



**HAL**  
open science

# The Contracting of Advanced Services Based on Digitally-Enabled Product-Service Systems

Shaun West, Zou Wenting, Oliver Stoll

► **To cite this version:**

Shaun West, Zou Wenting, Oliver Stoll. The Contracting of Advanced Services Based on Digitally-Enabled Product-Service Systems. IFIP International Conference on Advances in Production Management Systems (APMS), Sep 2021, Nantes, France. pp.228-237, 10.1007/978-3-030-85902-2\_25 . hal-04117669

**HAL Id: hal-04117669**

**<https://inria.hal.science/hal-04117669>**

Submitted on 5 Jun 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License



This document is the original author manuscript of a paper submitted to an IFIP conference proceedings or other IFIP publication by Springer Nature. As such, there may be some differences in the official published version of the paper. Such differences, if any, are usually due to reformatting during preparation for publication or minor corrections made by the author(s) during final proofreading of the publication manuscript.

# The contracting of advanced services based on digitally-enabled product-service systems

Prof. Dr. Shaun West<sup>1</sup>[0000-0002-8042-1459], Zou Wenting<sup>2</sup>  
and Oliver Stoll<sup>1</sup>[0000-0002-1918-3842]

<sup>1</sup>School of Technology and Architecture, Lucerne University of Applied Sciences and Arts,  
Lucerne, Switzerland  
shaun.west@hslu.ch & oliver.stoll@hslu.ch

<sup>2</sup>Aalto University  
Otakaari 1B, FI-00076 AALTO, Finland  
wenting.zou@aalto.fi

**Abstract.** This paper uses an integrative literature review to explore the contracting of advanced services based on digitally-enabled product-service systems (PSS). The need for this study was derived from studies that have highlighted the difficulty of selling and buying advanced services with a digital element. Other studies confirmed that firms had challenges with obtaining the value expected from such advanced service contracts. The integration of digital into a PSS value proposition increases the complexity and the potential application of advanced services. The emergence of digitally-enabled PSS (based on "Smart Products" in many cases) suggests a need to understand the sales and contracting process better. An integrative literature review was chosen, as the literature was fragmented between different fields. Forty-eight papers were selected as relevant, and 14 were then considered key to creating an initial model for the contracting process. It was identified that there were limited examples of contracts with high degrees of value-cocreation and that the ability of manufacturing firms to translate a value proposition successfully into a binding contract was weak. The contract negotiation process was found to be well defined, yet the governance of such contacts over their duration was again weak. For these reasons, a model based on the lifecycle was proposed. The model should be further integrated into the contracting process for services. This is an initial study, and it is recommended that further research should test the model.

**Keywords:** value propositions, offers, contracts, product-service system, digital.

## 1 Introduction

Reflecting the increasing importance of services in all industries, recent studies report a significant rise of interest in servitization of manufacturing firms over the past two decades [1,2]. This interest continues to grow rapidly and in line with the progress of

research on service-dominant logic [3]. Servitization is considered a competitive strategy for manufacturing to survive in competitive markets to address diverse customer needs and then gain revenue growth [4].

New research interests have arisen in the area of advanced services, where value is co-created through in-depth interactions and extensive capability integration between the manufacturing firm and the customer [1]. These interactions are based on the exchange of data, information, and knowledge. With digital transformation, the importance of advanced services has increased substantially in line with the introduction of digital technologies such as big data and the Internet of Things [5]. This inevitably increases risks and complexities for manufacturing firms during a collaborative process with their customers, which complicates the design of service contracts [6].

The previous studies [7,8] have identified that some buyers are not used (or are unable) to buy advanced services, whereas some suppliers cannot develop a suitable contract for advanced services. A study in the Harvard Business Review shows that firms lose between five to forty percent of value on a deal because of inefficient contract management [9]. Furthermore, inefficient contracts could also lead to legal problems due to the usage, storage, and ownership of data in addition to more traditional contractual disputes. Because of these challenges, designing and managing contracts for advanced services is difficult and complex. However, very little work has been done to provide guidance on the contract design for the effective delivery of advanced services.

