with the fifth archetype; product pooling. This archetype is similar to product renting or sharing. The products remain in possession of the provider, and the main difference with the other two archetypes is that users are using the product simultaneously.

3.1.3 Result-oriented services

According to Tukker (2004), the third category; result-oriented services, have the unique ability to help overcome all sorts of environmental incentives. These incentives have led the EU to invest extensively in the development of PSS (Tukker, 2004). This category is characterized by the fact that the provider and the client only agree on the result, the means to come to this result are not documented. Thus, there is no agreement about which product should be involved to come to the result. (6) Activity management/outsourcing, (7) pay per service unit and (8) functional result are the archetypes which fall into this category. In the sixth archetype, activity management/outsourcing, part of an activity is being outsourced to a third party. As most outsourcing contracts set performance indicators to monitor quality requirements, this archetype is one of the result-oriented services. Think of catering or cleaning services at an organization’s office. Archetype number seven concerns pay per service unit. Here, the customer does not pay for the product, only the output of the product is being bought. Think of Product-as-a-Service business models, such as Light as a Service from Philips, Tire-as-a-Service from Michelin Solutions (Lacy & Rutqvist, 2016) or the pay-per-copy formula from Xerox (Baines & Lightfoot, 2015). The last archetype, functional result, is one where the delivery of a result is the agreement made between provider and client. Unlike activity management/outsourcing, in this archetype the provider is completely free of how to deliver the result. The typical example presented is the delivery of a specified ‘pleasant climate’ rather than heating or cooling equipment.

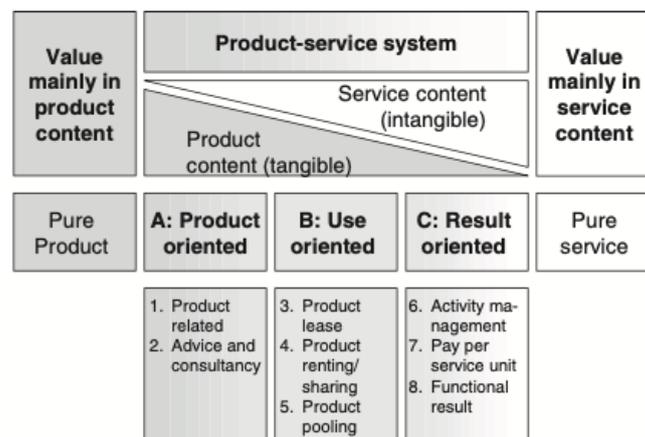


Figure 2 - Main and subcategories of PSS (Tukker, 2004)

The conceptualization shown in figure 2 should be interpreted as follows: the left side is purely product, where the main value is within the product. On the other side, the value is mainly in the service, which indicates a pure service. Moving from the first to the last archetype of this PSS conceptualization (from left to right), the dependence on a product as a core component reduces. Moving this way in the conceptualization, the organization gains freedom in the way

they fulfill the need of the customer. The value will become more in the service content and the ‘thing’ will become more intermingled with services. For this reason, this process is called servitization (of products) (Baines et al., 2007; Beuren et al., 2013; Fernandes, Pigosso, McAloone, & Rozenfeld, 2020; Kim, 2020; Kowalkowski, Gebauer, Kamp, & Parry, 2017; Li, Kumar, Claes, & Found, 2020; Neely, 2008; Raddats, Kowalkowski, Benedettini, Burton, & Gebauer, 2019; Reim et al., 2015).

3.2 Elaborating the PSS conceptualization

Although the conceptualization described above has been accepted by several authors, in the years after the conceptualization (Tukker, 2004), many studies elaborated on the conceptualization. Over 2072 articles cite the typology of Tukker (2004) (Google Citation Index, 2020), as can be seen in figure 3: Distribution of citing Tukker (2004) since 2007. Moreover, the figure shows that there is a growing trend acknowledging and using the work of Tukker (2004).

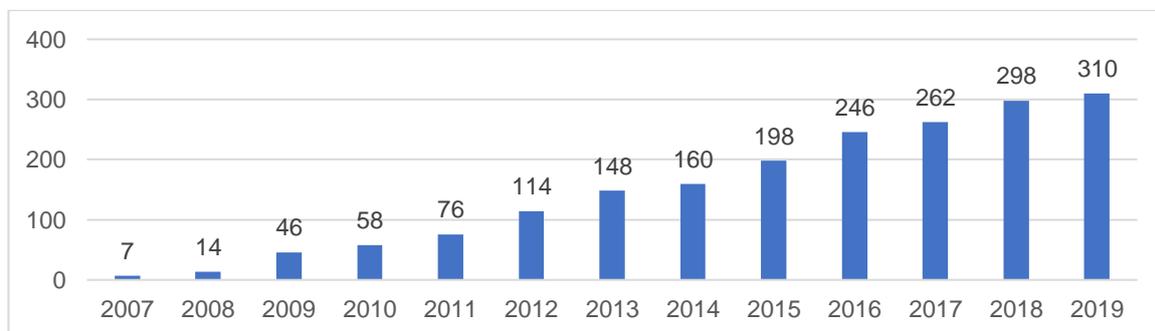


Figure 3 – Distribution of citing Tukker (2004) since 2007

Source: Google Citation Index (2020)

Within the diverse set of phenomena arising from this conceptualization, this section addresses three key concepts which are considered reviewing the literature regarding PSS conceptualization; (1) Servitization, (2) Business models and (3) Value content. This stems from the previous chapters, where more attention has been paid to these key concepts. Also, since several researchers have given their own interpretation to the PSS concepts, one section is devoted to synthesizing the different terms used to describe PSS.

3.2.1 Servitization

The transition from product systems towards PSS, and maybe eventually pure services, is called servitization. According to Baines et al. (2007), this leads to a shift from ‘sale of product’ towards a ‘sale of use’. Therefore, servitization is not only a concept within the emergence of

PSS, it is a course that can be followed towards a PSS. Unfortunately, servitization is not mentioned by Tukker (2004), which shows a gap in its typology. Baines et al. (2007), on the other hand, state that PSS is a special case of servitization and propose this as a pathway towards PSS. The conceptualization of Baines et al. (2007) is showed in figure 4. This conceptualization introduces two ways to come to the PSS, by the productization of services, or by the servitization of products. Productization of services refers to the introduction of physical products in certain services in order to be able to offer a combination of the two. In contrast, servitization of products assigns services to a physical product, thus doing the opposite of productization of services for the same purpose of combining products and services. The pathways towards a PSS of Baines et al. (2007) gave names to two approaches which can lead to PSS. Tukker (2004) did not include either one of these pathways, neither other pathways. Nevertheless, pathways should be included to get the whole picture. Thus, the pathways presented here are a good addition to the typology of Tukker (2004).

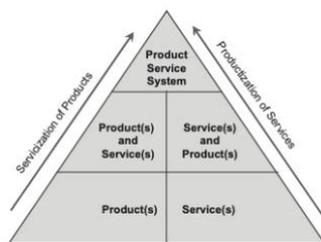


Figure 4 - Pathways towards a PSS (Baines et al., 2007)

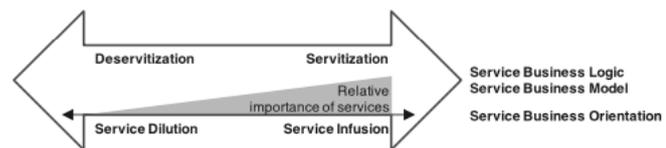


Figure 5 - Service growth and reduction processes (Kowalkowski et al., 2017)

Furthermore, Kowalkowski et al. (2017) have zoomed in on servitization by presenting an opposite direction called 'deservitization'. Deservitization happens when a company decides to apply service dilution rather than service infusion. Service dilution refers to the reduction of services within their organization. Reasons to do this could be that services become uneconomical in for example a price-competitive market. Service infusion is the opposite of this spectrum, when a company increases services in their organization. It is important to show both directions in the 'servitization' continuum to get a comprehensive overview of the pathways. Moreover, these pathways can help to interpret the typology and see the servitization-rate (the amount of servitization an organization is applying). Therefore, the 'Service growth and reduction processes' which is shown in figure 5 is a good extension of the servitization-pathway shown in 'pathways towards a PSS'. For this matter it can be stated that Tukker (2004) has not included an important aspect in this typology; servitization.

In addition, it can be seen from the literature that there is no constitution when it comes to different terms. As this section shows, the term servitization is used to refer to different things, even though they are interrelated. Therefore, the following section is used to add a key concept; terminology.

3.2.2 PSS Terminology

The typology by Tukker (2004) proposes three main categories of PSS (product-, use- and result-oriented), yet later studies suggest more or different categories. Within the diverse set of terms arising regarding PSS categorization, this section is devoted overcoming these differences. For example, Baines and Lightfoot (2015) talk about base, advanced and intermediate services rather than function-, use-, and result-oriented services (Tukker, 2004). Meier, Roy, and Seliger (2010) also showed other terms (function-, availability- and result-oriented) to refer to different PSS categories. Function-oriented business models refer to after sales services such as field service, spare part business and customer training. The initiative of this orientation is on the customers side. Availability-oriented business models are more insurance-like services where service contracts are present which focus on remote service solutions (also educational measure towards condition-based maintenance). However, the result-oriented business model in this case is the same as the PSS category from the typology of Tukker (2004). This orientation refers to only getting paid to for the output. Neely (2008) argues that there are five options for servitization. The typology of Tukker (2004) has some similar PSS options, but calls them categories. Some of them overlap, but these are bringing new options to the table. Other researchers are suggesting input-based, availability-based, usage-based and performance-based mechanisms as an addition to the typology from Tukker (2004); (Van Ostaeyen et al., 2013). Parida et al. (2014), on the other hand, propose four categories within their PSS typology, that they present as ‘business model categories’ and connected them to the categories presented by Tukker (2004). The table shown below (table 4), provides an overview of the terminologies evolved out of Tukker (2004).

Categories	Source
1. Product-oriented PSS 2. Use-oriented PSS 3. Result-oriented PSS	<i>Tukker (2004)</i>
1. Integration-oriented PSS 2. Product-oriented PSS 3. Service-oriented PSS 4. Use-oriented PSS 5. Result-oriented PSS	<i>Neely (2008)</i>
1. Function-/Product-oriented model 2. Use-/Availability-oriented model	<i>Aurich et al. (2010)</i>

3. Result-oriented model	
1. Function oriented PSS	
2. Availability oriented PSS	<i>Meier et al. (2010)</i>
3. Result oriented PSS	
1. Add-on customer services	
2. Maintenance and product support services	<i>Parida et al. (2014)</i>
3. R&D-oriented services	
4. Functional and operational services	
1. Base services	
2. Intermediate services	<i>Baines and Lightfoot (2015)</i>
3. Advanced services	

Table 4 - Terminologies of PSS categories

Many of the terms used in PSS literature relate to each other or mean (almost) the same thing. Since this master's thesis takes the PSS typology from Tukker (2004) as its starting point, the terms used in this conceptualization will be leading. However, product-oriented PSS is a PSS category that has been studied quite thoroughly. Hence, the addition from Neely (2008) shows more subdivided categories and therefore, is more thorough than the categories from Tukker (2004). The typology of Neely (2008) is similar to Tukker (2004) for the use-oriented and result-oriented PSS. The difference is made in the subdivision of the product-oriented PSS. Neely (2008) subdivided the product-oriented PSS known by Tukker (2004) into; integration oriented PSS (products plus services), product oriented PSS (additional services to the product, such as installation or maintenance and support services) and service oriented PSS (services added to the product itself, for example Vehicle Management tools) (Neely, 2008, p. 107).

In conclusion, this paragraph shows us two concerns. First, that the pathways; servitization, deservitization, servitization of products and productization of services, are missing in the conceptualization of Tukker (2004). This means that the PSS typology from Tukker (2004) is not sophisticated enough, and open to own interpretation when it comes to pathways to follow. In addition, the typology from Tukker (2004) can be extended when it comes to PSS orientations. The latter can be done by extending the product-orientated PSS as Neely (2008) did.

3.2.3 Business models

Business models and PSS are regularly connected in the past few years. This is done both for validation and illustration purposes. However, it is important to point out that most of the business model literature originated from organizational literature which is mainly aimed at transition business models. These are business models where the central concept is the transition from a product into (mostly monetary) value. However, PSS addresses the business models in another perspective, namely service-centric business model as is discussed in paragraph 2.1.2.

