Product-Service Systems in the Digital Era: Deconstructing Servitization Business Model Typologies

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1. INTRODUCTION

A business model [BM] is understood as the logic by which a company creates value for its customers, delivers that value to customers and captures a part of that value for itself (Osterwalder & Pigneur, 2010; Teece, 2010; Zott, C., Amit, & Massa, 2011).The application of a servitization strategy potentially invokes many changes in, and decisions about, a company's BM(s). Service-oriented BMs provide various ways in which to operationalise servitization strategies by creating value through services and finding new ways of delivering and appropriating parts of that value.

The most obvious change associated with servitizing is that the core of a company's offerings shifts from products to services. Other potential changes involve the ways in which focal supplier companies interact through value co-creation with their customers (Vargo & Lusch, 2008), focal firms interact with other parties in surrounding ecosystems (e.g. Kohtamäki, Parida, Oghazie, Gebauerf, & Baines, 2019) and value is appropriated through performance-based contracts (Parida, Sjödin, & Reim, 2019).

Not surprisingly, researchers have made several attempts to categorise service BM archetypes (e.g., Brax and Visintin, 2017; Kowalkowski et al., 2015). In an early work on servitization, Wise and Baumgartner (1999) described four 'downstream' BMs that focused on the service content of offerings (embedded services, comprehensive services and integrated solutions) and value chain migration (distribution control). Subsequently, Michelini and Razzoli (2004) introduced a distinction based on product ownership.

Another literature stream has focused on product-service systems (PSSs), defined as '*tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific consumer needs*' (Tukker, 2004, p. 246). The PSS concept emerged as an approach for resource efficiency, theoretically achieved by shifting from the need for a product to the need for the function that the product enables (Mont, 2002). It has, however, come to encompass the general transition toward the use of new, service-oriented BMs (Tukker & Tischner, 2006; Tukker, 2015) and can be understood as '*an integrated combination of products and services*' (Baines et al., 2007).

Tukker (2004) proposed three main categories of PSS on a spectrum ranging from product-oriented to results-oriented services, with decreasing tangible product content and increasing intangible service content, and argued that BMs vary according to this spectrum. Tukker's (2004) typology has been cited widely, but it arguably conflates two key dimensions of BMs: results-orientedness and ownership (Michelini & Razzoli, 2004). Moreover, the current widespread digitalisation trend was not as strong when Tukker introduced this typology; today, digitalisation is central to much BM innovation (Kohtamäki et al., 2019). Manufacturing businesses are now '*entering the fourth industrial revolution (Industry 4.0) through capitalizing digitalization*' (Parida et al., 2019, p. 2). In this regard, Aas et al. (2020) empirically found that PSS BMs vary along three dimensions: results-orientedness, ownership and smartness of the provided services.

The aim of this chapter is to continue the discussion on service BM categorisation, especially in the PSS context. In this conceptual essay we use Tukker (2004)'s typology as a starting point and elaborate on extant theory. During the discussion we use findings from empirical research such as Aas et al. (2020) to illustrate our main arguments (Siggelkow, 2007).

The chapter is organised as follows. We first discuss the theory underlying typologies. In the ensuing section, we discuss and deconstruct Tukker's (2004) 15-year-old typology, first with respect to the results-orientedness and ownership dimensions, and then in light of digitalisation. From this discussion a new typology that corresponds to the taxonomy proposed by Aas et al. (2020) emerges. We then expand this typology, discuss and illustrate the resulting eight BM types and compare them with other typologies.

2. THEORY DEVELOPMENT

2.1. Typologies

The identification of PSS BM typologies, such as the typology of Tukker (2004), is part of a long research tradition in organizational studies often referred to as the configurational approach (Kohtamäki et al., 2019). Configuration theory acknowledges that the suitableness of a particular organizational configuration (where a configuration includes organizational dimensions such as processes, structures, practices, cultures and strategies) depends on its fit with the context (Venkatraman, 1989). Thus, discovering organizational configurations, in the form of typologies, is recognized as a fundamental approach in organizational theorizing (Meyer, Tsui and Hinings, 1993). Typologies have the potential to provide parsimonious frameworks for complex organisational phenomena (Doty & Glick, 1994), and can contribute to a range of tasks, such as concept formation and refinement, the elucidation of underlying dimensions and the creation of categories for classification and measurement (Collier, LaPorte, & Seawright, 2012).