The integration of digital into PSS, or in some cases Smart Products, means that many more firms are developing PSS with advanced service attributes. Yet, without a contract that reflects the offer, the likelihood of successful commercialization is limited. Therefore, there is an urgent need to identify a contracting model for advanced services contracts in B2B contexts to improve today's research-based knowledge of advanced services contracts. The purpose of this paper is to provide initial input into such a model, which can then be further tested and further developed.

## **2 Research Framework and Methodology**

PSS is a mature research field, yet the commercializing of digitally-enabled PSS remains poorly investigated, particularly the development of advanced service contracts. There is a need for a model to describe the development of advanced service contracts within industrial contexts. Given the degree of variety in the research knowledge relating to the contracting of advanced services, an integrative literature review has been chosen for this study. This approach allows integrating knowledge from other research fields with a critical focus on how value is co-created through in-depth interactions and extensive capability integration between the manufacturing firm and the customer. The outcome of this review will be a theoretical model which can be applied for future studies. This approach requires that the literature and the main ideas and relationships of the issue are critically analyzed.

The methodology based on the integrative literature review follows the conceptual structure of the contracting process for advanced services within an industrial PSS context [10,11]. Web of Science was chosen as the database for the literature search. The analysis of the literature is based on the premise that digitally-enabled PSS provides the opportunities for outcome- or performance-based contracts. The data set was built by searching the following keywords (within the titles, abstract and keywords fields): TS=(servitization AND “outcome based contracts”) OR TS=(servitization AND “performance based contract”) OR TS=(“contract” AND “service-dominant logic”) OR TS=(Servitization AND procurement). The search was limited to literature within B2B environments that was relevant to long-life industrial PSS assets.

### **2.1 Dimension selection for the literature review**

Advanced service within the context of servitization is focused on value creation [1]; there has been significant discussion about value-in-exchange, value-in-use, and value-in-context within the literature [3]. Therefore, based on the association with advanced services within a PSS environment, it was considered important to focus on four aspects of value: drivers; creation (or co-creation); delivery; and capture. Marketing theory and service science, particularly SD logic, support the approach and the appropriate selection of the four value dimensions. Additionally, from SD logic [3,4], value creation and co-creation demand a multi-actor perspective, making this an important consideration for the literature review. Considering the PSS focus of the review, the lifecycle perspectives are essential, as there are phases in the lifecycle where different activities are necessary for contracting [5]. Returning to the contracting focus of the study, papers that describe contracting within the context of advanced services should be assessed.

## **3 Integrative literature review**

New digitalized technologies are being integrated into traditional PSS offers and value propositions within the context of servitization [12, 13]. Given the servitization focus and the importance of value co-creation, PSS and, in particular, advanced services literature have been assessed according to the value drivers; value creation; value co-creation; and value capture. Short insights from the process will be provided. 48 papers were identified and considered to provide useful insights for this integrative literature review, 14 of those were considered to provide significant value in building the model (Table 1).

### **3.1 Assessment of literature**

The literature gap in advanced service contracting was identified in 2016 [15] and continues to exist. The conflict between the value proposition and the contract is described naïvely [26]. This demonstrates that some firms find it challenging to transfer the value proposition's intent into a legally binding agreement between the parties and are unable to, in effect, create a fully formed offer (or solution) [27]. There exists a poor understanding of the transformation of the value proposition into a boilerplate (or template)

contract and the ongoing re-application of boilerplate contracts as the basis for an advanced service contract [17].

One study [19] described contract structures, including the form of typical advanced service agreements and the actor responsibilities for service delivery. Other papers tend to take a more marketing-led view of contracts, rather than using the fundamentals of contracting. The actors included in the contracting process have been well described [17] and the model proposed gives a solid foundation for converting a value proposition into a contract, considering the actors who are involved and when they are included in the contracting process. The use of the lifecycle supports the application of service-dominant logic during the pre-negotiation and negotiation process. However, it lacks governance and contract management during the delivery phase [20]. Linking the pre- and post-contract phases, including the importance of multi-actor engagement, is essential and confirms the importance of contract governance in the delivery phase [14].