The service-centric business model creates value for the customer through services. This makes that the focus of the products that are involved, is the function, utilization or performance of the product.

Going further, the PSS conceptualization mentions the eight archetypes as ‘business models’ (Tukker, 2004), without elaborating on the concept of business models in this typology. Moreover, although these 'business models' are described as specific PSS types, they are not fully exclusive. Within the PSS orientation that Tukker (2004) proposes, several other PSS types could take place, which has not been described as a constraint for this research. Other researchers are proposing criteria to subdivide the PSS categories of Tukker (2004) into several individual business models (Aurich et al., 2010) or have a more differentiated PSS categorization, which leads into business models (Parida et al., 2014). Many of the research on PSS refers to business models. Yet, in most literature the concept of business models is used superficially (Beuren et al., 2013; Reim et al., 2015). This not only shows a gap in literature, but also presents the gap in the several PSS typologies, including the one from Tukker (2004).

It is remarkable to see that many of the PSS typologies assume that the PSS types (or categories), which they propose, always fit with existing business models. Although filling in the PSS typology with business models is useful to illustrate and validate the typology, it is important to mention that this is only as an example, or by way of illustration. Assuming that new business models emerge on a regular basis, it would be better to develop a typology that makes it possible to fill in several kinds of business models. Now, most of the typologies just list a few, and leave almost no space for additions.

In some evolutions of PSS, business models are proposed that can contribute to the original conceptualization. Meier et al. (2010) introduced ‘industrial PSS’ which specified the PSS to deliver value in industrial applications, while focusing on business-to-business applications and business models for the PSS. But still, business models are just superficially mentioned. In addition, other literature proposes some criteria which can help to subdivide the PSS models into several individual business models. The PSS models mentioned here, are function-/product-, use-/availability- and result-based PSS. Criteria presented are; (1) Ownership of product, (2) Operational personnel, (3) Maintenance personnel, (4) Location of manufacturing facility, (5) Payment methods and (6) Delivery of raw materials and supplies (Aurich et al., 2010). Remarkably, only a few business models are subdivided by these criteria. The criteria in this typology, however, show that more combinations are possible. And can therefore help to fill in the PSS typology with business models.

The four business model categories which are proposed by Parida et al. (2014) shows that business models can be misunderstood. In this research, business models are discussed, but are giving what other researchers call main PSS categories. However, the business models that are assessed are Servitization Business Models, as defined in the previous chapter. For now, the following paragraph describes value content, which can be used to classify the SBM.

3.2.4 Value content

Within business models one concept is characterized as the center, namely value. Value is also a reoccurring term within the PSS typologies. One of the most noteworthy studies showed the added sustainable value of a PSS by Yang and Evans (2019). They showed for each PSS type, three values; economic, environmental and social value, and included the combinations of the values, which they then transformed into a conceptualization with several sustainability-slices within the PSS categories. This is supported by a multiple case-study, which includes three Chinese organizations that have activities within all the PSS categories. Although the presented values can be used as a starting point to add to the typology, the study aims to sustainability values, and therefore is insufficient. Other research distinguish three central sets of processes as values; value co-creation and relationship management, value co-production and innovation, and value appropriation and productivity (Rabetino, Kohtamäki, & Gebauer, 2017). However, the term value referred to in this study is more about the creation of value than about the content of the value.

Parida et al. (2014) describe financial value and argue that simple add-on services (function-oriented services) are not offering enough financial impact on the company revenues. According to them, advanced services such as maintenance, R&D support and functional services (use-oriented or result-oriented services) do have higher financial value. However, it is important to note that in the research of Parida et al. (2014) only financial value is being discussed, whereas value is much broader. As described in paragraph 2.2.1, new business models are more focused on multiple value creation instead of the traditional system of value creation. Other researchers talk about value co-creation and value creation for the customer (e.g. Lewandowski, 2016; Rabetino et al., 2017; Reim et al., 2015).

In this master thesis, the concept of value is added to review the extent to which a service or product is present. Therefore, it is examined whether the value content is more in the service or in the product. This is derived from Tukker (2004), who already added these two value contents in this typology. However, this typology only superficially added these two value contents,

without using them as a mechanism. While the value contents could properly be used to classify the Servitization Business Model into the amended PSS typology.

3.3 Dimensions for the amended PSS typology

Currently, more and more academic literature is being published on PSS. It can be concluded that literature about PSS is not like-minded and terminology is not merged. Many researchers are presenting PSS models, archetypes, options or business models but there is no agreement about what they are exactly presenting and how this relates. This research focuses on three aspects within the PSS spectrum, namely; (1) servitization, (2) business models and (3) value content. One aspect has been added; terminology, which describes the different terms used to indicate similar categories. This chapter is created to get an overview of different angles and synthesize them together. Considering these aspects, the following conclusions can be stated;

A major missing in the typology of the initial PSS conceptualization is to add pathways. These pathways involve servitization, deservitization, servitization of products and productization of services. There is a possibility that companies that do not follow pathways and start their business in the middle of the PSS conceptualization. However, it is worth indicating which pathways are followed or can be followed in order to strengthen the typology.

Besides, the product-oriented PSS as proposed by Tukker (2004), can be divided in order to make a better distinction between them. In recent years, this PSS orientation (and form of servitization) has been researched, which has resulted in distinctive categories. This can certainly add significant value to an amended PSS typology. In addition, a thorough operationalization of the types would help to classify the business models in the typology. Therefore, ownership, payment rational and product- and service-content should be explained in the different PSS types.

Talking about PSS business models it has been noticed that a lot of literature is written that connects PSS with business models. Unfortunately, this only happens in a superficial way. What is surprising is that many authors refer to PSS business models and proposing them, not mentioning that these are just examples. It is presented in such a way that it seems that each business model fits into one of the proposed PSS business models, whereas this does not necessarily have to be the case. Moreover, new business models are being invented regularly which makes it almost impossible to keep the PSS typology up to date. The above points can be listed in a 'wish list' of what should be amended to the typology of Tukker (2004). To present this in an understandable way, the points are shown as dimensions in table 5 on the next page.

	Dimensions	Meaning	Source
1	Pure product vs Pure service	<i>Showing where in the PSS spectrum each extremity can be placed</i>	<i>Tukker (2004)</i>
2	Types of PSS: 1. Integration oriented PSS 2. Product oriented PSS 3. Service oriented PSS 4. Use oriented PSS 5. Result oriented PSS	<i>Distinguishing between different types to make the PSS conceptualization clear</i>	<i>Neely (2008)</i>
3	Servitization of Products vs Productization of Services	<i>Introducing the pathways within the PSS frame</i>	<i>(Baines et al., 2007)</i>
4	Servitization vs Deservitization	<i>Pathways to follow when applying service infusion or service dilution (which goes beyond the PSS frame)</i>	<i>(Kowalkowski et al., 2017)</i>

Table 5 - Dimensions for an amended PSS typology

Bearing the dimensions shown in the table above in mind, the typology from Tukker (2004) needs to be revised, since several new models and archetypes arose from both science and practice. The conclusions of this chapter described above, are synthesized into an amended typology which is described in the following section.

3.4 An amended PSS typology

The theoretical framework provided in chapter two and three of this master thesis has given conclusions of business models and PSS. The conclusions given are now synthesized into an amended PSS typology, which is presented below in figure 6. The amended typology should be clear at a glance, nevertheless the way how it should be interpreted is explained below.

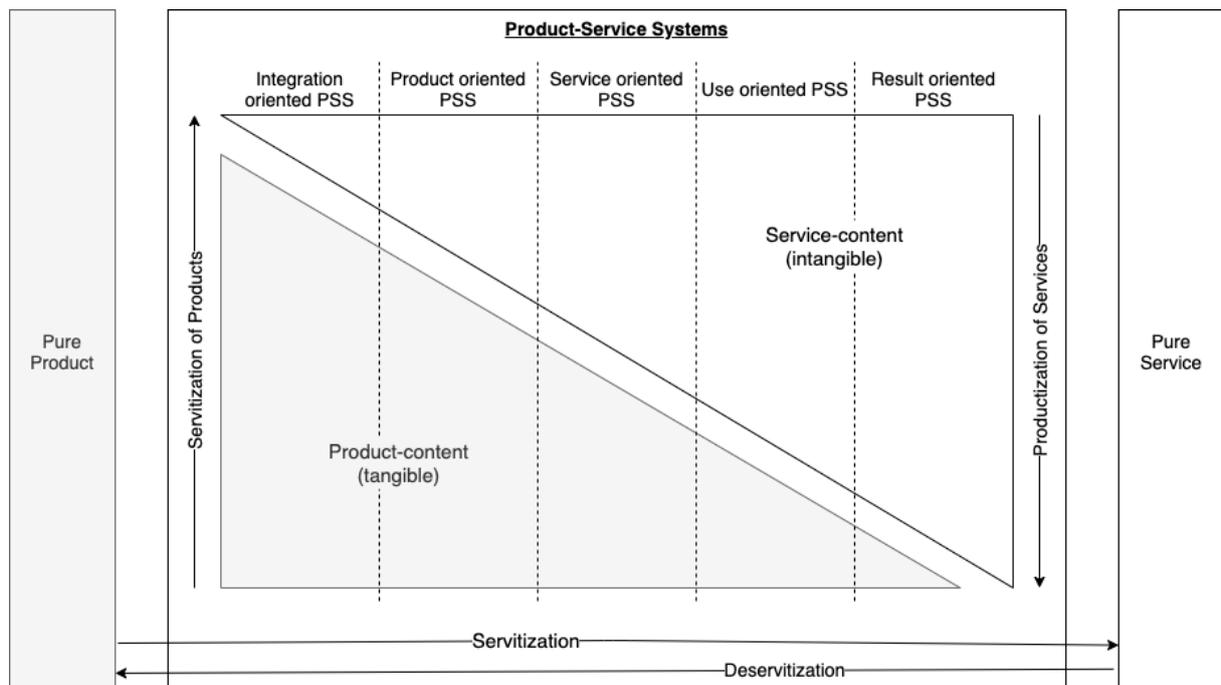


Figure 6 - Amended PSS typology

Source: adapted from Tukker (2004), with additions (Baines et al., 2007; Kowalkowski et al., 2017; Neely, 2008).

The amended PSS typology contains three spectrums. These spectrums are; pure product, PSS and pure services. The two extremes in this typology are 'pure product' and 'pure service'. These are shown in the typology to make the pathways clear and to show on which side of the PSS spectrum they should be placed. When going from a pure product to a pure service, servitization is applied. Doing so, you come across different PSS types. The extent to which the service is present determines which PSS type the business model in question falls into. When this happens the other way around, from a pure service transitioning to a pure product, this is called deservitization. PSS is located between pure products and pure services. In the PSS spectrum, services and products are displayed in a combined manner. This shows that a PSS is a combination of both products and services (tangible and intangible respectively). The different PSS types are distinguished by the dotted lines, which make it clear to what extent the product or service is present. Furthermore, the placement of the PSS orientations showed whether it is closer to a pure product or a pure service. The following PSS types are included in the PSS typology:

1. **Integration oriented PSS:** “products plus services”, adding services through vertical integration. Think of financial services, consulting services and courier services. You pay on production and pay extra for services that do not entirely, per se, are related to the product. Ownership of a tangible product is in this option transferred to the customer.
2. **Product oriented PSS:** additional services directly related to the product are provided, think of installation, implementation, maintenance and support services. Here, payment is made on production and additional services which are related to the product. In this option, ownership still is transferred to the customer.
3. **Service oriented PSS:** incorporation of services into the product itself. Ownership still is transferred, but services are offered to add value to the product. In this option the product is coupled with a service. And therefore, payment on production is still the case, however, the amount you pay may be increased due to the added value of services.
4. **Use oriented PSS:** this type shifts the focus to services, which is delivered through a certain product. Within this option, the ownership is often retained at the provider. The service provider sells the function of the product, via modified distribution and payment systems such as sharing, pooling and leasing. In this type, the customer pays for availability.

5. **Result oriented PSS:** a PSS type which tries to replace the product with a service. Products can be involved, but ownership is retained by the provider. The customer pays for a solution. In this way, the need for a product is reduced.

