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## Exploring servitization through the paradox lens: Coping practices in servitization

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## **Organizational paradoxes and coping practices in servitization**

Kohtamäki, M., Einola, S. & Rabetino, R.

### **Abstract**

The study analyzes the coping practices that emerge when a manufacturer of standardized products and add-on services expands to provide customized solutions. Based on a comparative case study methodology conducted across four case companies, and an analysis of extensive documentary data, the study challenges the dichotomous ‘either-or thinking’ in servitization research and highlights ‘both-and thinking’ by identifying both paradoxes and coping practices. The study extends the literature by identifying four paradoxes in servitization: 1) effectiveness in the customization of solutions vs. efficiency in product manufacturing, 2) building a customer orientation vs. maintaining an engineering mindset, 3) organizing product and service integration vs. separated services and product organizations, and 4) exploratory innovation in solutions vs. exploitative innovation in product manufacturing. Moreover, the study identifies nine practices that manufacturing companies apply when coping with the paradoxical challenges that emerge during servitization. The findings may help manufacturing companies understand, accept, and address paradoxical challenges and balance tensions, as not all tensions can be resolved. The identification of these paradoxes allows us to understand the difficulties that manufacturing companies face during the servitization process and may help explain the servitization-deservitization trend among some manufacturing companies that some recent studies have identified.

**Keywords:** Servitization and digital servitization, paradox theory, product-service systems (PSS), strategic change, coping practices, strategy-as-practice (SAP, practice theory)

## 1. Introduction

Servitization, or the process by which a company expands from selling products and basic services to delivering customized solutions, is far from simple, and companies seem to struggle with it (Martinez et al., 2017; Rabetino et al., 2017; Raja et al., 2017). The literature has not always been helpful in resolving this struggle, and studies typically provide overly simplified suggestions on how servitization should be enabled, facilitated, or managed in a basic, linear fashion (see critique, e.g. from Luoto et al., 2017). Some recent reviews have critiqued and questioned the overly simplistic assumptions and explanations in the servitization literature (Kowalkowski et al., 2017a; Rabetino et al., 2018; Raddats et al., 2019). Since its infancy, servitization-related research has been somewhat delimited by the ‘either-or’ thinking embedded in the literature and theorizing. Often, services have been seen to contrast with the products, these two theoretical poles competing for position in the research (i.e. service continuum), as well as in companies (product vs. service divisions). As the literature has evolved, researchers have constructed the servitization narrative as a journey from product-logic to service-logic, implying ‘either-or’ (Grönroos, 2006; Oliva and Kallenberg, 2003; Ramírez, 1999; Vargo and Lusch, 2008). The benefits of services in contrast to products have at times been over-emphasized, implying that products and services would generate alternatives in manufacturing (Vargo and Lusch, 2008). In practice, a manufacturing company can rarely choose between products and services, but instead moves from standardized products to customized customer solutions. These echo the evident tensions between products and services in manufacturing companies, and the rhetorical strategies (Alvesson and Sandberg, 2011) utilized by servitization scholars (Luoto et al. 2017). While the emphasis on the role of services has been important for the evolution of the literature and development of servitization in companies, these

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rhetorical strategies have been constructing ‘either-or’ thinking, with some scholars calling for alternative narratives in servitization research (Luoto et al., 2017). However, with products and services being considerably interdependent, integrated customized solutions require ‘both-and’ rather than ‘either-or’. We argue that paradox theory offers an interesting, challenging and valuable alternative narrative for servitization research.

The paradox approach provides an alternative lens to the ‘either-or’ thinking embedded in the classic organization and strategy theory. Management theory has suffered from the constraints of ‘either-or’ thinking, sometimes suggesting that firms should choose differentiation or low cost, prefer exploitation or exploration, and use trust or structure when governing business relationships (Smith and Lewis, 2011). In the past, contingency theory advanced the ‘either-or’ argumentation further by suggesting that an organization should resolve tensions between the environment and strategy by finding an appropriate fit (Smith, 2014). According to contingency theory, competing demands can be resolved (Gaim, 2017; Poole and van de Ven, 1989). Paradox theory challenged the ‘either-or’ assumption. According to paradox theory, no simple solution exists for many of the challenges that organizations face, and when in flux, an organization should address uncertainty and occasionally accept and even embrace ‘both-and’ solutions (Jay, 2013; Lewis, 2000; Schreyögg and Sydow, 2010).