Below we discuss two pressing issues related to Tukker's (2004) typology. First, how more recent literature has addressed the conflation of the ownership and results-orientedness dimensions in this typology, and second, how recent research explains the relationship between the contemporary digitalisation and PSS BMs.

2.2. PSS BM typologies, and the dimensions of ownership and results-orientedness

Tukker's (2004) typology was originally published in *Business Strategy and the Environment*. The first of the three main categories, product-oriented BMs, centres on product sales, with services sold as product add-ons and a low degree of results-orientedness. In the second main category, use-oriented BMs, manufacturers retain ownership of the products, which are made available to customers through various leasing, renting or sharing arrangements. The third main category, results-oriented BMs, centres on contracts between providers and buyers for the provision of functional results, rather than on the delivery of specific products.

Although Tukker (2004) implicitly recognizes the issue of ownership, 'use-oriented' may not be the best label for that particular BM dimension, as users' needs can be taken into account when implementing product- and results-oriented BMs (e.g. Resta, Powell, Gaiardelli, & Dotti, 2015). Thus, this category may be more accurately conceptualised according to the 'degree of ownership retention', which is more suitable from the viewpoint of environmental sustainability and material resource efficiency. By pooling products among different buyers and being incentivised to maintain and extend products´ lifespans, a provider can maximise capacity utilisation and requires fewer products. Thus, less raw material and energy are needed for the production of new products.

Whether the ‘retention of ownership’ belongs on the same continuum as results orientation may also be questioned. In some reported cases (e.g. Kowalkowski, Gebauer, Kamp, & Parry, 2017), manufacturers retain ownership of products while simultaneously establishing results-oriented contracts with customers. For example, Michelin offers a range of efficiency services to commercial transportation firms in addition to tires (Kowalkowski et al., 2017). This example is contrary to findings from capital-intensive industries, where the retention of ownership and results-orientation do not always go together (Aas et al., 2020). For customers in these industries, an ‘asset-light’ strategy involving the leasing of products may be attractive for purely financial reasons, rather than environmental sustainability. Thus, an ownership-based BM requires that the supplier has a solid financial position and assets (i.e., a “strong balance sheet”), often generated in cooperation with a financial institution. Such a BM requires that the supplier can provide services to, and take custody of, a product regardless of its location, which may not be easy or desirable in the case of mobile products (e.g. those installed onboard ships).

Results-orientation, in turn, is a strong trend in contemporary service sales. For example, outcome- and performance-based contracting (Liinamaa et al., 2016; Ng, Ding, & Yip, 2013) has been advocated as a fundamental element of new BMs (if not a BM in its own right). This trend is exemplified by the increased interest in value-based pricing (e.g. Reen, Hellström, Wikström, & Perminova-Harikoski, 2017; Töytäri, Rajala, & Alejandro, 2015) and value-based selling of services (e.g. Luotola, Hellström, Gustafsson, & Perminova-Harikoski, 2017; Töytäri & Rajala, 2015). However, the implementation of a results-oriented BM is not easy or risk free. For this reason, many services are still sold through product-oriented contracts, with fewer rewards for the actual results.

Thus, we propose that ‘results-orientedness’ and the ‘degree of ownership retention’ are two BM dimensions of servitized firms that do not belong on a one-dimensional continuum, as

proposed by Tukker (2004). From a BM perspective (Osterwalder & Pigneur, 2010; Teece, 2010; Zott, C. et al., 2011), we suggest that these dimensions belong on separate continuums related to how value is captured and how value for customers is created, respectively.

2.3. PSS BM typologies and the digital dimension

Existing service BM typologies have previously been very useful (e.g. Williams, 2007), but their relevance may be questioned in the contemporary context, as we enter the fourth industrial revolution and companies rely increasingly on digital technologies to maintain competitiveness.

Companies' strategies and BMs are likely to change with the increased offering of smart products and services (Allmendinger & Lombreglia, 2005; Porter & Heppelmann, 2015). This shift, here referred to as 'digital servitization' (Kohtamäki et al., 2019), involves revisiting existing PSS BM typologies. For example, Baines and Lightfoot (2013, 2014) used different customer profiles as the basis for the categorisation of PSSs offerings by manufacturers as "base", "intermediate" and "advanced" services. Specifically, to deliver advanced services, they observed that manufacturers typically deploy information and communication technologies that enable the provision of remote monitoring services related to product location, condition and use. Kohtamäki et al. (2019) furthered the theoretical development in this field by presenting a framework for the construction of offerings in digital servitization along three dimensions: solution customisation, solution pricing and solution digitalisation. The latter dimension is related to the capabilities that smart products and services offer in terms of monitoring, control, optimisation and autonomy (Porter & Heppelmann, 2015).