Several authors proposed PSS archetypes or subcategories for the PSS typology. This conceptualization, in contrast, does not include any kind of subdivisions as seen in other research. Reason for this is that the subdivisions can create confusion. The amended PSS typology contains the main lines that come with a PSS. The most important aspects are included, without giving examples. In this way, no misunderstanding about ‘business models’ can be developed. On the other hand, it is very thought-provoking to fill the typology out with business models for example by means of illustrative cases. In that way, it becomes clear how the amended PSS typology should be used.

In addition to the amended PSS typology, table 6 below is presented. This theoretical overview is a table presenting an overview of the dimensions of the amended PSS typology.

	Dimensions	Attributes	Meaning	Source(s)
1	Value content	Value mainly in product-content or service-content	<i>This shows to what extent both parts of the Product-Service Systems are present</i>	<i>Tukker (2004)</i>
2	PSS orientation	Types of PSS: 1. Integration oriented PSS 2. Product oriented PSS 3. Service oriented PSS 4. Use oriented PSS 5. Result oriented PSS	<i>Shows which type of PSS has been applied</i>	<i>Neely (2008)</i>
3	PSS Pathway (internal)	Servitization of Products vs Productization of Services	<i>Presents which pathway appears to have been followed within the PSS spectrum</i>	<i>(Baines et al., 2007)</i>
4	PSS Pathway (cross-bordered)	Servitization vs Deservitization	<i>Demonstrates which pathways have been followed outside (and through) the PSS spectrum</i>	<i>(Kowalkowski et al., 2017)</i>
5	Market orientation	Business to Business (B2B) vs Business to Consumer (B2C)	<i>Shows what kind of customers the business focuses on</i>	<i>(Schor & Fitzmaurice, 2015)</i>

Table 6 – Dimensions of the amended PSS typology

The dimensions of the amended PSS typology, shown in table 6, can be used to see which dimensions appear in the amended PSS typology as well as giving tools to fill it in with, for example, Servitization Business Models.

3.4.1 Reflection and Limitations of the amended PSS typology

Despite the systematic literature review that was used to thoroughly revise the PSS conceptualization from Tukker (2004), there are still limitations with respect to the amended PSS typology proposed. These limitations are described here, alongside with a reflection on the process of the literature review.

The first limitation to appoint is the mutual exclusivity limitation. Since multiple BM can be used next to each other, and these depend on the case in question, overlap may occur. Some cases may find themselves in a grey area, where it is not possible to classify them in one PSS orientation alone. In addition, the decision to adopt the PSS orientations proposed by Neely (2008) can also be a limitation. On the one hand because of the division of the product oriented PSS into three orientations can lead to confusion, since one of the three orientations is called 'product oriented'. On the other hand, by abandoning the alternative terms, which are listed in section 3.2.2.

The amended PSS typology only gives an indication of the PSS orientations and the corresponding dimensions, it is not a thorough overview that covers all aspects. There are no specific attributes to classify the orientations and only two pathways are cited before including them in the amended typology. The amended PSS typology therefore does not show how to classify the PSS orientation at hand and how the pathways should be followed. It shows that there has been servitized, but not to what extent. Moreover, the usage of the terms 'service-content' and 'product-content' within the amended PSS typology can be interpreted wrong. One can think that a result oriented PSS cannot consist of a product for the predominant part, and an integration oriented PSS cannot consist of a service for the larger part. However, this is possible since these two contents as well as the other dimensions within this amended PSS typology are only indicative.

The elaboration of the PSS typology of Tukker (2004) in this chapter results into an amended PSS typology, which is proposed in 3.5. While the amended PSS typology is based on a thorough systematic literature study, the robustness is not yet addressed with empirical comparisons. In chapter 5, this will be done to validate the proposed amended PSS typology, and to increase its robustness.

4 Methodology

This chapter elaborates the methodology used for this master thesis. It starts with the purpose of this research described as the research objective, followed by the specification of the research method where both the literature study and illustrative case analysis is specified. Next, a description of the research design is given. Subsequently, the method for data analysis, which involves both the identification and the analysis of the illustrative case analysis is explained. After that, the reliability, validity, and integrity of the research is being evaluated. Lastly, the limitations that come with this research are presented and discussed.

4.1 Research objective

The research conducted in this master thesis results in an amended typology of PSS which is developed on the basis of the conceptualization of Tukker (2004). To increase the robustness and validity of the amended PSS typology, it is filled in with Servitization Business Models (SBM). For that reason, this master thesis includes illustrative cases in the form of these Servitization Business Models which help to illustrate and validate the PSS orientations proposed. Also, the amended PSS typology should be able to be used to classify Servitization Business Models. In this master thesis, the existing literature is reviewed in order to map out the criticisms and developments concerning the PSS typology of Tukker (2004). Inserting the illustrative cases in the amended PSS typology also represents how the amended PSS typology could be used and validates the amended PSS typology. Using the SBM to validate and illustrate the amended PSS, a connection is made between SBM and PSS. The proposed PSS orientations within the amended PSS typology are identified and validated, together with the PSS pathways presented, which together validate the overall amended PSS typology. To meet the research objective as described above, the following main research question is formulated;

What are the main elements of an amended Product-Service Systems typology enabling it to classify Servitization Business Models?

This main research question is supported by the following sub-question:

How can an amended Product-Service Systems typology be used to classify Servitization Business Models?

4.2 Research method

In order to carry out this research, a systematic literature study is performed to develop a typology, in the form of an amended PSS typology. The next step in this explorative research is to validate and illustrate the amended PSS typology using illustrative cases. Hence, in the following paragraph the research method used will be examined in more detail, starting with a systematic study of existing literature. After that, the illustrative cases will be further explained.

4.2.1 Literature study

The study of literature can be characterized as a systematic way of investigating existing literature while justifying what you are doing (Fink, 2014). This is used to evaluate and synthesize the existing literature on business models and PSS. To do so, there are four characteristic words that this research should comply with: systematic, explicit, comprehensive and reproducible (Fink, 2014). The literature study is performed as a systematic review to minimize bias. The systematic review is ‘a review of a clearly formulated question that uses systematic and explicit methods to identify, select and critically appraise relevant research, and to collect and analyze data from the studies that are included in the review’ (Siddaway, 2014, p. 1). The two main aims of the literature review are (1) identifying patterns while summarizing the existing research, and (2) identify the conceptual content of the PSS related literature (Meredith, 1993). This last one is contributed by the development of a typology. The conclusion offered by the literature review contains the state of play of the PSS typology from Tukker (2004) in the form of an amended PSS typology, which is presented in paragraph 3.5.

4.2.2 Illustrative cases

Since the amended PSS typology is a conceptual one, which is based on purely theoretical literature, illustrative cases are used to validate and illustrate the theoretical model. The illustrative cases are carefully selected from academic and non-academic literature to increase the reliability. Furthermore, the methods used to do the illustrative case analysis inspired by methods used by a case-study as described by Yin (2018), the analysis will focus only on the PSS application within the organization, so multiple cases can be selected. During the selection of the cases, the diversity and richness of the cases are monitored to increase the validity (Yin, 2018). Although the aim is to do so, this does not guarantee the reliability and validity of a real case study such as one which Yin (2018) describes. The exact analysis of the illustrative cases will be explained in detail in paragraph 4.4 data analysis where the measurement tool of this

master thesis, the dimensions for analyzing the illustrative cases, is described as an adequate and representative set of items that exploits the concept (Sekaran & Bougie, 2016).

4.3 Research Design

In order to achieve the goal of this research to propose an amended PSS typology, a twofold approach is used. First, specify the fundamental concepts of both PSS and Business Models, by means of an extended literature review. Academic articles and books which are published between 1997-2020 are studied in order to give a thorough description of these key concepts in chapters two and three. In addition, chapter three presents an amended PSS typology, after which the second approach follows; an illustrative case analysis. The illustrative cases are collected and analyzed by means of business documents and (news) articles, which are accessed online. The cases act as an illustrative example of the studied literature.

4.4 Data analysis

The data used in this master thesis is secondary research material in the form of literature regarding PSS. Within this dataset, a distinction is made between academic and non-academic literature. In this section we talk about the data analysis of the illustrative cases. First of all, possible cases will have to be identified and selected, this is described in the first part. Described thereafter is how the randomly selected cases, and thus the data, will be analyzed.

4.4.1 Identification and selection of illustrative cases

Before analyzing the illustrative cases, first a selection must be made of what illustrative cases are. The selection of the illustrative cases is done in two steps. The first step is to make a long list of cases that meet the description of both Servitization Business Models and PSS as defined in chapter two and three. Thus, the cases selected should have business models which have the three characteristics of a Servitization Business Model; service-centric, servitization implemented and striving for multiple value creation. Also, the cases should use PSS in their business model. Thus, the organizations have to combine products and services to gain a competitive advantage.

The next step is to filter the longlist through seven criteria, in the form of statements. An overview of these criteria can be found in appendix A. If the case passes all statements, the case is applying PSS in their servitization business model, and more importantly, the organization is still in business and still applying the PSS. Also, the case has sufficient amounts of secondary research material available to conduct a thorough case analysis. The last statement; “The case’s

business model can be classified into one of the PSS orientations of the amended PSS typology” may be overruled, since it then shows that the amended PSS typology is not covering all grounds within the PSS spectrum. In addition, it is important that the secondary data that can be found about the case is either in English or Dutch. Due to the limited time available, this research will focus on Dutch cases only. The longlist can be found in appendix B. In the end, 10 cases are selected which can be found in appendix C originating from both academic and non-academic literature. The cases are found by using search engine Google and by snowballing.

4.4.2 Analysis method for illustrative cases

After identifying cases and randomly selecting the illustrative cases, they are analyzed for validating and illustrating the theoretical amended PSS typology. The data collected to analyze the illustrative cases is only secondary data, which results in poor data quality. To analyze the illustrative cases, table six, which presented the dimensions for the amended PSS typology is transformed into a methodological scheme. The methodological scheme is shown below in table seven. Analyzing the illustrative cases, this scheme is used and filled in, in order to eventually fill in the amended PSS typology.

	Dimensions	Attributes	Parameter(s)
1	Value content	Value mainly in product-content vs Value mainly in service-content	<i>Extent to which product- or service-content enhances the value of the PSS</i>
2	PSS orientation	Types of PSS: 1. Integration oriented PSS 2. Product oriented PSS 3. Service oriented PSS 4. Use oriented PSS 5. Result oriented PSS	<i>Distinguish the illustrative case and try to classify it to one of the five types of PSS</i>
3	PSS Pathway (internal)	Servitization of Products vs Productization of Services	<i>Products made into services vs Services made into products</i>
4	PSS Pathway (cross-bordered)	Servitization vs Deservitization	<i>Infusion of services vs Dilution of services</i>
5	Market orientation	Business to Business (B2B) vs Business to Consumer (B2C)	<i>Business focuses on businesses vs Business focuses on consumers</i>

Table 7 - Dimensions for the illustrative case analysis

The selected cases are each analyzed using the table presented above. The table contains the analyze dimensions and what they say about the case in question. The purpose of the analysis is to determine whether the amended PSS typology needs to be adjusted in order to achieve a more comprehensive PSS typology. Also, the illustrative cases show how to imply and use the amended PSS typology and if it can be used to classify Servitization Business Models (SBM).

4.5 Reliability, Validity and Integrity

This section describes the extent to which this research is reliable, the level of validity and the way in which the integrity of this research is maintained.

The reliability of a study shows whether the study is stable and consistent over time. It gives an indication of the study still shows the same results when performed again (Sekaran & Bougie, 2016). In this study, a systematic use of the analysis method as presented above increases the reliability. However, the reliability of this study decreases because it is explorative in nature. Also, triangulation is not performed which means that only one research method is used to conduct research, instead of several to 'test' the initial research method. However, the literature is cross-checked, and several kinds of debates are presented before proceeding to draw any further conclusions. Together, this makes that this research has medium reliability.

The validity determines whether the research actually measures what it is intended to measure, which is why it also shows the extent to which the research can be generalized to the external environment (Sekaran & Bougie, 2016). The validity of this research reduces considerably as the interpretation of the sources is not validated. However, the validity increases by using a variety of literature and taking several perspectives into account when making the amended PSS typology as well as the methodological scheme. Moreover, during the systematic analysis of the illustrative cases different academic and non-academic sources are consulted, which increases the generalizability. All in all, this leads to a medium validity.