Thus, a servitizing organization cannot often choose between the customization of solutions and efficiency of product operations but instead should achieve both effective customization of solutions and efficiency in delivery. Customization increases customer value but complicates delivery; yet, the delivery should be made as efficient as possible. Because the customization of

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solutions is an important component of differentiation (Martinez et al., 2010; Visnjic Kastalli et al., 2013), efficiency improvements by increasing the standardization and repeatability of solutions (Davies et al., 2006; Kowalkowski et al., 2015) create a paradoxical challenge. No simple solution to this paradox exists, but the tension persists, and servitizing companies must balance these contradictory logics (Davies et al., 2006; Windahl and Lakemond, 2010). These opposing dimensions of customization and efficiency have been addressed by prior servitization studies. Kowalkowski et al. (2015: 63; See also Raja et al., 2017) identified these logics, or “trajectories”, and designated the first as an availability provider and the second as an “industrializer”. While these logics may exist simultaneously, the authors did not focus on the paradox in this setting. The servitization literature has mostly lacked contributions emerging from the paradox approach, with a few notable exceptions (Brax, 2005; Gebauer et al., 2005; Johnstone et al., 2014; Visnjic Kastalli and Van Looy, 2013) without developing theory on paradoxes in servitization or on the coping practices needed to address these paradoxes. With regard to paradox theory, Smith (2014: 1593) writes about the need to study how companies manage paradoxes: *“How senior leaders address strategic paradoxes critically impacts an organization’s success, yet remains relatively unexamined.”* There has been a recent call for studies to conceptualize the paradoxes in servitization and the coping practices utilized by manufacturing companies (Rabetino et al., 2018). The paradox approach has the potential to contribute to our understanding of servitization processes and the challenges they pose, and to generate a rich stream of research within the servitization and PSS domain.

We approach servitization through paradox theory by addressing the following research questions:  
*How do organizational paradoxes emerge and challenge the servitization of manufacturing*

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*companies, and how do companies cope with the paradoxes in servitization?* Applying paradox theory, the abundant literature regarding servitization, and data from four large manufacturing companies, this article contributes to the servitization literature in two ways. The study highlights paradoxes and tensions that impede servitization. The study identifies four paradoxes of servitization and presents a dynamic model that shows how the paradox between effectiveness in the customization of solutions vs. efficiency in product manufacturing spurs the three other paradoxes: building a customer orientation vs. maintaining an engineering mindset, organizing product and service integration vs. separated services and product organizations, and exploratory innovation in solutions vs. exploitative innovation in product manufacturing. We extend prior studies (Brax, 2005; Davies et al., 2006; Gebauer et al., 2005; Johnstone et al., 2014; Kowalkowski et al., 2015; Visnjic Kastalli and Van Looy, 2013) by arguing that effectiveness in the customization of solutions and efficiency of product manufacturing generate a paradox that also spurs other paradoxes in servitization. This argument should encourage further research efforts to redefine practices to cope with paradoxes. The identified paradoxes are highly meaningful for servitization and represent potential reasons for the back-and-forth, servitization-deservitization movement recently recognized among manufacturing companies (Böhm et al., 2017; Finne et al., 2013; Kowalkowski et al., 2017b, 2015).