Aas et al. (2020) extended Kohtamäki et al.'s (2019) framework by proposing a taxonomy covering the three generic BM dimensions of value creation, value delivery and value capture

(Figure 1). In this empirically derived taxonomy, the smart digital element is a means of delivering the service, and not the core of the offering. This approach is in line with Amit and Zott's (2001; Zott & Amit, 2010) activity systems perspective of BM innovation. Inspired by examples from early e-commerce, they argued that BM innovation can occur by altering the content, sequence or governance of underlying activities (Amit and Zott, 2001; Zott and Amit, 2010). A case in point is the way in which e-marketplaces bypass incumbent distribution channels. Hence, in the value delivery dimension of our framework, we distinguish BMs with high and low degrees of 'smartness'. Similarly, Allmendiger and Lombreglia (2005) distinguished traditional and smart (digital) services. We claim that this extension is important, specifically since empirical research has found that traditional and digital services co-exist (Aas et al., 2020).

Thus, the extant literature identifies three main dimensions of PSS BMs, related to the three main BM components (value creation, value delivery and value capture). These dimensions are illustrated in Figure 1.1 as the degrees of ownership retention, smartness and results-orientation.

(INSERT FIGURE 1.1 ABOUT HERE)

Figure 1.1 PSS BM dimensions

3. THE EIGHT TYPES OF SERVICE-ORIENTED BM

The dimensions illustrated in Figure 1 are not dichotomous (e.g. whether or not to implement a results-oriented contract), but rather fall along continuums, as captured by the use of the term 'degree'. In an empirical study, Aas et al. (2020) found several examples in which some parts of PSSs were accompanied by results-oriented contracts and others were accompanied

by more traditional product-oriented contracts. The same principle applies to the other dimensions. Smart digital technology may be heavily used in some parts of a PSS and to a lesser extent in others, and some parts of the system can be made available through leasing arrangements while other parts are sold to customers. As companies can choose different degrees of results orientation, ownership retention and smartness, and combine these dimensions in different ways, an infinite number of PSS BMs is possible, rendering BM decision making in this context very challenging.

Nevertheless, with the aim of increasing the manageability of this complexity, we focus on the outliers in each dimension, resulting in the creation of a new typology with eight PSS BM categories (Figure 1.2). In this section, we briefly describe and discuss these PSS BM types.

(INSERT FIGURE 1.2 ABOUT HERE)

Figure 1.2 New typology with eight PSS BM categories

3.1. BM 1a: Product sales and add-on services

This BM type is arguably the most traditional PSS BM (Tukker, 2004). A manufacturing firm sells a product to customers, with add-on services related to the product sold on a case-by-case basis. The price of the services can be based on supplier costs (e.g. the customer pays a fixed fee or according to a cost-plus contract) or customer use intensity (e.g. the customer pays an hourly rate) (e.g. Bonnemeier, Burianek, & Reichwald, 2010). A wide range of add-on services is relevant when implementing BM 1a, and Partanen et al. (2017) provide a useful overview with the distinction of pre-sales, R&D, operational, product support and product lifecycle services. In their empirical study, Aas et al. (2020) observed that companies providing complex products, such as advanced offshore load handling equipment, often

provided add-on services in most of these categories, whereas companies providing less-complex products, such as flat hoses, provided add-on services in fewer categories.

3.2. BM 1b: Product sales and smart add-on services

This BM is similar to the traditional BM 1a, since product ownership is transferred to the customer and product-related add-on services are provided on a case-by-case basis, and priced using a supplier cost or service use intensity regime. However, when implementing BM 1b and delivering a smart add-on service, a supplier utilises digital technology and data to a large extent. As also argued by other authors, increasingly physical products are digitally networked and integrated with information systems, which '*enable*[s] *the co-creation of 'smart service' that is based on monitoring, optimization, remote control, and autonomous adaptation of products*' (Beverungen, Müller, Matzner, Mendling, & vom Brocke, 2019, p. 7; see also e.g. Zheng, Lin, Chen, & Xu, 2018). Empirical findings from Aas et al. (2020) suggest that BM 1b is used quite commonly; one example is a supplier of advanced offshore drilling equipment that had integrated numerous sensors in its equipment. Data from these sensors was not only useful when providing product lifecycle services, such as maintenance, but also enabled the firm to provide advanced operational services by which they helped customers to use the equipment optimally.