The integrity of this research means whether it has been conducted within all honesty and reliability regarding the ethical practices related to data collection and analysis (Watts, 2008). In this research, use is made of mostly online sources, which have been produced for many people. Although the data collection and analysis cannot be validated, and a long-term involvement with authors and validation of the cases has not been followed up, the intention of the data collection and analysis is to illustrate. In doing so, the researcher declares the integrity of his own by following the four principles laid down in the European Code of Conduct for Research Integrity. Thus, the investigator adheres to reliability, honesty, respect and responsibility (European Science Foundation & All European Academies, 2017). The key to following the principles is to rely on the results of the research instead of the assumptions of the researcher. Also, all the information being used is Therefore, it can be concluded that the integrity of this research is sufficient.

4.6 Limitations

Although every effort is made to perform the research as thorough and complete as possible, there are always limitations. In this study an extensive literature review is carried out, in which cases are only added as illustrations. As a result, the business models that are described come from existing literature and there is no possibility to verify them or identify new, yet unknown, cases. Besides, this research is exploratory in nature with the aim of gaining new insights and illustrative cases that are reviewed should be a good representation of the relevant topics in order to draw conclusions (Yin, 2018). However, this research does not have such thorough results as in a multiple case study. For this reason, it can be said that the results of the illustrative cases of this research have a one-sided perspective, which is also because this research is performed by one researcher only. The research also has a relatively low reliability and validity, which is an important research limitation.

Also, this research has narrowed the PSS conceptualization down to a more practical one including business models. However, the exact advantages for a PSS instead of a solely product or solely service system are not addressed in this master thesis, neither do the disadvantages. Lastly, this research is qualitative from nature, which does not address the empirical evidence in a quantitative approach.

Furthermore, apart from the limitations of academic nature another limitation arose. The virus "COVID-19", better known as the Coronavirus, made its mark, from which so far more than 6000 people in the Netherlands have died alone (RIVM, 2020). Because the virus is so contagious, staying at home was highly recommended and many companies, public spaces and universities (including the Radboud University) have been closed (Radboud University, 2020). Working and education is done as much as possible from home, which resulted that in-depth interviews were difficult to conduct and changed the initial research design of this master thesis.

5 Validation of the amended PSS typology

The purpose of this master thesis is to propose an amended PSS typology which can be used to classify Servitization Business Models. To do so, in chapter two a definition for SBM is formulated. In addition, the PSS typology of Tukker (2004) is presented in chapter three as the starting point for this research. Chapter three showed new insights and criticisms surrounding this phenomenon which indicate that additions to this typology are not unnecessary. As a result, the PSS typology from Tukker (2004) is amended into an amended PSS typology at the end of chapter three along with the explanatory notes that come with it. Additionally, a theoretical overview with the dimensions of the amended PSS typology is presented, which is transformed into a methodological scheme to enable a systematic analysis of the illustrative cases.

This chapter describes the validation of the amended PSS typology to classify SBM by analyzing illustrative cases. These illustrative cases are first identified and selected which is described in the first section of this chapter. Also, an overview of the dataset is presented where the organizations and servitization essence of the illustrative cases are briefly described. Next, the analysis of the illustrative cases is being done using the methodological scheme presented in paragraph 4.4.2. Finally, a reflection is given where the limitations of this analysis are described.

5.1 *Identification and Selection of the illustrative cases*

Before the analysis can be performed, the illustrative cases must be identified and selected. First, a long list of possible organizations is identified, which meet the selection criteria set out in section 4.4.1 (and appendix A). The long list of identified cases is presented in appendix B. Ten randomly selected illustrative cases were then selected from the long list to analyze in the next paragraph. These ten illustrative cases selected are presented in table 8 underneath along with the essence of their servitization.

Organization	Servitization essence
<i>DAF Trucks</i>	Offering repair & maintenance contracts with the aim to improve customer retention
<i>Michelin</i>	Tire management for an entire fleet of trucks, aiming to expand customer base
<i>MUD Jeans</i>	Provide ‘Lease a Jeans’, in order to get a better grip on used products for recycling
<i>Signify (Philips Lighting)</i>	Selling a promised level of illuminance in a building to take on the responsibility to make sustainable solutions
<i>Greenwheels</i>	Providing a car only when you need one in order to reduce traffic jams, air pollution and costs for possible car-owners
<i>Swapfiets</i>	By offering a bicycle with the needed service for a fixed rate per month bringing ‘leasing’ to the bicycle market

<i>Wehkamp</i>	Increase revenue by offering a possibility to staggered payments and lending money to their customers
<i>Coolblue</i>	Servitization applied with the aim to improve customer retention
<i>Bundles</i>	Servitization aiming to reuse and thus sustainability when it comes to whitegoods
<i>SHARENOW</i>	Providing a car only when you need one in order to reduce traffic jams, air pollution and costs for possible car-owners

Table 8 - Dataset for the Illustrative Case analysis

The illustrative cases selected emerge from both academic and non-academic literature and are presented in no particular order. They help to illustrate the amended PSS typology while simultaneously test if the PSS orientations proposed are comprehensive. Moreover, it shows how to use the amended PSS typology to classify SBM.

5.2 Illustrative cases

In this section, the illustrative cases of table 8 are analyzed using the methodological scheme shown in table 7, presented in paragraph 4.4.2. This section focuses on the PSS implementation of the randomly selected illustrative cases. Here, the organizations in the cases are briefly described, since the focus of this research is on the PSS applications of these organizations. In the next chapter, the illustrative cases are used to shape the final amended PSS typology. This is done by synthesize the illustrative cases by summarized overview and filling them into the amended PSS typology. The synthesis of the analyzed cases, along with the findings of this analysis are presented in chapter six.

Important to mention is that the amended PSS typology in this master thesis is only filled in with Servitization Business Models (SBM) for illustrative and validation purposes. Thus, analyzing these cases, the amended PSS typology is only used as a tool where business models can be filled in. This does not mean that the cases assessed are the only possibilities within the proposed PSS orientations.

5.2.1 DAF Trucks

DAF Trucks (hereafter DAF), an originally Dutch production company, is a well-known player on the truck market. The company offers DAF MultiSupport, which is the umbrella term for all repair and maintenance contracts offered by this company. The combination of, on the one hand, the repair and maintenance service in which working hours and replacement vehicles are 'reimbursed' as well as, on the other hand, the costs of the products (parts) that are associated with it, demonstrates that this offer is a classic example of service-oriented PSS. This only is the case since the product (the truck) is coupled up with services to that extent that the services

add maybe even more value than the product itself. The exact internal PSS path in this case is not easy to classify, since both ways are followed. DAF moved from selling solely services (repair and maintenance services) towards also offering the combination where products in the form of replacement trucks or parts were involved. However, it also sells solely products in the form of trucks and parts, to which services have been added. This indicates that both pathways were followed (servitization of products and productization of services) within DAFs application of PSS. Resulting into DAFs meeting point of the pathways: DAF MultiSupport. DAF MultiSupport takes care of the customer, while DAF receives customer retention. The cross-bordered pathway DAF followed is servitization, since they started to produce solely products and added services to it after a while. However, the PSS offerings of DAF entail value which is found mainly in the service content, as can be seen in the overview of the dimensions for this case in table 9.

	Dimensions	Attribute
1	Value content	Value mainly in service
2	PSS orientation	Product oriented PSS: TRP trucks and trailer parts Service oriented PSS; DAF MultiSupport
3	PSS pathway (internal)	Servitization of Products and Productization of Services
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2B

Table 9 - Overview of Dimensions for case: DAF Trucks

In addition, DAF offers truck and trailer parts under the brand TRP since 1994. This sale of spare parts is often provided alongside maintenance and repair activities but is here offered as an independent service with a different brand name. For that reason, Gaiardelli et al. (2014) identified this as a sort of product oriented PSS. Therefore, in the amendment PSS typology TRP also refers to product oriented PSS. This shows that DAF has both a product oriented PSS (TRP) and a service oriented PSS (DAF MultiSupport) applied within their BM. On top of that, they also offer their trucks without the additional services. On this basis, it is assumed that DAF handles several business models side by side. Implementing this system at truck manufacturers is not unique. Just like DAF, MAN Trucks does this in a similar way, with Fleet Management being one of their offers (Baines & Lightfoot, 2015). Moreover, car and truck manufacturers are also known to offer lease contracts, which is a way of use oriented PSS.

In conclusion, DAF has multiple applications of PSS within their organization, in several business models. The pathways followed were not mutually exclusive and showed how an organization can use both pathways to come to an application of PSS.

5.2.2 Michelin

An often-described case of the application of PSS is Michelin's business model. Besides their sales of tires, they offer a service where one can lease tires instead of having to buy them. This is sold under the name 'Michelin Fleet Solutions' and is only of interest to businesses, therefore business-to-business (Michelin, 2020). Leasing instead of buying tires is done in a 'Tires as a Service' model, where the customer pays per mile driven. In this way, customers don't own the tires and don't have to worry about the repair and maintenance of the tires. Moreover, they do not have to pay if they drive less than expected. Michelin's incentive in this respect is to make the tires as durable (long-lasting) as possible. In addition, tires which reached their lifetime return to Michelin, which they can reuse to produce new tires (Lacy & Rutqvist, 2016). Michelin's managers are also trained to increase the service life of tires by regrooving and retreading them. This involves monitoring tire pressure, reducing customer fuel consumption and improving the service life of tires (Stahel, 2010). All this done by Michelin, relieves the customer tremendously, which indicates that this offer has the main value in the service. The dimensions for this case are shown in table 10 below and explained thereunder.

	Dimensions	Attribute
1	Value content	Value mainly in service
2	PSS orientation	Use oriented PSS
3	PSS pathway (internal)	Servitization of Products
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2B

Table 10 - Overview of Dimensions for case: Michelin

The PSS orientation of Michelins offering is use oriented, since it is a leasing model. The business model of Michelin is mainly service based, where the value is mainly to be found in the service. The pathways that Michelin followed are servitization of products, since they started to sell a product with little services, to which they added more services to add additional value. Also, the cross-bordered pathway of Michelin Fleet services is servitization, because it made the transition from a pure product towards a combined PSS.

Concluding, the Michelin case is a textbook example of a case applying use oriented PSS in their business model. It moreover showed how a PSS can contribute to the longevity of a certain product and showed insights of the value for a producer to adopt a PSS.

5.2.3 MUD Jeans

The organization of MUD Jeans offers jeans by means of two ways. In the first, you can just buy jeans. The other applies PSS and is centered around one of the major concepts within the

PSS spectrum; leasing products. Customers of MUD Jeans make exclusive use of the product, without being the owner (Lewandowski, 2016). The Dutch fashion label provides jeans in a lease structure, where the customer is consumer and pays a fixed amount per month to use the product. The concept of Lease a Jeans, as MUD Jeans call their business themselves, is currently only applied in the business model of MUD Jeans. The ownership of the jeans stays at MUD Jeans, and if the customer is finished with the jeans, or worn out, he can just trade them in for a new one. After the trade-in, MUD Jeans uses the worn jeans to make new products (Rikkert, 2013). The dimensions for this case are shown below in table 11, followed by their explanation.

	Dimensions	Attribute
1	Value content	Value mainly in service
2	PSS orientation	Use oriented PSS
3	PSS pathway (internal)	Servitization of Products
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2C

Table 11 - Overview of Dimensions for case: MUD Jeans

In their second offering, the initial offered product ‘jeans’ is transformed into a service, hence the servitization of products. Also, the PSS pathway cross-bordered has evolved from a pure product through the integration, product and service oriented PSS into the use oriented PSS. This can be seen due to the extent where service is present in this business model and refers to servitization when it comes to the PSS pathway cross-bordered. Building on that, this case shows a typical use-oriented PSS.

Taken together, the case of MUD Jeans shows a use typical use oriented PSS in the form of a leasing model, where the value can be found mainly in the service. This new way of offering jeans to consumers shows that the pathway of servitization is followed.