**Table 1.** Key references from the literature study ordered based on the dimension

Reference	Value drivers	Value creation	Value delivery	Value capture	Multi-actor perspective	Lifecycle perspectives	Contract process
[14] Broekhuis, M., & Scholten, K. (2018) 12	x	x	x	X	X	X	X
[15] Essig, M., Glas, A. H., Selviaridis, K., & Roehrich, J. K. (2016)	x	x	x	x	X	X	X
[16] Hou, J., & Neely, A. (2018)	x	x	X	x	X	x	x
[17] Liinamaa, J., Viljanen, M., Hurmerinta, A., Ivanova-Gongne, M., Luotola, H., & Gustafsson, M. (2016)	X	X	X	X	X	x	X
[18] Riialand, A., Nesheim, D. A., Norbeck, J. A., & Rødseth, Ø. J. (2014)	x	x	x	X	X	X	X
[19] Kleemann, F. C., & Essig, M. (2013)	x	x	X	x	X		X
[20] Nystén-Haarala, S., Lee, N., & Lehto, J. (2010)	x	x	x		X	X	X
[21] Raja, J. Z., Frandsen, T., Kowalkowski, C., & Jarmatz, M. (2020)	X	X	X	x	x	x	
[22] Razmdoost, K., & Mills, G. (2016)	X	X	x	x		X	X
[23] Smith, L., Maull, R., & Ng, I. C. L. (2014)	x	X	X		X	x	x
[24] Tjendani, H. T., Anwar, N., & Putu Artama Wiguna, I. (2018)	x	x	X	x	X		X
[25] Zou, W., Brax, S. A., Vuori, M., & Rajala, R. (2019)	x	x	x		X	X	x
[26] Ng, I. C. L., Maull, R., & Yip, N. (2009)	X	X	X		X		x
[27] Töytäri, P. (2018)	X	X	x				

Notes: X – major relevance; x – minor relevance

The application of service-dominant logic in terms of value identification and co-creation within an advanced service contract is essential and not in any way easy to deliver [22, 23, 26]. Risk is an alternative form of value, and the transfer of risk [16] can be viewed as an essential part of the value proposition that needs to be included in the contract [16]. The importance of a shared understanding of the customer's value creation process within the context of advanced service is described in the literature [21]. Missing within this approach is risk perception; the approach may be combined with others [24] to quantify the value of risk transfer in an advanced service contract.

A few of the papers reviewed [25, 18] consider the buyer's (or beneficiary's) perspective. There are several ways to achieve this; during the contracting process or during the delivery phase, the application of standard KPIs appears to be common (e.g., the measurement of availability or reliability).

In summary, there is a gap in the literature on the design of suitable forms of contract based on the underlying value proposition. This is partially described through the value identifying processes, but the details of integrating this into a form of contract are missing. The contracting process is well described in the literature, yet the governance of the contract in the delivery phase is poorly defined. The aspect of digital PSS is absent within the literature reviewed with respect to the translation of the value proposition into a contract, during the contracting and delivery phases.

## 4 Discussion

Based on the literature assessed in this study, a model for digitally-enabled PSS contracts is proposed to support the timely and effective contract development of an advanced service. The issue of asset ownership has challenged the traditional buyer-supplier contractual relationships and requires a multi-actor perspective. This perspective may be guided via value co-creation aspects and becomes important [3]. In an industrial environment, the value co-creation process may be a triadic (or more) relationship and here, contracts can describe roles and obligations between parties.

Customer segmentation, expressed as preferences, supports an approach to value propositions, offers, and the associated contract where multiple options exist. This adds a layer of complexity to the contracting process; nevertheless, when developing Smart Products, firms should know that their customers may expect advanced services. Forms of contract (based on the patterns described) should be developed in parallel with the development of the digitally-enabled PSS during the beginning-of-life phase. There are boilerplate forms of contract for advanced services that exist, yet with the advent of digitally-enabled PSS, they may not reflect fully the value co-creation that takes place. A contract that does not reflect the value proposition's promise may explain why performance has been below the expected value.