3.3. BM 2a: Product sales and integrated services

When implementing BM 2a, a manufacturer transfers ownership of a product to a customer in the same manner as in BMs 1a and 1b. However, rather than selling add-on services on a case-by-case basis, the manufacturer establishes a results-oriented service contract (often long-term) with the customer. According to Selviaridis and Wynstra (2015, p. 3505) a results-oriented contract '*can be briefly defined as the contractual approach of tying at least a portion of supplier payment to performance*'. Key performance indicators (KPIs) are

fundamental elements of such contracts, as they provide the basis for supplier payments (Selviaridis & Wynstra, 2015) and a value-based pricing strategy (rather than supplier cost or service use intensity) is typically used to determine the prices of services included in the contracts (e.g. Lindström, 2013). A challenge associated with the implementation of results-oriented contracts is that '*service performance is often not only dependent on supplier effort but also on the behavior of the buying firm*' (Akkermans, Oppen, Wynstra, & Voss, 2019, p. 22), implying that suppliers and customers often need to co-create such contracts (Luotola et al., 2017). Aas et al. (2020) identified a few cases in which results-oriented contracting was used without digital technology; for example, one supplier provided equipment that was supposed to reduce the need for manual labour and was paid accordingly.

3.4. BM 2b: Product sales and smart integrated services

This BM is similar to the more traditional BM 2a in that product ownership is transferred to a customer while services are sold through results-oriented contracts. The difference between BMs 2a and 2b is the utilisation of digital technologies to provide smart services in the latter. Several firms in the empirical study (Aas et al., 2020) employed BMs of this type. For example, a supplier of advanced offshore drilling equipment had established a long-term results-oriented maintenance contract with a customer in which the main KPIs were related to the equipment uptime. To optimise maintenance, the supplier analysed large amounts of data from sensors installed in its equipment. Similar cases in sectors such as defence, transportation and construction have been reported (Kowalkowski et al., 2017).

3.5. BM 3a: Product leasing and add-on services

This BM is similar to BM 1a, although a supplier retains ownership of its product, which is made available to a customer through a leasing arrangement. The customer purchases add-on services related to the product in the same manner as in BM 1a. This option is viable for

expensive equipment (Aas et al., 2020). Leasing, rather than buying, equipment could be financially beneficial for the customer. The use of BM 3a, sometimes referred to as 'dry leasing', has also been reported in the airline industry (Hsu, Chao, & Huang, 2013).

3.6. BM 3b: Product leasing and smart add-on services

Another option is to use digital technology to sell smart add-on services in combination with the leasing of a product to a customer. This BM is similar to the more traditional BM 1b, with the difference being the use of digital technology to provide smart services. BM 3b is also used in other industries, such as the automobile industry, in which vehicles packed with digital technologies are leased to consumers and business customers (e.g. Williams, 2007).

3.7. BM 4a: Product leasing and integrated services

In BM 4a, a product is made available to a customer with no transfer of ownership, and services are sold through a combined leasing and results-oriented contract. This BM is similar to BM 2a, with the exception of the ownership dimension. It is also used, for example, in the airline industry, and is sometimes referred to as 'wet leasing' (Hsu et al., 2013). BM4a may be suitable, for example, for risk-averse customers with limited equity who need capital-intensive equipment to carry out their operations.

3.8. BM 4b: Product leasing and smart integrated services

In BM 4b, a manufacturing firm makes a product available to a customer without transferring ownership while selling smart services through a combined leasing and results-oriented contract. Many examples of the use of this BM in the market (e.g. Xerox's offering of pay-per-use services) have been described (Kowalkowski et al., 2017). BM 4b is probably more common than BM 4a, as it incentivises suppliers to use digital technologies to optimise maintenance and operations when these services are not purchased traditionally as add-ons

(Selviaridis & Wynstra, 2015). BMs 4a and 4b are arguably the most service-oriented BMs available to manufacturers, as they do not involve the offering of any tangible product.