5.2.4 Signify (Philips Lighting)

Signify is the name of the organization that has been split off from Philips to focus on the development, production and sale of light bulbs and lighting solutions. Also known as Philips Lighting, since they received a license to use the brand Philips on their lighting products, Signify has made a move towards a circular economy by offering ‘Light as a Service’ and ‘Philips Circular lighting’. The main principle of these two offerings is that customers only pay for the light and not for the lamps, in other words, they only pay for the performance of the product. Also, the ecological footprint will lower due to the ‘substantial reduction in energy costs’ (Philips Lighting, 2017). By offering lighting as a service, the incentive for Signify to create sustainable, long-lasting products, which are built using components that can easily can

be replaced is created (Lacy & Rutqvist, 2016). Customers who are already use this offering are Bruynzeel Storage systems, High Tech Campus Eindhoven and Schiphol Airport. Hence, the market orientation for this offering is business to business (B2B). The success stories presented have reduced energy-consumption by a minimum of 50%, which can be seen as an incentive for both the customer and Signify (Philips Lighting, 2017). In table 12, the dimensions of this PSS case are shown.

	Dimensions	Attribute
1	Value content	Value mainly in service
2	PSS orientation	Use oriented PSS Result oriented PSS
3	PSS pathway (internal)	Servitization of Products
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2B

Table 12 - Overview of Dimensions for case: Signify

According to Lacy and Rutqvist (2016) the level of service and types of lighting to use can be agreed upon together (Signify and the customer), which makes the value content of this case mainly to be found in the service. The pathway within the PSS spectrum that Signify followed is Servitization of Products, since the product ‘lamps’ are being replaced by the service of lighting. Also, cross-bordered, the PSS pathway of Signify is Servitization, since it made the transition from consulting services towards a more integrated solution where the products used are not important anymore. Therefore, the PSS orientation is difficult to classify. Since Signify offers more than just light as a service and wants to take care of energy consumption when selling Philips Circular Lighting, it is complicated to classify this case as either use oriented or result oriented PSS. However, it is obvious that this case is in either use or result oriented PSS, since the transition of ownership of a product is not included in both light as a service and Philips Circular Lighting.

This case shows that the PSS orientation can be hard to identify or classify. In addition, it can be concluded that the case of Signify is one where the longevity of the products involved can increase.

5.2.5 Greenwheels

Greenwheels is the name of the organization which is providing an ‘availability based PSS, in the form of sharing’ (Lewandowski, 2016). The business model of Greenwheels provides ‘a car at the customer’s convenience’ (Greenwheels, 2020b). The Greenwheels case has its value mainly in the service, since it services the customer to have a car ready for them all the times. Also, because their partnership with NS, a Dutch railway company, in the form of a discount

for NS subscriptions, Greenwheels makes it easier and cheaper to make use of their products. Moreover, providing these two services (Greenwheels with NS), a problem called the “first mile, last mile”-problem is being reduced, if not tackled. This is the problem which occurs when people live further away from transit stops, because they have to walk the first and last mile to the transit stop (Cohen & Kietzmann, 2014). Greenwheels (2020a) states the following; “A Greenwheels car is a car you have at your command, not a car you own”. This makes it more affordable for a consumer to make use of a car, than having to buy one. The fact that a Greenwheels car is not owned by customer(s) refers to use oriented PSS. It is not a result oriented PSS, since it offers an extremely limited ranges of products (Tunn, Fokker, Luijkx, De Jong, & Schoormans, 2019), namely cars. The other dimensions and explanations are shown in table 13 underneath. However, by a very close partnership with for example NS, their PSS orientation could be transformed into a result oriented PSS. So far, by providing a Greenwheels car to their customers, Greenwheels reduces the car ownership by 30% and the car usage by 18%, which they propose as the reason to subscribe and create a more sustainable society (Greenwheels, 2020a).

	Dimensions	Attribute
1	Value content	Value mainly in service
2	PSS orientation	Use oriented PSS
3	PSS pathway (internal)	Servitization of Products
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2B & B2C

Table 13 - Overview of Dimensions for case: Greenwheels

The PSS pathway Greenwheels followed within the PSS spectrum is the servitization of products, since they started with a product (cars) and combined it with services to enhance its added value. Cross-bordered it also followed a servitization pathway, because it started with a pure product. The market orientation of Greenwheels is both business to business and business to consumer because it is possible to subscribe both as a consumer and as business (Greenwheels, 2020b).

In conclusion, the case of Greenwheels presents yet another use oriented PSS, which has its value mainly in the service. Also, this case shows that the possibility to make a product, what is difficult for some to pay is made more accessible by applying PSS in the business model.

5.2.6 Swapfiets

Another case which appears in both academic and non-academic literature regarding PSS is the case of Swapfiets. The bicycle company which is founded in 2014 in the Netherlands applies a

bicycle-lease system on subscription basis for their customers. Customers can register online or in a Swapfiets-store, and receive their personal Swapfiets bicycle (Ma, Yuan, Van Oort, & Hoogendoorn, 2020). In this way, they only use the leased bicycle, instead of buying and owning one. The leasing model of Swapfiets indicates a use oriented PSS, which can be seen alongside the other dimensions in table 14 underneath.

Dimensions		Attribute
1	Value content	Value mainly in service
2	PSS orientation	Use oriented PSS
3	PSS pathway (internal)	Servitization of Products
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2B & B2C

Table 14 - Overview of Dimensions for case: Swapfiets

The case of Swapfiets shows that services are added to that extent, that the product becomes a service. For that matter, servitization was the pathway followed cross-bordered. Also, they followed the pathway servitization of products, since they started with a product, and added services to add value. Swapfiets is applicable for both organizations and individuals, thus their market orientation is business to business and business to consumer (Swapfiets, 2020).

Swapfiets is comparable with the case described above, Greenwheels, but is not entirely similar. Having a subscription at Swapfiets gives you the exclusive access to the product, where Greenwheels does not. This makes Swapfiets a sort of leasing model, where Greenwheels is more referenced to as ‘availability based’ since you are paying to receive its availability (Aurich et al., 2010; Lewandowski, 2016). This is important to mention, because judging from table 13 and table 14 it seems as if Swapfiets and their PSS dimensions are identical to those of Greenwheels.

To conclude, it demonstrates that the dimensions are not always as thorough as they should be. It seems to deal with two identical cases, which are in fact different. Besides, this case provides a good example of a use-oriented PSS in the form of a lease model.

5.2.7 Wehkamp

Wehkamp is an originally Dutch company, which has grown in scale with their mail order business model. Nowadays, Wehkamp is known as an online warehouse company where customers can shop for clothes, furniture, garden products, electronics and more. In recent years, the company has started to call the use of mail order services different, namely staggered payments. Using this payment form, the customer gets credit to pay per month. The customer decides in how many months they will pay off (Wehkamp, 2020). On top of that, customers

who use staggered payment at Wehkamp can also lend money. This offer to make use of financial services when buying a certain product is an example of integration oriented PSS, since customers can buy a ‘product plus services’. The addition of services in this case is called vertical integration, partly because the services offered are not directly related with the product. The dimensions are shown in table 15 underneath.

Dimensions		Attribute
1	Value content	Value mainly in product
2	PSS orientation	Integration oriented PSS
3	PSS pathway (internal)	Unidentifiable
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2B & B2C

Table 15 - Overview of Dimensions for case: Wehkamp

The table above presents that the value in this case is mainly in the product. This is because the service which is provided here is not the main reason to purchase the product. However, the service does add value. Another remarkable observation is the fact that the internal PSS pathway cannot be identified as solely servitization of products or productization of services. It could be both but is also possible to be none, therefore it is stated to be unidentifiable for this case. However, it is possible to identify the cross-bordered PSS pathway; servitization. Reason for this is that the pure product is being extended with the financial services as described above. It is possible to make use of this extra service as a consumer and as organization, hence business to business and business to consumer.

Overall, this case is the first to show what an integration oriented PSS can look like. What is striking in this case is the fact that the value can mainly be found in the product content. Also, this case confirms that it is not always possible to classify or identify PSS pathways.

5.2.8 Coolblue

Coolblue define themselves as a Dutch ecommerce company and sell all kinds of (mostly electronical) products to their customers. On top of their ecommerce activities, they offer a so-called customer journey. To do so, they have two main goals; create value and set the bar for customer-centric entrepreneurship (Coolblue, 2019). However, it all begins with their overall goal of achieve ultimate customer satisfaction (Coolblue, 2020). In 2019, Coolblue launched subscriptions for white goods (washing machines, dryers, refrigerators, freezers, and/or dishwashers) called 'Washing machines as a service', which responds to the problem that customers have when their washing machine breaks down unexpectedly and inconveniently. With this service Coolblue guarantees a working washing machine for a small monthly fee. If

the washing machine still breaks down, the customer will receive a replacement product within 48 hours (Coolblue, 2019). It is offered to both consumers and organizations, which makes its market orientation both business to business and business to consumer. The combination of the product with the service is another suitable example of a PSS and shows that 'Product as a Service' is an important aspect of PSS. In this case, the value is mainly in the service. As can be seen in the overview of the dimensions in table 16 below.

	Dimensions	Attribute
1	Value content	Value mainly in service
2	PSS orientation	Use oriented PSS Result oriented PSS
3	PSS pathway (internal)	Servitization of Products
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2B & B2C

Table 16 - Overview of Dimensions for case: Coolblue

It is difficult to precisely classify the PSS orientation of this case. The 'Washing machine as a Service' tends towards a use oriented PSS, however, a solution is offered in which it can also resemble a result oriented PSS. The difference between these two PSS orientations is that the use oriented PSS refers to a specific product, and in a result oriented PSS the need for a specific product is reduced. Since Coolblue offers both washing, dryers and the combination between the two, one can say it is offering a solution rather than a certain product. That is why this case shows that it is difficult to distinguish between these two PSS orientations. The pathways, however, are easier to classify in this case since Coolblue started to sell just products with additional installation services. This indicates a cross-bordered PSS pathway of Servitization, since the installation services evolved in this 'Washing machine as a Service' PSS application. The internal PSS pathway refers to a Servitization of Products, since services are added to the products instead of the other way around.

This 'Washing machine as a Service' application of PSS in the business model is not a unique one, since other companies are applying it as well. Other examples are Witgoedverhuur, Splash Lease, Skala, Meolease, Smartstudentdeals, Bluemovement and Bundles (Vermeulen, 2020).

The conclusion of this case is that it finds itself in grey area, since the difficulty to classify the case into only one PSS orientation. Moreover, this case shows that it is apparently not only interesting for a production company to adopt a PSS, another company can do so as a provider such as Coolblue. The proposed financial incentive to create a longer lasting product is in this case reduces, since the producer does not increase their revenue with a longer lasting product.

5.2.9 Bundles

Bundles was founded in 2014 and started as an idea to sell subscriptions for white goods. Within a year they managed to establish a partnership with a large washer manufacturer. The subscription to a washing machine is offered through the collaboration with Miele. Over time, dishwashers and dryers also are added to the subscription model (Möller, 2018). Nowadays, it is also possible to use this application of a PSS to get coffee machines and beds at Bundles. Bundles itself defines itself as a provider of the best products as a service. The customer does not become an owner, but a user. In doing so, Bundles keeps an eye on sustainability and reuse (Bundles, 2020). Bundles can be purchased by both organizations and consumers, so both market orientations are included in the dimensions overview. Moreover, at Bundles, customers can choose for an all-in subscription, including laundry detergent. In doing so, Bundles takes account that washing is as sustainable as possible, as they use 'Miele autodosing'. In this subscription model, the value can be found mainly in the service as the all-in subscription of the washing machines confirms. Other dimensions are shown in table 17 below.

	Dimensions	Attribute
1	Value content	Value mainly in service
2	PSS orientation	Use oriented PSS Result oriented PSS
3	PSS pathway (internal)	Unidentifiable
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2B & B2C

Table 17 - Overview of Dimensions for case: Bundles

As with Coolblue's subscription model, it is difficult to specify the exact PSS orientation for Bundles. This is for the same reason as with Coolblue, it is debatable whether a result is sold here, or usage with a specific product involved. This shows yet again that the amended PSS typology does not entirely fulfil when it comes to the classification of PSS orientations. On the other hand, the PSS pathways are harder to identify since this organization applies the PSS since its existence. For that reason, this case is likewise unidentifiably marked. However, assuming that the company has developed its business model around the products rather than the services, it is concluded here that the PSS pathway cross-bordered involve servitization.

Concluding, this case is yet another example that sometimes PSS orientations and pathways are hard to identify. However, it shows that the difficulties in classifying the PSS orientations are only founded in the use or result oriented PSS.