A model for the development of contracts that match the value proposition and is applicable for digitally-enabled PSS is needed. Fig. 1, based on the synthesis of the findings, provides such a model; it describes the generic tasks necessary to take a value proposition to a contract. The figure also connects to the middle of the product's life, where the installed base may call for renegotiations or where the supplier may wish to

offer new value propositions to support the customer. The end-of-life provides the opportunity for upgrades, which can provide a route to contract extensions. It also provides a potential for “retirement services”. A contracting process for a single contract, covering the four phases: ‘pre-sales’ where the value proposition is “sold” to the customer, the “detailed sales” where the offer is jointly detailed, the “negotiation phase” where the contract is settled and finally a “contract delivery and governance phase” where the long-term successful outcome of the contract is managed. The four steps represent a modification to the model [17] through the addition of the delivery and governance phase. The process is predicated on having in place a clearly defined value proposition, the underlying hybrid offer definition, and appropriate boilerplate contracts. Value identification is based on the negotiation phase and the preference for a practical value proposition during the first phase of the contracting process. The model assumes high-value contracts, and it may be more difficult without some automation to use it for lower-value contracts.

#### **4.1 Managerial implication**

Contracts standardize and regulate the value co-creation and value capture of advanced services associated with PSS [7, 8]. Without contracts, we organizations cannot achieve this outcome successfully, and furthermore, contracts should reflect the promised value proposition that was sold. When creating contracts, firms should consider flexibility within the type of contracts as the value propositions can change over the equipment's lifecycle, and actor risk-tolerance and resources may also evolve [14, 17]. Specific contracts have been identified along the lifecycle, and the different types are in no way exhaustive [12, 16, 18]. There will be other forms of contract for different solutions that have not been identified in this integrative literature review. To succeed in value co-creation and value capture with of advanced services, management needs to focus on the specific form of contract in a digitally- enabled PSS environment.

#### **4.2 Theoretical implications**

SD logic is compelling for servitization strategies and PSS-based business models [1, 3, 23]. Yet without contracts that standardize the value co-creation and value capture, it is difficult to imagine how they can be successfully implemented. A conceptual and practical gap exists between the value co-creation and value capture and the contracting of advanced services coming from (digital-enabled). Different disciplines (including law and finance specialists) will be required to fill this research gap successfully [8]; only by doing so will the value be obtained that is promised by digitally-enabled PSS. Without contracts that can support value co-creation and value capture from advanced services based on digitally-enabled product-service systems, there will remain a detachment between value contracted and value delivered. This is important for SD logic research, as firms move to advanced services and move to value proposition based on value-in-use or value-in-context with multi-actor value co-creation processes [22, 25, 24].