4. CONCLUDING REMARKS

In this chapter, we provide a framework bridging extant PSS typologies, emphasising the role of digital technologies in servitization BMs. The proposed three PSS BM continuums and the new typology, which distinguishes eight types of BMs available to servitized manufacturers, are built on Tukker (2004), Kohtamäki et al. (2019) and Aas et al. (2020). The proposed typology serves to bridge the contributions of Tukker (2004) and Kohtamäki et al. (2019) to achieve relevance in the digital era.

Extant research on PSS BMs has a wide variety of theoretical bases. The ownership dimension of PSSs is examined using frameworks derived from sustainability science, whereas the results orientation is considered based on various forms of governance theory (e.g., transaction cost economies and contract theory). In developing their framework, Kohtamäki et al. (2019) drew on a wide range of foundational theories of the firm, in line with Santos and Eisenhardt's (2005) solid conceptions. Aas et al. (2020), in turn, based their taxonomy on empirical observations, as in much servitization research (Rabetino, Harmsen, Kohtamäki, & Sihvonen, 2018). In general, the BM conceptualisation proposed in this chapter is rooted in the resource-based view (Amit & Zott, 2001) and innovation appropriation theory (Teece, 1986). Thus, the proposed framework represents an amalgamation of multiple academic traditions for PSSs underpinned by digitally enabled intangible deliverables.

It has been argued that BMs may be used to operationalise servitization strategies (Gebauer et al., 2010). Thus, from a configuration theory viewpoint the typology presented in this chapter may be perceived as different configurations of servitization strategies. The suggested

typology may therefore be useful for future configuration research aiming to identify the antecedents, processes, and effects of servitization in different contexts (Kohtamäki et al., 2019).

The proposed typology is also useful for practitioners in two ways: First, the framework can be used as a sensitising concept (Blumer, 1954) that enables practitioners to assess BM options along the three identified continuums. According to Blumer (1954, p. 7), sensitising concepts lack clear definition in terms of attributes or fixed benchmarks, but give the user a general sense of reference and guidance in approaching empirical cases.

Second, the three PSS BM continuums and eight types of PSS BM can be conceived as a navigational tool for manufacturing firm managers who aim to develop innovative BMs in the digital era. The framework provides users with a common language that simplifies communication and makes the evaluation of different opportunities more robust. BMs are often used for constant testing and fine-tuning. In this regard, we recommend that the typology be used as a learning tool for organisations experimenting with service-oriented BMs.

REFERENCES

Aas, T. H., Breunig, K.,J., Hellström, M. M., & Hydle, K. M. (2020). Service-oriented business models in manufacturing in the digital era: toward a new taxonomy. *International Journal of Innovation Management*, 2040002.

Akkermans, H., Oppen, W. v., Wynstra, F., & Voss, C. (2019). Contracting outsourced services with collaborative key performance indicators. *Journal of Operations Management, 65*(1), 22-47. doi:10.1002/joom.1002

Allmendinger, G., & Lombreglia, R. (2005). Four strategies for the age of smart services. *Harvard Business Review,* (October 2005) Retrieved from https://hbr.org/2005/10/four-strategies-for-the-age-of-smart-services

Amit, R., & Zott, C. (2001). Value creation in e-business. *Strategic Management Journal, 22*(6-7), 493-520.

Baines, T., Lightfoot, H. W., Evans, S., Neely, A., Greenough, R., Peppard, J., . . . Wilson, H. (2007). State-of-the-art in product-service systems. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture, 221*(10), 1543-1552. doi:10.1243/09544054JEM858

Baines, T., & Lightfoot, H. (2013). *Made to serve: How manufacturers can compete through servitization and product service systems*. Hoboken, NJ: Wiley. Retrieved from https://www.wiley.com/en-us/Made+to+Serve%3A+How+Manufacturers+can+Compete+Through+Servitization+and+Product+Service+Systems-p-9781118585313

Baines, T., & Lightfoot, H. (2014). Servitization of the manufacturing firm: Exploring the operations practices and technologies that deliver advanced services. *International Journal of Operations & Production Management, 34*(1), 2-35. doi:10.1108/IJOPM-02-2012-0086

Beverungen, D., Müller, O., Matzner, M., Mendling, J., & vom Brocke, J. (2019). Conceptualizing smart service systems. *Electronic Markets, 29*(1), 7-18. doi:10.1007/s12525-017-0270-5

Blumer, H. (1954). What is wrong with social theory? *American Sociological Review, 19*(1), 3-10. doi:10.2307/2088165

Bonnemeier, S., Burianek, F., & Reichwald, R. (2010). Revenue models for integrated customer solutions: Concept and organizational implementation. *Journal of Revenue and Pricing Management, 9*(3), 228-238. doi:10.1057/rpm.2010.7

Brax, S. A., & Visintin, F. (2017). Meta-model of servitization: The integrative profiling approach. *Industrial Marketing Management,* 60, 17-32.