5.2.10 SHARENOW

SHARENOW is a joint venture between DriveNow (BMW) and Car2Go (DaimlerAG), which profiles itself as a car-sharing service (ANP, 2018; SHARENOW, 2020). They provide an app that makes thousands of cars available and accessible to their customers, which have to pay a fee to make use of the app. SHARENOW is active in the Netherlands, Denmark, Germany, France, Hungary, Italy, Austria and Spain for both businesses and consumers (SHARENOW, 2020). The car sharing business model makes use of a use oriented PSS model, because it offers a single product in the form of a sharing service. Here, it is easier to identify the orientation, since it offers an extremely limited range of products (Tunn et al., 2019), namely cars. In addition, the value of this case is mainly in the service content as can be seen, along with the other dimensions, in table 18 underneath.

	Dimensions	Attribute
1	Value content	Value mainly in service
2	PSS orientation	Use oriented PSS
3	PSS pathway (internal)	Servitization of Products
4	PSS pathway (cross-bordered)	Servitization
5	Market orientation	B2B & B2C

Table 18 - Overview of Dimensions for case: SHARENOW

This illustrative case has evolved from a leasing model towards a more sharable subscription model where one can use the car for a short amount of time. Therefore, you do not have the exclusive usage of the product. It does show that the pure product of a car is servitized, hence the PSS pathway cross-bordered is servitization. Moreover, it applied servitization of products, since it has included more services with a product instead of the other way around.

All in all, this case is similar to the case of Greenwheels described in 5.1.5 as can also be seen at the exact same overview of the dimensions. It also demonstrates together with the case of Greenwheels and Swapfiets, that mobility is a ‘hot’ opportunity within the application of PSS.

5.3 Reflections and Limitations

Although chapter six describes the findings of the illustrative cases analysis in more detail, this section will point out the reflections and limitations of the analysis.

First and foremost, the cases should all be based in the Netherlands, but there are still two foreign cases (Michelin and SHARENOW). However, these cases cannot be excluded because they are a good representation of the use-oriented PSS and contribute to the result as presented in chapter six.

To continue, the analysis of the cases in this master thesis only focused on the PSS activities of the organizations that were examined. The intentions of the organization as well as the accuracy of the information were not validated at the companies themselves. Also, because this analysis is performed by one researcher, the interpretations of the sources may be biased.

In addition, the majority of the cases are use or result oriented in nature, which makes it difficult to generalize results regarding the integration, product and service oriented PSS to an overall conclusion. Insisting on the PSS orientations, together with the PSS pathways, it was sometimes difficult to classify the orientation and/or pathway to which an organization relates. This leaves the analysis of the case sometimes open for own interpretation, which can be biased due to that this analysis is being done by one researcher only.

6 Towards an amended PSS typology

The presented amended PSS typology, together with the overview of the dimensions, has been used in chapter five to perform an illustrative case analysis. This is both to create a robust amended PSS typology as well as to illustrate how this typology can be used to classify Servitization Business Models. In this chapter, the synthesis is presented together with the findings of the analysis.

While analyzing the illustrative cases in chapter five, several observations were made. These observations and the reflections and limitations of the illustrative analysis showed to what extent it is possible to fill in the amended PSS typology with Servitization Business Models. This chapter therefore presents how to fill in the illustrative cases into the amended PSS typology by the following steps; First, the illustrative cases are summarized into a summarized overview, which provides a clear understanding of the cases with respect to each other and, moreover, with respect to the amended PSS typology. This will help to fill the cases into the amended PSS typology, which is done in the second paragraph. After completing these steps, the findings of the analysis will be presented in the third paragraph, together with the first conclusions. Lastly, the reflections and limitations of both the amended PSS typology and the interpretations of the findings are summed up.

6.1 Summarizing the illustrative cases

This paragraph will summarize the illustrative case analysis of chapter five into a summarized overview, in order to present the final filled-in amended PSS typology in the next paragraph. Table 18 below displays a summarized overview, with the rows covering the different dimensions and attributes, and the columns present the illustrative cases assessed.

Dimensions	Attributes	<i>DAF Trucks</i>	<i>Michelin</i>	<i>MUD Jeans</i>	<i>Signify</i>	<i>Greenwheels</i>	<i>Swapfiets</i>	<i>Wehkamp</i>	<i>Coolblue</i>	<i>Bundles</i>	<i>SHARENOW</i>	
1	Value content	Mainly in service content	X	X	X	X	X	X		X	X	X
			Mainly in product content						X			
2	PSS orientation	Integration oriented PSS						X				
		Product oriented PSS	X									
		Service oriented PSS	X									

	Use oriented PSS		X	X	X	X	X		X	X	X
	Result oriented PSS				X					X	
3	PSS pathway (internal)	Servitization of products	X	X	X	X	X		X		X
		Productization of services	X								
4	PSS pathway (cross-bordered)	Servitization	X	X	X	X	X	X	X	X	X
		Deservitization									
5	Market orientation	Business to Business (B2B)	X	X		X	X	X	X	X	X
		Business to Consumer (B2C)			X		X	X	X	X	X

Table 19 - Summarized Overview of the illustrative case analysis

By means of table 19 it is possible to go through the illustrative case analysis. Therefore, this table is used as a tool to fill in the amended PSS typology in the next paragraph, and subsequently present the findings of the illustrative case analysis and the conclusions drawn.

6.2 Final amended PSS typology

Using table 19 from the previous paragraph, the illustrative cases described in chapter five are filled into the final amended PSS typology, which classifies and synthesizes the cases.

Again, here must be stated that the cases filled in are not fixed. Other cases can be added, and the existing cases can be (re)moved. However, figure 7 shows where the illustrative cases which are analyzed in this research can be placed within the amended PSS typology. Nevertheless, it shows in what way similar analyses of (illustrative) cases in the future can be filled in and thus how Servitization Business Models can be classified using the amended PSS typology.

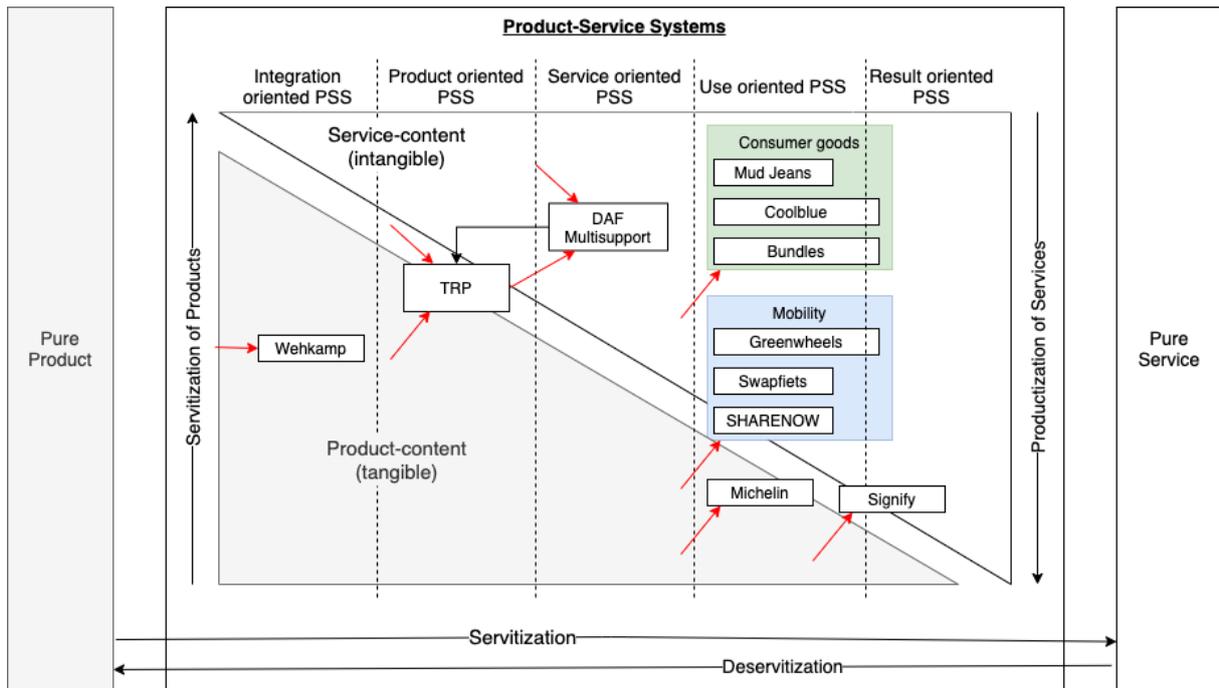


Figure 7 - Amended PSS typology filled in with cases

This final version of the amended PSS typology filled in with the illustrative cases must be interpreted as follows; The red arrows represent the pathways that are identified. Also, similar companies are grouped in categories. Thus, MUD Jeans, Coolblue and Bundles are all cases that offer consumer goods (although sometimes they are also offered to businesses), whereas Greenwheels, Swapfiets and SHARENOW are all three mobility providers.

The cases Coolblue, Bundles and Greenwheels can all be found for a small part in the result oriented PSS. The reason for this is that these cases are for the most part use oriented PSS but can also be delivered in an application that points more to a result oriented PSS. Signify, on the contrary, can be found for the most part in the result oriented PSS. This demonstrates that Signify has a mostly result oriented PSS, which can also be delivered or interpreted as a use oriented PSS.

The filled in amended PSS typology gives an overview of the followed pathways and the current place an organization is standing within the PSS spectrum. Therefore, this filled in amended PSS typology gives a classification of the illustrative cases analyzed. However, besides this, filling in the cases using the summarized overview and the amended PSS typology results in noteworthy findings, which are described in the following paragraph.

6.3 Findings of the Illustrative Case Analysis

In this paragraph, the findings of the illustrative case analysis are summed up and the first conclusions are drawn. The findings are subdivided into four main themes, namely PSS Pathways, Applying PSS in the organization, PSS Orientations and Value content & Sustainability. After presenting the findings of the analysis, the reflections and limitations of this chapter are described.

6.3.1 PSS Pathways (internal and cross-bordered)

First, the pathways which are proposed in the amended PSS typology gave a clear representation of the routes that were followed by the organizations of the cases. However, sometimes the pathways of the case are not easy to identify. The case of DAF showed that multiple pathways could be followed. On the other hand, Wehkamp and Bundles presented the ‘unidentifiable’ pathways, partly because of the origin of the organization. This should be considered when using the amended typology and the corresponding dimensions for illustrative case analysis.

Elaborating further on the pathways, the cross-bordered PSS pathways showed the following. Deservitization is not applied anywhere within the illustrative cases. Remarkably as this may seem it is not that surprising. As described in the theoretical framework, nowadays, servitization is more applied than ever. For that matter, the fact that these cases all describe the presence of servitization is just a validation of the previously noted servitization trend. However, although this may seem that deservitization does not occur, deservitization could emerge if for example Swapfiets, SHARENOW or Greenwheels starts to sell its products without the services that currently come with it. This could be occurring already in other industries.

All in all, the conclusion is that both pathways (internal and cross-bordered) are significant contributing to the amended PSS typology. However, they are not always easy to identify and thus are not thorough enough. In addition, the deservitization pathway is not validated enough in this research. Therefore, the addition of pathways in the amended typology is a step in the right direction but needs to be validated even more. The validation by analyzing illustrative cases shows that the pathways need to be further examined.

6.3.2 Applying PSS in the organization

When it comes to applying PSS in an organization, and thus the BM, the following was perceived. The first finding is that several of the cases have multiple BM working together in

one organization. DAF Trucks demonstrated that they have two PSS's side by side, where one is product oriented (TRP) and the other is service oriented (DAF MultiSupport). Not to forget that DAF also offers its trucks without any service associated with it. Moreover, MUD Jeans is applying PSS by their 'Lease a Jeans' BM next to the sales of jeans solely. Other cases that are applying PSS as an addition to their existing BM are Michelin, Signify, Wehkamp and Coolblue. This refers to the described servitization paradox in chapter two, where was stated that the implementation of servitization in an organization should be about managing both BMs parallel rather than transforming the initial BM.

The second finding when it comes to the application of PSS in a BM is that the form of 'Product as a Service' (hereafter PaaS) is a common realization of PSS. This form of PSS is almost the same as the earlier described leasing model, only it differs on the contract length. However, this study revealed Michelin, Signify, Swapfiets, Coolblue and Bundles as appliers of PaaS within their organization. It also showed that the PaaS-organizations all are at least use oriented PSS, or servitized even more towards a result oriented PSS.