The study contributes to the literature on servitization by illustrating the types of practices that manufacturing companies apply when coping with the paradoxical challenges that emerge during servitization. By focusing on coping practices, we highlight the central practices that enable manufacturing companies to balance and stretch between contradictory demands. This study contributes to the servitization literature by using the concept of coping practices and combining

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contributions from the paradox approach and practice theory (Bourdieu, 1990; Feldman and Orlikowski, 2011; Jarzabkowski et al., 2013; Reckwitz, 2002; Vaara and Whittington, 2012). Practice theory provides potential contributions for the servitization literature (Kohtamäki et al., 2018a) as practice theory and the ‘narrative turn’ more generally, provides conceptual grounds for studying micro-practices in organizational change processes (Fenton and Langley, 2011; Seidl and Whittington, 2014). For managers of manufacturing companies, this study provides a model of paradoxes in servitization that can be utilized to understand the challenges experienced during service transformation. In addition, this study identifies coping practices to support servitization processes. Finally, we present a variety of suggestions for future paradox research on servitization. After this first introductory chapter, we introduce the paradox theory together with the servitization literature, before presenting the methodology of the study. The findings section provides a detailed description of the results of the empirical research, which are then discussed and concluded in the final chapter.

## 2. Theory

### 2.1. Paradox theory

In contrast to the classic organization or strategy theory, the paradox approach provides an alternative lens through which organizations can be examined (Jay, 2013). Rather than selecting ‘either-or’ approaches or finding an appropriate fit, an organization should accept ‘both-and’ strategies (Smith and Lewis, 2011). Accordingly, the ‘either-or’ approach to paradoxes narrows the lens through which an organization interprets the surrounding world (Smith et al., 2010), whereas the ‘both-and’ strategy provides a broader scope to interpret the complex reality (Dweck, 2006; Gupta and Govindarajan, 2002) and identify practices to address paradoxes (Calton and Payne, 2003; Jay, 2013; Poole and van de Ven, 1989). To avoid confusion among a variety of

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labels, such as “*tension*”, “*dilemma*”, and “*dialectic*” (Smith & Lewis, 2011: 385), we build on Putnam, Fairhurst and Banghart’s (2016: 72) definition of organizational paradox, in which paradoxes are “*contradictions that persist over time, impose and reflect back on each other, and develop into seemingly irrational or absurd situations because their continuity creates situations in which options appear mutually exclusive, making choices among them difficult*”. Comparing the concept of a paradox to that of a dilemma, a dilemma can be defined as a situation in which one can evaluate the advantages and disadvantages and then decide ‘either-or’ (Smith, 2014). Instead, a dialectic refers to a process in which interdependent opposites, or tensions, are resolved through integration, potentially spurring new paradoxes as time passes (Putnam et al., 2016; Smith and Lewis, 2011). Thus, paradoxes emerge when contradictory but interrelated elements coexist and persist over time.

As paradox theory enables a deeper understanding of the diverse characteristics and dynamics of the different tensions that organizations face, scholars have been fascinated by paradoxes at various organizational levels and in varied environments: management teams (Amason, 1996; Smith, 2014), the individual level (Miron-Spektor et al., 2017), the relational level (Denison et al., 1995; Lüscher and Lewis, 2008), and private, hybrid, and public organizations (Beech et al., 2004; Roberts, 2002). Paradoxes have been studied not only among management and organizational scholars (Jay, 2013; Smith and Lewis, 2011) but also in operations (Johnstone et al., 2014; Visnjic Kastalli and Van Looy, 2013), communication (Mcguire et al., 2006) and sociology (McGovern, 2014). Although the paradox approach has spread extensively among interdisciplinary scholars, only a small number of servitization studies have utilized the concept of paradoxes (Brax, 2005; Gebauer et al., 2005; Johnstone et al., 2014; Visnjic Kastalli et al., 2013).



## 2.2. Paradoxes in servitization

Servitization in manufacturing is a transition process from standardized products and add-on services to customized solutions and advanced services. This transition from a product logic to a service logic involves both products and services, typically referred to as PSSs (Baines and Lightfoot, 2013; Parida et al., 2014; Rabetino et al., 2018). In PSSs, advanced services are somewhat dependent on the customized product; that is, customized products and advanced services become interdependent (Lee et al., 2016), particularly when a company utilizes advanced analytics (Cenamor et al., 2017; Hazen et al., 2017; Kohtamäki et al., 2020; Porter and Heppelmann, 2014; Rymaszewska et al., 2017). In servitized business models, PSSs are customized solutions that extend manufacturers' offerings toward selling operational and performance-based services and typically involve customized products, software, advanced services, and new pricing methods (Kohtamäki et al., 2019b). In other words, we define customized solutions as PSSs that require tailoring according to customer needs (Baines and Lightfoot, 2014; Kowalkowski et al., 2015; Lightfoot and Gebauer, 2011; Rabetino et al., 2015; Ulaga and Reinartz, 2011). Customized solutions typically involve tailoring not only products but also service elements, such as advanced services (Baines and Lightfoot, 2013; Lightfoot and Gebauer, 2011; Visnjic et al., 2017a).