Casadesus-Masanell, R., & Ricart, J. E. (2010). From strategy to business models and onto tactics. *Long Range Planning, 43*(2), 195-215. doi:10.1016/j.lrp.2010.01.004

Collier, D., LaPorte, J., & Seawright, J. (2012). Putting typologies to work: Concept formation, measurement, and analytic rigor. *Political Research Quarterly, 65*(1), 217-232. doi:10.1177/1065912912437162

Doty, D. H., & Glick, W. H. (1994). Typologies as a unique form of theory building: Toward improved understanding and modeling. *The Academy of Management Review, 19*(2), 230-251. doi:10.2307/258704

Gebauer, H., Edvardsson, B., Gustafsson, A., & Witell, L. (2010). Match or mismatch: Strategy-structure configurations in the service business of manufacturing companies. Journal of Service Research, 13(2), 198-215.

Hsu, C., Chao, C., & Huang, P. (2013). Fleet dry/wet lease planning of airlines on strategic alliance. *Transportmetrica A: Transport Science, 9*(7), 603-628. doi:10.1080/18128602.2011.643508

Kohtamäki, M., Henneberg, S. C., Martinez, V., Kimita, K., & Gebauer, H. (2019). A configurational approach to servitization: review and research directions. *Service Science*, 11(3), 213-240.

Kohtamäki, M., Parida, V., Oghazie, P., Gebauerf, H., & Baines, T. (2019). Digital servitization business models in ecosystems: A theory of the firm. *Journal of Business Research, 104*, 380-392. doi:10.1016/j.jbusres.2019.02.012

Kowalkowski, C., Windahl, C., Kindström, D., & Gebauer, H. (2015). What service transition? Rethinking established assumptions about manufacturers' service-led growth strategies. *Industrial marketing management*, 45, 59-69.

Kowalkowski, C., Gebauer, H., Kamp, B., & Parry, G. (2017). Servitization and deservitization: Overview, concepts, and definitions. *Industrial Marketing Management, 67*, 4-10. doi:10.1016/j.indmarman.2017.09.009

Liinamaa, J., Viljanen, M., Hurmerinta, A., Ivanova-Gongne, M., Luotola, H., & Gustafsson, M. (2016). Performance-based and functional contracting in value-based solution selling. *Industrial Marketing Management, 59*, 37-49. doi:10.1016/j.indmarman.2016.05.032

Lindström, J. (2013). A model for value-based selling: Enabling corporations to transition from products and services towards further complex business models. *Journal of Multi Business Model Innovation and Technology, 2*(1), 67-98. doi:10.13052/jmbmit2245-456X.213

Luotola, H., Hellström, M., Gustafsson, M., & Perminova-Harikoski, O. (2017). Embracing uncertainty in value-based selling by means of design thinking. *Industrial Marketing Management, 65* doi:10.1016/j.indmarman.2017.05.004

Meyer, A. D., Tsui, A. S., & Hinings, C. R. (1993). Configurational approaches to organizational analysis. *Academy of Management journal*, 36(6), 1175-1195.

Michelini, R. C., & Razzoli, R. P. (2004). Product-service eco-design: Knowledge-based infrastructures. *Journal of Cleaner Production, 12*(4), 415-428. doi:10.1016/S0959-6526(03)00036-2

Mont, O. K. (2002). Clarifying the concept of product–service system. *Journal of Cleaner Production, 10*(3), 237-245. doi://dx.doi.org/10.1016/S0959-6526(01)00039-7

Ng, I. C. L., Ding, D. X., & Yip, N. (2013). Outcome-based contracts as new business model: The role of partnership and value-driven relational assets. *Industrial Marketing Management, 42*(5), 730-743. doi:10.1016/j.indmarman.2013.05.009

Osterwalder, A., & Pigneur, Y. (2010). *Business model generation*. Hoboken, NJ: Wiley.