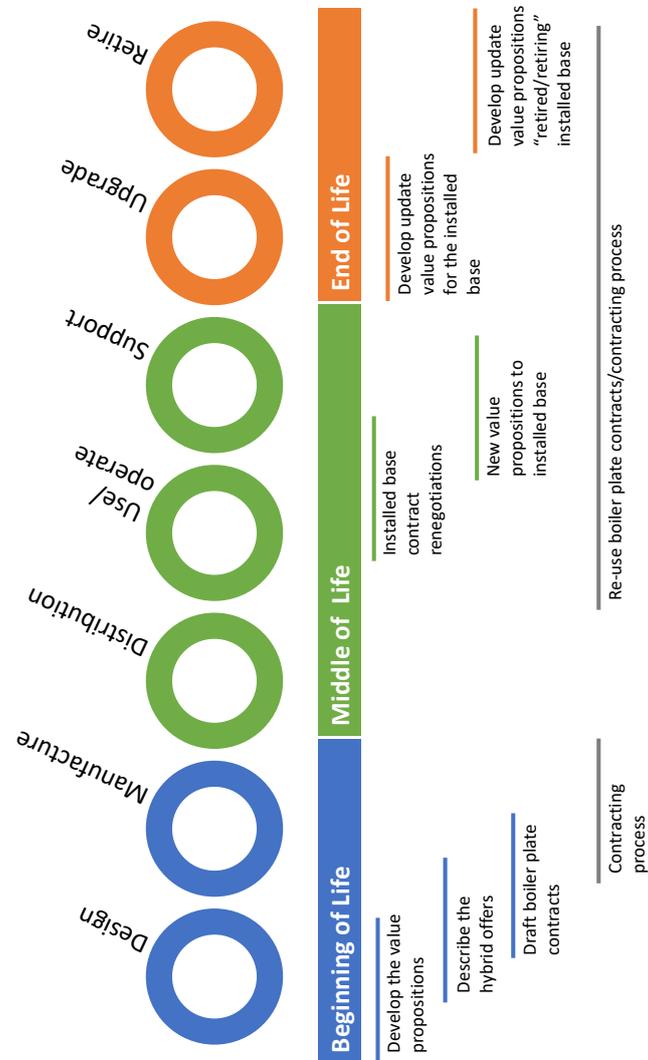


Fig. 1. Contract development along the lifecycle

## 5 Conclusions and Recommendations

Commercialization of innovation requires firms to sell the value proposition and convert it into a contract to deliver value to the different parties. Without a contract it is not possible to convert innovation into commercial reality. Digital brings to PSS a new level of possibilities and increases complexity, often for manufacturing firms who are more used to selling products rather than advanced services. Drafting advanced service

contacts that support multi-actor value creation is a multi-disciplinary process drawing from diverse research areas, such as servitization, PSS, project management, general management, marketing, finance, legal and risk management. The research gap identified in this study on one side was rather surprising in that some firms have successfully created advanced services and have contracted them. However, the multi-actor approach to value creation and how value capture takes place through contract is poorly understood and to understand it fully needs a wider team of researchers than is normally the case. It also requires firms to understand more fully the middle-of-life phase and the opportunities it offers, and how to design value propositions and appropriate contracts that allow their delivery.

A model has been proposed that is integrated with the lifecycle and linked to a generic contracting process. Three recommendations are made from this study:

1. The model proposed should be tested and further adapted;
2. More research into how firms design contracts for advanced services by using digital technologies within a PSS context is required;
3. The influence of contract design on service (or business) performance should be studied.

## References

- [1] Baines, T., Ziaee Bigdeli, A., Bustinza, O. F., Shi, V. G., Baldwin, J., & Ridgway, K. (2017). Servitization: revisiting the state-of-the-art and research priorities. *International Journal of Operations and Production Management*, 37(2), 256-278. doi:10.1108/IJOPM-06-2015-0312
- [2] Kreye, M. E., Roehrich, J. K., & Lewis, M. A. (2015). Servitising manufacturers: The impact of service complexity and contractual and relational capabilities. *Production Planning and Control*, 26(14-15), 1233-1246. doi:10.1080/09537287.2015.1033489
- [3] Brodie, R. J., Löbner, H., & Fehrer, J. (2019). Evolution of service-dominant logic: Towards a paradigm and metatheory of the market and value cocreation? *Industrial Marketing Management*, 79, 3-12.
- [4] Smith, L., Maull, R., & Ng, I. C. L. (2014). Servitization and operations management: A service dominant-logic approach. *International Journal of Operations and Production Management*, 34(2), 242-269. doi:10.1108/IJOPM-02-2011-0053
- [5] Latonen, T., & Akpınar, M. (2019). Designing an advanced services contract in servitization strategy: a study from the B2B sector in Finland.
- [6] Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J., & Gebauer, H. (2019). Servitization: A contemporary thematic review of four major research streams. *Industrial Marketing Management*, 83, 207-223.
- [7] Stoll, O., West, S. & Hannecke, L. (2021). Procurement of advanced services within the domain of Servitization: preliminary results of a systematic literature review. In: West, S., Meierhofer, J., & Ganz, C. (Eds.) *Smart Serves Summit: Digital as an Enabler for Smart Service Business Development*. Springer: Progress in IS. Cham.