Although the meta-narrative in the existing literature tends to favor servitization (Luoto et al., 2017), companies vary regarding their success in servitization. Indeed, previous studies have provided mixed evidence on the performance outcomes of servitization, suggesting that the link between servitization and performance can be direct and linear (Homburg et al., 2002), nonlinear

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(Fang et al., 2008; Kohtamäki et al., 2013b; Visnjic Kastalli and Van Looy, 2013), or even nonexistent (Neely, 2008). Previous research has also acknowledged different factors that challenge servitization (Alghisi and Saccani, 2015; Martinez et al., 2017; Raddats et al., 2018; Raja et al., 2017; Zhang and Banerji, 2017) and may act as barriers that mitigate the transition, which may eventually trigger a deservitization process (Finne et al., 2013; Kowalkowski et al., 2017a; Valtakoski, 2017). As a transition process, servitization is far from a simple, easy-to-manage, and linear transformation (Bustinza et al., 2017; Forkmann et al., 2017; Kohtamäki et al., 2019a).

The servitization literature analyzes challenges from various perspectives, and studies have suggested several mitigating factors, such as organizational inertia (Brady et al., 2005), an embedded manufacturing culture (Martinez et al., 2010), manufacturing-driven microfoundations (Kindström, Kowalkowski, and Sandberg 2013), cognitive barriers (Gebauer et al., 2005; Gebauer & Friedli, 2005), ambivalence (Lenka et al., 2018), failure to recognize productive opportunities (Cohen, Agrawal, & Agrawal, 2006; Spring & Araujo, 2013), or a misfit between various characteristics of strategy, structure and the business environment (Kohtamäki et al., 2019a). Whereas these studies draw from organization theory, strategy and contingency theory, or the resource-based view, servitization research still largely lacks systematic, qualitative analyses of servitization utilizing paradox theory to identify organizational paradoxes or coping practices.

While only a few studies have related the paradox concept to servitization, the phenomenon and the concept of tension have been embedded in servitization research since its infancy. For instance, Oliva and Kallenberg (2003) identified the tension between product logic and service

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logic and highlighted the tradeoff between products and services by addressing how an increase in product quality can reduce revenue from maintenance services or how an increase in service quality can reduce the sales of new products as a result of extending an old product's lifecycle. Kowalkowski et al. (2015; See also Raja et al., 2017) identified three trajectories in servitization (availability provider, performance provider, and industrializer) and recognized that these trajectories may coexist. Visnjic, Van Looy and Neely (2013: 111) warned about potential tensions that emerge *“between those responsible for product revenues and those responsible for service revenues.”* More broadly, the tension between products and services has been relatively strong in the strategy (Ramírez, 1999) and marketing literatures (Grönroos, 2006; Vargo and Lusch, 2008).

The concept of a paradox has been previously used in the servitization literature, even if the paradox theory has not been used to analyze servitization. Gebauer et al. (2005: 14) suggested the concept of a “service paradox” and argued that *“[w]here there is such a paradox, substantial investment in extending the service business leads to increased service offerings and higher costs but does not generate the expected correspondingly higher returns.”* Visnjic Kastalli and Van Looy (2013; Visnjic Kastalli et al., 2013) provided evidence for the existence of the service paradox by demonstrating the challenge of carving out profit from services at a moderate level of servitization. They found that in the early stages of servitization, a manufacturing company can increase profit margins effectively, but in the moderate stages, increases in profit margins diminish. They also found that profit margins increase more at higher levels of servitization. Therefore, the study demonstrated the service paradox initially acknowledged by Gebauer et al. (2005).