Lastly, some of the cases discussed made revealing observations, since it showed that the application of PSS in the business model is not only beneficial for producers, but also for other companies. Bundles, Coolblue and Greenwheels demonstrated this finding, because these are all providers instead of producers of the products involved. Doing so, the incentive to create longer lasting products is transformed into an incentive to establish partnerships with producers of longer lasting products.

When it comes to the application of PSS in organizations, it is concluded that the analysis of illustrative cases confirms the theoretical servitization paradox that it is more advantageous to have several BM side by side. Also, the application of PaaS could be both use and result oriented, which could therefore be a significant addition to the model in the form of a sixth (overlapping) PSS orientation.

6.3.3 PSS orientations

In addition to the PSS paths that are difficult to classify, PSS orientations are sometimes difficult to identify too. The cases of DAF, Signify, Coolblue and Bundles demonstrated that the PSS orientation can be debatable. For that reason, the orientations within the amended PSS typology are not exhaustive. It would be better if one can easily classify the cases in a reliable way within the correct PSS orientation. Furthermore, the first three orientations (integration,

product and service oriented PSS) are easier to classify than use and result oriented PSS. This may be due to the subdivision from Neely (2008).

As a result, concluded is that the last two orientations; use- and result oriented PSS have to be subdivided too, in order to make it easier to classify and identify different PSS orientations.

6.3.4 Value content & Sustainability

In the methodological scheme, the value content is tested per case. This led to the finding that in almost all cases the value content was mainly in the service. The only exception was the case of Wehkamp, which is the only case that enhanced the integration oriented PSS. However, since there is only one case in this study which addresses to the integration oriented PSS, this cannot lead to a conclusion on that part.

During the review of the cases and their application of PSS, sustainability is mentioned several times. The cases of Signify, MUD Jeans, Michelin, Coolblue, Greenwheels and SHARENOW have all stated that their application of PSS within their BM leads to a more sustainable production and use of the goods. Although this is not scientifically proven, some have published figures showing that the longevity of products increases. However, the introduction of this master thesis describes the finding that sustainability of the application of PSS should be judged case by case.

Concluding, the current analysis of the illustrative cases shows that most of the value content can be found mainly in the service. It also shows that more integration oriented PSS cases should be assessed, in order to draw a conclusion for the value content of this orientation. Moreover, the actual contribution of PSS to sustainability is something that needs to be explored in more depth.

6.4 Reflections and limitations

The analysis of the cases not only gave the above results, limitations of the amended PSS typology also emerged after interpreting the empirical cases. This paragraph therefore sums up the reflections and limitations of both the amended PSS typology and the interpretations of the findings.

First, a limitation of the amended PSS typology is the fact that it is sometimes hard to identify and classify the PSS orientations proposed. After assessing multiple cases where no exact PSS orientation could be concluded, these cases find themselves in a sort of grey area when it comes to their PSS orientation. The PSS orientations, therefore, may be a limitation on its own.

Moreover, the PSS pathways that are proposed in the amended PSS typology were not always easy to classify as well. For that matter, the basic elements within the amended PSS typology are not as thorough as was assumed earlier.

Further, the analysis of the cases alongside with the interpretation of the results and research findings was done by one researcher. This may cause bias in the interpretation of the research material which was used analyzing the data (cases) of within this study. Besides, the uncertainties arising from the unidentifiable PSS orientations and/or pathways do have an influence on the end result and thus the robustness of the amended PSS typology. Lastly, the overview of the dimensions, which is used filling in the amended PSS typology, is not anchored to the typology. This makes it possible that the amended typology which is presented in this master thesis could give different outcomes when approached differently.

7 Conclusion and Discussion

In chapter five the illustrative cases were identified, selected and analyzed to validate the proposed amended PSS typology. The synthesis of the analysis is made in chapter six, creating the filled-in amended PSS typology. In addition, the findings and conclusions of the analysis are presented in chapter six.

This chapter contains the conclusion and discussion of this research. In order to do so, first of all the purpose of the study is described once again together with the research questions. Next, the research process is described, and the research contributions are given. Section four contains the concluding remarks, in which the research question is answered. Next, the reflections and limitations of this research are described in order to make suggestions for future research in section six.

7.1 Research objective & questions

The objective of this research is to propose an amended Product-Service System (PSS) typology which can be used to classify Servitization Business Models (SBM). In order to achieve this, the following research question is formulated; *“What are the main elements of an amended Product-Service Systems typology enabling it to classify Servitization Business Models?”* To increase the robustness of the amended PSS typology and validate the ability of the amended PSS typology to classify SBM, illustrative cases are assessed. The main research question therefore is answered with the help of answering the sub-question, which is the following; *“How can an amended Product-Service Systems typology be used to classify Servitization Business Models?”*

7.2 Research process

An extended, systematic literature study is performed in order to review the two central concepts. First, the concept of business models was studied in order to provide a definition for 'Servitization Business Models' (SBM) to answer the sub-question. Next, by means of assessing the criticisms and developments regarding the conceptualization of Tukker (2004), several key concepts are assessed, to which the amended Product-Service System typology is established. These key concepts are; (1) Servitization, (2) Business Models and (3) Value content. Moreover, the terminology of several academical sources are assessed, since there was quite a discrepancy of terminologies.

To validate and illustrate the amended PSS typology, this master thesis performed an illustrative case analysis after identifying and selecting the illustrative cases which are SBM applying PSS. In order to be able to carry out the analysis in a systematic way, an operationalized scheme 'dimensions for the illustrative case analysis' was used. This is established in paragraph 4.4. After analyzing the illustrative cases, these were summarized into a matrix-table (table 19) making it easier to synthesize the illustrative cases into the amended PSS typology. The filled-in amended PSS typology was followed by the findings.

7.3 Research Contributions

The main contribution of this research entails the amended Product-Service System (PSS) typology, which is revised from the foundational conceptualization from Tukker (2004). This aggregates the most important criticisms and developments of the initial PSS typology into a more recent one. Furthermore, this research identifies Servitization Business Models (SBM) by giving a definition of the concept and describing its characteristics. It has also interlinked SBM and PSS by presenting a way to classify SBM and giving an indication on how to fill SBM into the amended PSS typology. By doing so, the amended PSS typology shows possible pathways that were followed or possible pathways to follow. It also contributes by presenting possible PSS orientations of the SBM which is assessed. Moreover, by performing the research, the dimensions of the PSS are drawn up, which can be used to concretize the SBM of any organization. This master thesis therefore is the first step towards a revision of the PSS typology of Tukker (2004), and brings new ideas to the table to amend this typology in a more comprehensive one.

7.4 Concluding remarks

This research has shown that the amended PSS typology enabling the classification of Servitization Business Models consists of three main elements. These elements are; the three spectra (blocks) that form the basis of the amended PSS typology, the PSS pathways that run through, and within these spectra and the five PSS orientations that fall within one of these spectra.

The first element is the three spectra as the basis of the amended PSS typology. These spectra are respectively; pure product, PSS, and pure service. The two pure forms of products and services stand on the two extreme sides, with the PSS spectrum in between. This makes it clear

how close to a service (or a product) a certain PSS orientation is and shows which spectra are encountered when following a PSS pathway.

The PSS pathways, the second element, is included to demonstrate which pathways can be followed. Moreover, the pathways can be used to draw up a plan for the future, to come to another PSS orientation. The pathways are servitization and deservitization, and pass through all three spectra, hence the cross-bordered PSS pathways. Servitization in this context refers to enhancing the infusion of services into your organization to gain competitive advantage. On the contrary, deservitization happens when the dilution of services into your organization results in coming closer to a 'pure product'.

The pathways within the PSS spectrum can eventually result in another PSS orientation for your organization. However, this does not have to be the case. The internal PSS pathways are servitization of products, where products are turned into services that can lead to a PSS and the productization of services, where services are productized to be able to create a PSS.

The third element of the amended PSS typology is the PSS orientations. These orientations are established to distinguish several types of PSS to classify the Servitization Business Models. This study demonstrated that there are five PSS orientations. These PSS orientations are identified in the amended PSS typology and divided using the dotted lines. The PSS orientations presented are (1) integration oriented PSS, (2) product oriented PSS, (3) service oriented PSS, (4) use oriented PSS, and (5) result oriented PSS.

As the literature review has shown, a Servitization Business Model is defined as follows; A Servitization Business Model is a service-centric business model, where multiple values are created due to the combination of products and services to add value and gain competitive ground.

The analysis of the illustrative cases indicated that the amended PSS typology enables classifying Servitization Business Models (SBM) through the methodological scheme. This scheme is derived from the dimensions overview for illustrative case analysis and consists of the following five dimensions; (1) value content, (2) PSS orientation, (3) PSS pathway (internal), (4) PSS pathway (cross-bordered), and (5) market orientation. After analyzing the illustrative cases the analysis not only classifies the PSS orientation, but also the PSS pathways, which contribute to filling in the SBM into the amended PSS typology. At last, using the dimensions which are determined using the methodological scheme, one can fill in the amended

PSS typology and include arrows to show which pathways were followed. Also, the amended PSS can show arrows to classify which pathway to follow in the future.

All in all, the three main elements, with its underlying dimensions and attributes make the amended PSS typology more applicable than the conceptualization from Tukker (2004), since it can be used to fill in, identify and classify existing (and yet to discover) Servitization Business Models.

7.5 Reflections and limitations

This paragraph gives an overview of the limitations of this master thesis. The research of this master thesis is based on two concepts; PSS and SBM. Whereas servitization and business models separately have been around for some time (Ferdinand, 1954; Vandermerwe & Rada, 1988), the concepts combined into SBM have limited to none academical sources. Therefore, this research has an explorative character, with the purpose to establish the linkage of PSS and SBM to the academic field. Due to the explorative nature of this research the design resulted into an illustrative case analysis from secondary data, instead of a multiple case-study with primary data. Although several sources have been assessed, the analysis of the cases is not verified at the organization which is described and therefore some of the interpretations done, could be imperfect.

The theoretical framework in this research, the extended literature study, has focused on servitization, business models and value content. However, if other key concepts had been explored, this could have led to different results. The theoretical framework could have been changed by investigating concepts such as new business models and multiple value creation in depth when it comes to the establishment of the amended PSS typology, instead of the key concepts that were chosen.

In addition, in this study it was decided to conduct an extended literature study. If this study would have been done with the help of a survey or interviews, this could lead to different results.

During the identification and selection of the cases, one of the characteristics was that the case must apply SBM. This concept has limited academical background and therefore the characteristics as well as the definition is based on the limited to none previously available sources. Another requirement was that the cases had to be in the Netherlands, in order to delineate the investigation on Dutch SBM, though later some cases turned out to be non-Dutch. This shows that the scope of this research is not fully protected.

After the selection of cases, these cases were analyzed using the operationalized dimensions for illustrative case analysis into a methodological scheme. This scheme has been drawn up with five dimensions, which all result from the theoretical framework described in this master thesis. Although this scheme made the analysis easier, it also found several cases that were in grey areas or simply could not be identified. That the orientations and pathways of the amended PSS typology are not always easy to classify makes it possible that the classifications based on one's own interpretation may appear biased. Moreover, the scheme of this research is not attached to the amended PSS typology, and leaves room for other academic research to approach the amended PSS typology in another way, resulting in other research findings.

After analyzing the synthesis of the cases, it was found that only one case was detected in the integration, product and service oriented PSS each. Therefore, when it comes to findings within these orientations, these cannot be generalized, since insufficient data can support the findings. Moreover, due to time constraints a limited amount of cases was assessed (10). Conducting a more thorough research would have picked more cases, when ensuring the reliability and validity of the study. Furthermore, the research is conducted by one researcher, which enables the analysis and results of this research to be somewhat biased. However, the explorative nature of this research does invite for more validating research to subjects that have been unveiled in this research.

7.6 Suggestions for future research

The presented research on an amended PSS typology has revealed a number of suggestions for future research, which are listed below.

One of the things future research can contribute in is to get a broader view and understanding of the PSS concept. The amended PSS typology presented did not process the advantages and disadvantages of the application of PSS. Also, it did no in-depth research when it comes to the sustainability of implementing PSS into the Servitization Business Model, thus, future research can be done on the extent of sustainability which is achieved through the adoption of PSS in the BM.