- [8] West, S., Gaiardelli, P., Ozbek, D., & Züst, S. (2021). Exploring the alignment between servitization based value propositions and contracts. In: Baines, T., Bigdeli, A., Rapaccini, M., Saccani, N., & Adrodegari, F. *Servitization: A Pathway towards a Resilient, Productive and Sustainable Future*. Spring Servitization Conference May 2021. Aston.
- [9] Stouthuysen, K., Slabbinck, H., & Roodhooft, F. (2012). Controls, service type and perceived supplier performance in interfirm service exchanges. *Journal of Operations Management*, 30(5), 423-435.  
doi:<http://dx.doi.org/10.1016/j.jom.2012.01.002>
- [10] Torraco, R. J. (2005). Writing Integrative Literature Reviews: Guidelines and Examples. *Human Resource Development Review*, 4(3).  
<https://doi.org/10.1177/1534484305278283>
- [11] Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104.  
<https://doi.org/10.1016/j.jbusres.2019.07.039>
- [12] Grubic, T., & Jennions, I. (2018). Do outcome-based contracts exist? The investigation of power-by-the-hour and similar result-oriented cases. *International Journal of Production Economics*, 206. <https://doi.org/10.1016/j.ijpe.2018.10.004>
- [13] Kohtamäki, M., Parida, V., Oghazi, P., Gebauer, H., & Baines, T. (2019). Digital servitization business models in ecosystems: A theory of the firm. *Journal of Business Research*, 104, 380-392.
- [14] Broekhuis, M., & Scholten, K. (2018). Purchasing in service triads: the influence of contracting on contract management. *International Journal of Operations and Production Management*, 38(5). <https://doi.org/10.1108/IJOPM-12-2015-0754>
- [15] Essig, M., Glas, A. H., Selviaridis, K., & Roehrich, J. K. (2016). Performance-based contracting in business markets. *Industrial Marketing Management*, 59.  
<https://doi.org/10.1016/j.indmarman.2016.10.007>
- [16] Hou, J., & Neely, A. (2018). Investigating risks of outcome-based service contracts from a provider's perspective. *International Journal of Production Research*, 56(6). <https://doi.org/10.1080/00207543.2017.1319089>
- [17] 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.  
<https://doi.org/10.1016/j.indmarman.2016.05.032>
- [18] Rialland, A., Nesheim, D. A., Norbeck, J. A., & Rødseth, Ø. J. (2014). Performance-based ship management contracts using the Shipping KPI standard. *WMU Journal of Maritime Affairs*, 13(2), 191–206. <https://doi.org/10.1007/s13437-014-0058-9>
- [19] Kleemann, F. C., & Essig, M. (2013). A providers' perspective on supplier relationships in performance-based contracting. *Journal of Purchasing and Supply Management*, 19(3). <https://doi.org/10.1016/j.pursup.2013.03.001>
- [20] Nystén-Haarala, S., Lee, N., & Lehto, J. (2010). Flexibility in contract terms and contracting processes. *International Journal of Managing Projects in Business*, 3(3). <https://doi.org/10.1108/17538371011056084>

- [21] Raja, J. Z., Frandsen, T., Kowalkowski, C., & Jarmatz, M. (2020). Learning to discover value: Value-based pricing and selling capabilities for services and solutions. *Journal of Business Research*, 114. <https://doi.org/10.1016/j.jbusres.2020.03.026>
- [22] Razmdoost, K., & Mills, G. (2016). Towards a service-led relationship in project-based firms. *Construction Management and Economics*, 34(4–5). <https://doi.org/10.1080/01446193.2016.1200106>
- [23] Smith, L., Maull, R., & Ng, I. C. L. (2014). Servitization and operations management: A service dominant-logic approach. *International Journal of Operations and Production Management*. <https://doi.org/10.1108/IJOPM-02-2011-0053>
- [24] Tjendani, H. T., Anwar, N., & Putu Artama Wiguna, I. (2018). Two stage simulation to optimize risk sharing in performance-based contract on national road a system dynamic and game theory approach. *ARNP Journal of Engineering and Applied Sciences*, 13(15), 4432–4439.
- [25] Zou, W., Brax, S. A., Vuori, M., & Rajala, R. (2019). The influences of contract structure, contracting process, and service complexity on supplier performance. *International Journal of Operations and Production Management*, 39(4), 525–549. <https://doi.org/10.1108/IJOPM-12-2016-0756>
- [26] Ng, I. C. L., Maull, R., & Yip, N. (2009). Outcome-based contracts as a driver for systems thinking and service-dominant logic in service science: Evidence from the defence industry. *European Management Journal*, 27(6). <https://doi.org/10.1016/j.emj.2009.05.002>
- [27] Töytäri, P. (2018). Selling solutions by selling value. In *Practices and Tools for Servitization: Managing Service Transition*. [https://doi.org/10.1007/978-3-319-76517-4\\_15](https://doi.org/10.1007/978-3-319-76517-4_15)