Paradoxes in servitization emerge between effectiveness in customizing solutions and efficiency in product manufacturing (Kohtamäki et al., 2018b), reflecting a paradox inherently embedded in the provision of customized solutions. In previous research, Rajala et al. (2019) have emphasized the challenges created by customization of integrated solutions suggesting modularity as a mean to cope with the challenge. Modularity provides an opportunity to balance between customization and efficiency (Kohtamäki et al., 2018b). Also Kowalkowski et al. (2015) as well as Storbacka and Pennanen (2014) discussed about the role and challenges of industrialization of solutions as a mean to increase scalability. In practice, this paradox implies that the solution provider must effectively customize product-service solutions to satisfy customer needs, while maintaining efficiency when producing and delivering customized products and advanced services. Capacity utilization is central to profitability and is often achieved via standardization, e.g. modular solutions (Kowalkowski et al., 2015; Ramírez, 1999). In the business model related to servitization and integrated solutions, both logics are needed (Windahl and Lakemond, 2010); therefore, servitizing manufacturers face a paradox that spurs other paradoxes.

### 2.3. Coping with the paradoxes in servitization

When considering the various means by which organizations can cope with paradoxes, studies suggest that organizations must accept, appreciate, make sense of, and cope with paradoxes (Beech et al., 2004; Lewis, 2000; Poole and Van De Ven, 1989). In various cases, organizations have forced themselves into artificial integrity that fosters new tensions and paradoxes (Calton and Payne, 2003; Luscher et al., 2006) instead of accepting and appreciating contradictory demands. When addressing paradoxes, companies may utilize a variety of practices to cope with tensions.

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As a paradox cannot be easily resolved but tends to persist over time, companies should learn how to balance and stretch resources to meet conflicting yet interrelated demands.

While the previous servitization research does not consider factors that manufacturing companies can utilize to cope with the paradoxes in servitization, several servitization studies provide some evidence and suggestions regarding managerial practices that can be utilized to manage the process of service transition (Kohtamäki et al., 2018a). This argument does not suggest that managing and coping are the same or equal practices, but they share similar characteristics. Some previous studies provide suggestions that can be applied to our objective of analyzing the practices used to cope with paradoxes. Servitization studies provide insights on how companies can manage the design, sale, production, and delivery of integrated solutions by improving practices to define explicit service-oriented strategies (Gebauer and Fleisch, 2007), describe the strategic logic of servitization (Rabetino et al., 2017), develop scalable platforms (Raja et al., 2017), involve personnel in coping with organizational inertia (Antioco et al., 2008), de-centralize sales operations (Gebauer and Fleisch, 2007), develop a front-back structure to facilitate cross-functional integration (Davies et al., 2006), develop incentive systems to facilitate the transition (Galbraith, 2002; Kindström and Kowalkowski, 2014), or organize workshops with key customers (Gebauer et al., 2005). While servitization studies have identified managerial practices to facilitate servitization, the existing research tends to neglect the paradox perspective, in which paradoxes cannot be easily resolved but an organization must instead learn how to accept, appreciate, make sense of, and cope with paradoxes.

The present study approaches coping practices from the practice theoretical perspective and considers practices as routinized sayings or doings (Schatzki, 2002; Seidl and Whittington, 2014). Thus, the practice theoretical perspective concentrates not only on “practical practices” (Johnson et al., 2003) but also on social practices that may be routinized behaviors or sayings. In organizations, sayings and doings interplay, and sayings may often become doings (Seidl and Whittington, 2014). From paradigmatic ontological, epistemological, and methodological standpoints, practice theory fits well into the discussion on coping practices (Dameron and Torset, 2014; Jarzabkowski and Lê, 2017). Paradoxes and coping practices are socially constructed phenomena – neither paradoxes nor coping practices can be observed as objective facts but instead are seen as socially constructed, important organizational phenomena embedded into organizational sayings and doings (Vaara and Whittington, 2012).