The amended PSS typology is established focusing on three key concepts (servitization, business models and value content). However, putting this focus on other key concepts could evolve in different and perhaps even more elements for the amended PSS typology. Therefore, the suggestion for future research is to study the amended PSS typology with the focus on different key concepts.

Neely (2008) made a subdivision for the product oriented PSS as proposed by Tukker (2004). The distinction that was made, made it easier to subdivide the case and it was much harder to distinguish the use and result oriented PSS. For that reason, the next suggestion for future research is to make a subdivision for them as well. Moreover, a suggestion is to make a classification list to distinguish the PSS orientations in order to classify cases.

Another suggestion for further research would be to verify these cases and identify and discover new, yet unknown SBMs into the amended PSS. Moreover, it also ensures that the amended PSS typology as proposed here is also brought to the attention of other researchers, resulting in a more valid PSS typology. Furthermore, a suggestion is to analyze more cases which are more diversified over the different PSS orientations in order to validate all included PSS orientations.

Moreover, analyzing this amended PSS typology while performing a different kind of research could contribute to the robustness of the typology. In this study, it was decided to carry out an illustrative case analysis, but a different type of research, such as surveys or interviews, may give a different outcome. Carrying out a different type of research to investigate the amended PSS typology will cause triangulation, which improves the reliability, validity and robustness of the amended PSS typology.

The illustrative cases assessed in this research all were examples of organizations who implemented servitization. However, the other way around should be assessed to make this amended PSS typology applicable for all pathways. Hence, the final suggestion for further research is to assess cases where deservitization was applied to come into, or past, the PSS spectrum.

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Appendices

Appendix A – Criteria to select cases

Criteria to select cases:

Nr.	Statement about the case	Check
1	The organization's business model is service-centric.	
2	The organization's business model combines products and services to gain a competitive advantage (implements servitization).	
3	The business model strives for multiple value creation	
4	The business is B2B or B2C.	
5	The case is still in existence.	
6	There is enough secondary research material available to conduct a thorough research.	
7*	The case's business model can be classified into one of the PSS orientations of the amended PSS typology. *	

*This may be exceeded, which could mean that the amended typology is not comprehensive.

Appendix B – Longlist PSS cases

Underneath the longlist of PSS cases is shown. In the second column, is indicated whether the source is Academical (A) or Non-Academical (N).

No.	A	Company	Country	Source(s)	Published
1	A	Airbnb	USA	Lewandowski (2016)	2016
2	A	Allegrini S.p.A.	Italy	Manzini, & Vezzoli, (2003)	2003
3	A	Alstom Transport	France	Baines & Lightfoot (2015)	2015
4	A	AMG solar heat selling service	Italy	Manzini, & Vezzoli, (2003)	2003
5	A	Arcomet	NL	Van Ostaeyen, (2014)	2014
6	A	Atlas Copro	Sweden	Van Ostaeyen, (2014)	2016
7	A	Blablacar	France	Lewandowski (2016)	2017
8	A	Boomerang	Sweden	Corvellec & Stål (2017)	2017
9	A	Bosch	Germany	Gaiardelli, Resta, Martinez, Pinto, & Albores, (2014)	2014
10	A	Call a bike	Germany	Beuren, Gomes Ferreira, & Cauchick Miguel (2013)	2013
11	A	Canon	Japan	Gaiardelli, Resta, Martinez, Pinto, & Albores, (2014)	2014
12	A	Castrol Inc	USA	Baines et al., (2007)	2007
13	A	Caterpillar	USA	Rashid, Asif, Krajnik, & Nicolescu, (2013)	2013
14	A	Cockerill Maintenance & Ingénierie	Belgium	Van Ostaeyen, (2014)	2014
15	A	DAF Trucks	NL	Gaiardelli, Resta, Martinez, Pinto, & Albores, (2014)	2014
16	A	Dell	USA	Lewandowski (2016)	2016
17	A	Didi & Gori S.p.A.	Italy	Manzini, & Vezzoli, (2003)	2003
18	A	Eastern Energy	UK	Baines et al., (2007)	2007
19	A	Econation	Belgium	Van Ostaeyen, (2014)	2014
20	A	EGO	Italy	Ceschin (2013)	2013
21	A	Electrolux	Sweden	Baines et al., (2007)	2007
22	A	ESCO	Finland	Ceschin (2013)	2013
23	A	Evergreen Lease	USA	Ceschin (2013)	2013
24	A	Filippa K	Sweden	Corvellec & Stål (2017)	2017
25	A	Greenwheels	NL	Lewandowski (2016)	2016
26	A	H&M	Sweden	Corvellec & Stål (2017)	2017

27	A	Habitacao Sekisui Chemical Co.	Japan	Beuren, Gomes Ferreira, & Cauchick Miguel (2013)	2013
28	A	Hilti	Liechtenstein	Van Ostaeyen, (2014)	2014
29	A	Indiska	Sweden	Corvellec & Stål (2017)	2003
30	A	Kluber	Germany	Manzini, & Vezzoli, (2003)	2016
31	A	Leasedrive	UK	Lewandowski (2016)	2015
32	A	MAN Trucks	Germany	Baines & Lightfoot (2015)	2014
33	A	Michelin	France	Van Ostaeyen, (2014)	2014
34	A	Miele	Germany	Gaiardelli, Resta, Martinez, Pinto, & Albores, (2014)	2014
35	A	Mobility	Switzerland	Baines et al., (2007)	2007
36	A	Mud Jeans	NL	Lewandowski (2016)	2016
37	A	Nudie	Sweden	Corvellec & Stål (2017)	2017
38	A	Parkersell	UK	Baines et al., (2007)	2007
39	A	PayXUse	Italy	Ceschin (2013)	2013
40	A	Philips Lighting	NL	Van Ostaeyen (2014)	2014
41	A	Qurrent	NL	Ceschin (2013)	2013
42	A	RICOH	Japan	Rashid, Asif, Krajnik, & Nicolescu, (2013)	2013
43	A	Rolls-Royce	UK	Van Ostaeyen, (2014)	2014
44	A	Siemens	Germany	Neely (2008)	2008
45	A	Smart Bike	USA	Ceschin (2013)	2013
46	A	Stone Rent-a-PC	UK	Lewandowski (2016)	2016
47	A	The Clothes Library	Australia	Corvellec & Stål (2017)	2017
48	A	ThredUP	USA	Lewandowski (2016)	2016
49	A	Uniforms for the dedicated	Sweden	Corvellec & Stål (2017)	2017
50	A	Vigga	Denmark	Corvellec & Stål (2017)	2017
51	A	Volkswagen	Germany	Gaiardelli, Resta, Martinez, Pinto, & Albores, (2014)	2014
52	A	Volvo	Sweden	Gaiardelli, Resta, Martinez, Pinto, & Albores, (2014)	2014
53	A	Whirlpool	USA	Beuren, Gomes Ferreira, & Cauchick Miguel (2013)	2013
54	A	Xerox	USA	Baines et al. (2007)	2007
55	A	Bosch	Germany	Neely (2008)	2008
56	A	DaimlerChrysler	Germany	Neely (2008)	2008
57	N	Rolls Royce	UK	https://www.mt.nl/made-in-nl/bedrijfsvoering/nieuwste-trend-product-dienst-maken-zo/	12-12-2016

58	N	KUKA	Germany	https://www.mt.nl/made-in-nl/bedrijfsvoering/nieuwste-trend-product-dienst-maken-zo/	12-12-2016
59	N	Vanderlande	NL	https://www.mt.nl/made-in-nl/bedrijfsvoering/nieuwste-trend-product-dienst-maken-zo/	12-12-2016
60	N	Philips Lightning	NL	https://www.mt.nl/made-in-nl/bedrijfsvoering/nieuwste-trend-product-dienst-maken-zo/	12-12-2016
61	N	Moba	NL	https://www.mt.nl/made-in-nl/bedrijfsvoering/nieuwste-trend-product-dienst-maken-zo/	12-12-2016
62	N	Ahrend	NL	https://www.mt.nl/made-in-nl/bedrijfsvoering/ahrend-ontzorgt-klanten-tot-puntjes/	01-05-2017
63	N	Mudjeans	NL	https://www.frankwatching.com/archive/2014/08/12/van-product-naar-dienst-nieuw-businessmodel-voor-apple-samsung/	12-08-2014
64	N	Adobe	USA	https://www.frankwatching.com/archive/2014/08/12/van-product-naar-dienst-nieuw-businessmodel-voor-apple-samsung/	12-08-2014
65	N	Microsoft	USA	https://www.frankwatching.com/archive/2014/08/12/van-product-naar-dienst-nieuw-businessmodel-voor-apple-samsung/	12-08-2014
66	N	Michelin	France (USA)	https://www.frankwatching.com/archive/2014/08/12/van-product-naar-dienst-nieuw-businessmodel-voor-apple-samsung/	12-08-2014
67	N	Dow Chemicals	USA	https://www.frankwatching.com/archive/2014/08/12/van-product-naar-dienst-nieuw-businessmodel-voor-apple-samsung/	12-08-2014
68	N	Spotify	Sweden	https://www.frankwatching.com/archive/2014/08/12/van-product-naar-dienst-nieuw-businessmodel-voor-apple-samsung/	12-08-2014
69	N	EcoNation	Belgium	Plan C	25-02-2014
70	N	Taxistop	Belgium	Plan C	25-02-2014
71	N	Sheltercare	Belgium	Plan C	25-02-2014
72	N	Dégage	Belgium	Plan C	25-02-2014
73	N	Floow2	NL	Plan C	25-02-2014
74	N	NNOF	Belgium	Plan C	25-02-2014
75	N	Interface	Belgium	Plan C	25-02-2014
76	N	Kringwinkel Antwerpen	Belgium	Plan C	25-02-2014
77	N	Rawijs	Belgium	Plan C	25-02-2014

78	N	DuPont Flooring Systems	USA	quora.com/What-are-the-best-examples-of-Product-service-systems-function-oriented-business-model-in-terms-of-improved-sustainability	26-03-2014
79	N	Xerox	USA	quora.com/What-are-the-best-examples-of-Product-service-systems-function-oriented-business-model-in-terms-of-improved-sustainability	26-03-2014
80	N	Canon	Japenese	quora.com/What-are-the-best-examples-of-Product-service-systems-function-oriented-business-model-in-terms-of-improved-sustainability	26-03-2014
81	N	OCÉ (nowadays Canon)	NL	quora.com/What-are-the-best-examples-of-Product-service-systems-function-oriented-business-model-in-terms-of-improved-sustainability	26-03-2014
82	N	Amazon	USA	quora.com/What-are-the-best-examples-of-Product-service-systems-function-oriented-business-model-in-terms-of-improved-sustainability	26-03-2014
83	N	Swapfiets	NL	https://toestemming.ndcmmediagroep.nl/?token=621f8923-e13d-489e-8ab5-6363ea586b0b	10-01-2020
84	N	Greenwheel s	NL	https://www.greenwheels.com/global	2020
85	N	Coolblue	NL	https://www.coolblue.nl/advies/alles-over-coolblue-abonnementen.html?redirect=abonnement	2020
86	N	SHARENOW	NL	https://www.share-now.com/	2020
87	N	Bundles	NL	https://bundles.nl/	2020
88	N	Wehkamp	NL	https://www.wehkamp.nl/	2020

Appendix C – Dataset of the illustrative cases assessed

Organization	Market orientation	Proposed PSS orientation(s)	Country of origin
DAF Trucks	B2B	(2) Product oriented PSS (3) Service oriented PSS	Netherlands
Michelin	B2B	(4) Use oriented PSS	France
MUD Jeans	B2B & B2C	(4) Use oriented PSS	Netherlands
Signify	B2B	(4) Use oriented PSS (5) Result oriented PSS	Netherlands
Greenwheels	B2B & B2C	(4) Use oriented PSS	Netherlands
Swapfiets	B2B & B2C	(4) Use oriented PSS	Netherlands
Wehkamp	B2B & B2C	(1) Integration oriented PSS	Netherlands
Coolblue	B2B & B2C	(4) Use oriented PSS (5) Result oriented PSS	Netherlands
Bundles	B2B & B2C	(4) Use oriented PSS (5) Result oriented PSS	Netherlands
SHARENOW	B2B & B2C	(4) Use oriented PSS	Germany

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