Parida, V., Sjödin, D., & Reim, W. (2019). Reviewing literature on digitalization, business model innovation, and sustainable industry: Past achievements and future promises. *Sustainability, 11*(2), 391. doi:10.3390/su11020391

Partanen, J., Kohtamäki Marko, Vinit, P., & Joakim, W. (2017). Developing and validating a multi-dimensional scale for operationalizing industrial service offering. *Journal of Business & Industrial Marketing, 32*(2), 295-309. doi:10.1108/JBIM-08-2016-0178

Porter, M. E., & Heppelmann, J. E. (2015, -10-01T04:00:00Z). How smart, connected products are transforming companies. *Harvard Business Review*, Retrieved from https://hbr.org/2015/10/how-smart-connected-products-are-transforming-companies

Rabetino, R., Harmsen, W., Kohtamäki, M., & Sihvonen, J. (2018). Structuring servitization-related research. *International Journal of Operations & Production Management, 38*(2), 350-371. doi:10.1108/IJOPM-03-2017-0175

Reen, N., Hellström, M., Wikström, K., & Perminova-Harikoski, O. (2017). Towards value-driven strategies in pricing IT solutions. *Journal of Revenue and Pricing Management,* , 1-15. doi:10.1057/s41272-017-0079-z

Resta, B., Powell, D., Gaiardelli, P., & Dotti, S. (2015). Towards a framework for lean operations in product-oriented product service systems. *CIRP Journal of Manufacturing Science and Technology, 9,* 12-22. doi:10.1016/j.cirpj.2015.01.008

Santos, F. M., & Eisenhardt, K. M. (2005). Organizational boundaries and theories of organization. *Organization Science, 16*(5), 491-508. doi:10.1287/orsc.1050.0152

Selviaridis, K., & Wynstra, F. (2015). Performance-based contracting: A literature review and future research directions. *International Journal of Production Research, 53*(12), 3505-3540. doi:10.1080/00207543.2014.978031

Siggelkow, N. (2007). Persuasion with case studies. *Academy of Management Journal, 50*(1), 20-24. doi:10.5465/AMJ.2007.24160882

Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy, 15*(6), 285-305. doi:10.1016/0048-7333(86)90027-2

Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning, 43*(2), 172-194. doi:10.1016/j.lrp.2009.07.003

Töytäri, P., & Rajala, R. (2015). Value-based selling: An organizational capability perspective. *Industrial Marketing Management, 45*, 101-112. doi:10.1016/j.indmarman.2015.02.009

Töytäri, P., Rajala, R., & Alejandro, T. B. (2015). Organizational and institutional barriers to value-based pricing in industrial relationships. *Industrial Marketing Management, 47*, 53-64. doi:10.1016/j.indmarman.2015.02.005

Tukker, A. (2004). Eight types of product–service system: Eight ways to sustainability? experiences from SusProNet. *Business Strategy and the Environment, 13*(4), 246-260. doi:10.1002/bse.414

Tukker, A. (2015). Product services for a resource-efficient and circular economy – a review. *Journal of Cleaner Production, 97*, 76-91. doi:10.1016/j.jclepro.2013.11.049

Tukker, A., & Tischner, U. (2006). Product-services as a research field: Past, present and future. reflections from a decade of research. *Product Service Systems: Reviewing Achievements and Refining the Research Agenda, 14*(17), 1552-1556. doi://dx.doi.org/10.1016/j.jclepro.2006.01.022

Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: Continuing the evolution. *Journal of the Academy of Marketing Science, 36*(1), 1-10.

Venkatraman, N. (1989). The concept of fit in strategy research: Toward verbal and statistical correspondence. *Academy of management review*, 14(3), 423-444.

Williams, A. (2007). Product service systems in the automobile industry: Contribution to system innovation? *Journal of Cleaner Production, 15*(11), 1093-1103. doi:10.1016/j.jclepro.2006.05.034

Wise, R., & Baumgartner, P. (1999). Go downstream: The new profit imperative in manufacturing. *Harvard Business Review, 77*(5), 133-141.

Zheng, P., Lin, T., Chen, C., & Xu, X. (2018). A systematic design approach for service innovation of smart product-service systems. *Journal of Cleaner Production, 201*, 657-667. doi:10.1016/j.jclepro.2018.08.101

Zott, C., Amit, R., & Massa, L. (2011). The business model: Recent developments and future research. *Journal of Management, 37*(4), 1019-1042. doi:10.1177/0149206311406265

Zott, C., & Amit, R. (2010). Business model design: An activity system perspective. *Long Range Planning, 43*(2), 216-226. doi:10.1016/j.lrp.2009.07.004