### 3. Methodology

#### 3.1. Research strategy

An exploratory multiple case study approach is utilized to conduct the analysis. This strategy is a suitable approach to study complex and dynamic organizational phenomena (Eisenhardt and Graebner, 2007) that have not been extensively analyzed (Leonard-Barton, 1990). The use of case studies is a valid strategy to exhaustively explore issues that are difficult to replicate (Dubois and Araujo, 2007; Dyer and Wilkins, 1991; Siggelkow, 2007). Considering the complexity of servitization and organizational paradoxes, an exploratory multiple case study approach can be considered a sound choice.

### 3.2. Case selection

This article includes data from four global Finnish industrial corporations in the metal and machinery industries. Using a straightforward, purposeful case selection strategy, this research focuses on leading international, publicly listed manufacturers that have been expanding from products and add-on services to customized solutions and advanced services for years. According to our research data, these companies have also experienced struggles between the standardization of products and services and the customization of solutions and advanced services. In 2017, the case companies' net sales ranged from 1,000 to 5,000 million euros, and the share of service-related sales ranged from 37% to 46% of net sales. The cases were “information-rich” and worthy of detailed exploration (Patton 2002: 231). Next, we present basic information about each case (Table 1).

**Table 1.** Case and data description.

CASE	Net sales (M€)	% Net sales from services	Core products	Core services	Respondent titles (some examples)	Number of interviews	Length of the interviews	
							Pages	Minutes
A	5,000 (2017)	45%	Integrated solutions for marine customers	Spare parts and operations and maintenance services and solutions for the entire life cycle of its installations	General manager, agreements Director, business development Vice president, services Director, key account management	15	9-37	35-155
B	2,000 (2016)	46%	Heavy equipment for process industries and various terminals	Service programs primarily consisting of various consultation- and maintenance-related services	Global category manager Director, service development Director, services Area manager Director, automation services	15	12-39	49-180
C	3,000 (2017)	37%	Production lines and technologies for process and power industries	Expert services and maintenance services involving spare and wear parts and consumables	Manager, strategic business development Vice president, services Vice president, strategy	14	10-40	42-145
D	1,000 (2017)	42%	Technology systems for metal processing industries	Spare parts, maintenance and technical services, modernization, and operations	Director, services Director, business development Director, strategy Director, account management	16	11-46	54-101



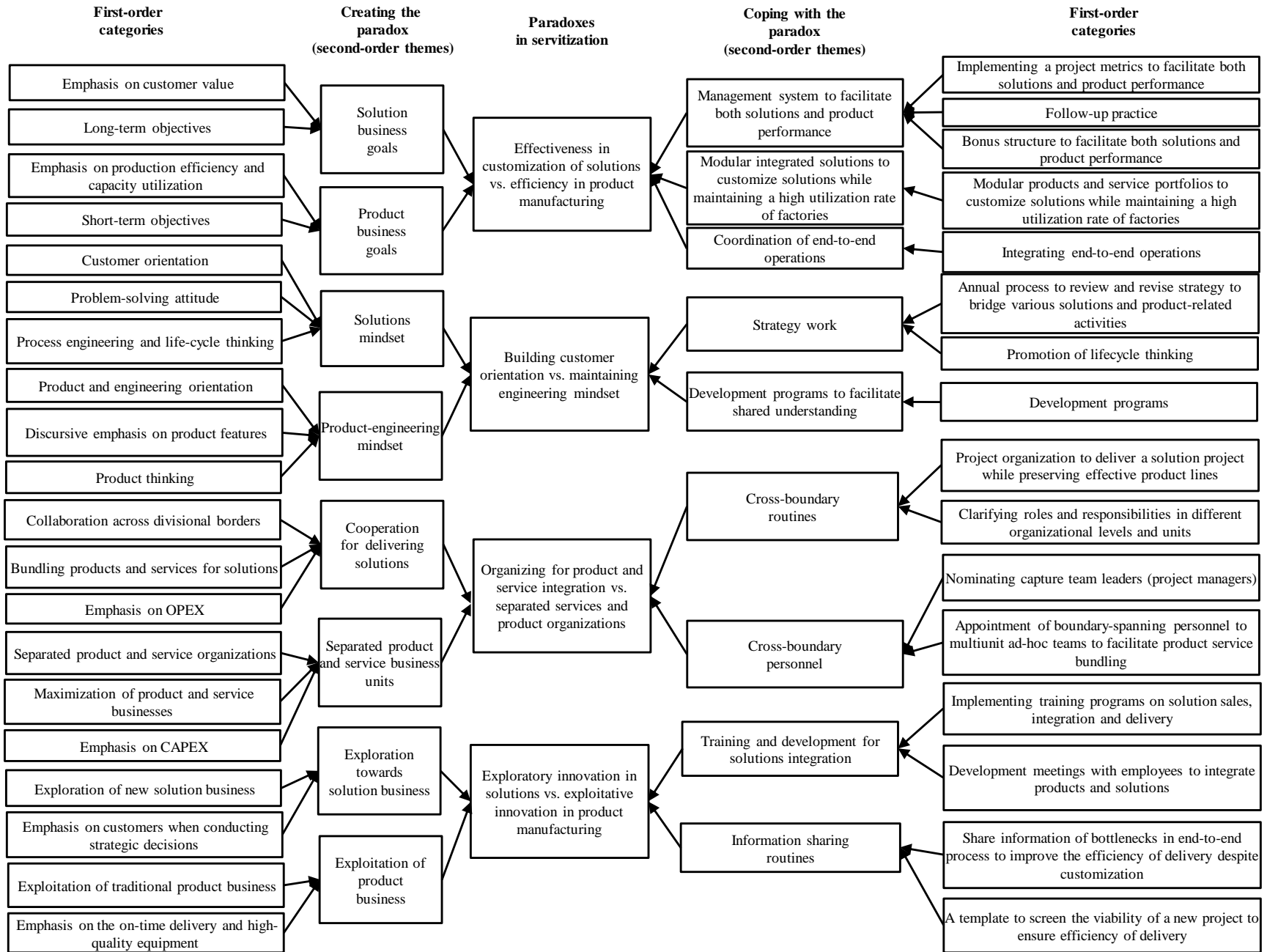
### 3.3. Data collection and analysis process

This study uses interview data to identify paradoxes and coping practices that occur during servitization. During the lengthy research process, the researchers collected a significant amount of interview data and analyzed publicly available documentary data, such as annual reports and strategic documents. The interviews were conducted between November 2012 and December 2017 as a part of a research program about servitization. The interviews focused primarily on describing companies' long-lasting servitization processes, strategies and organizational practices, including enabling and disabling factors. To cover these issues, interviewees were selected from several organizational levels and business units based on their years of experience at the company (people who have experienced and were involved in the servitization process). The interviews were recorded and transcribed verbatim directly after each meeting. We used acronyms to characterize cases and quotations to guarantee the anonymity of the firms and interviewees. Altogether, for the present study, we analyzed 60 face-to-face interviews (982 transcribed pages) in the four selected cases. Table 1 presents additional details about the interviews so that both the companies and interviewees remain unidentifiable.

Due to the extensive data gathered and validated during the long research program, access to the case companies created an opportunity to collect rich and thorough information. Therefore, the data analysis process was inherently abductive (Dubois and Gadde, 2002). First, before proceeding to the systematic analysis of the data, we identified the major tensions in the studied cases that seemed to significantly inhibit servitization processes. We found that the preliminary analysis of our data sufficiently echoed the original main paradoxes of Smith and Lewis (2011), which then generated the initial template to guide our analysis (King, 2004). During the analysis process, the

first-order categories emerged from the data, whereas the second-order themes were categorized based on our interpretation and originated the aggregated paradoxes. Eventually, the paradoxes were re-generated to reflect servitization theory and the empirical data. Finally, we crafted a model of servitization because, during the analysis, we found that one of the paradoxes incited the others. After identifying the paradoxes, a similar process was repeated to identify coping practices, where the identified paradoxes were used to guide the analysis process.

Figure 1 shows the identified first-order categories, second-order conceptualized themes, and aggregated theoretical dimensions further conceptualized based on paradox theory and the data. While the analysis was not a simple and straightforward process, we found that the data structure (Figure 1) is an appropriate tool to display the identified structure of the results (Nag et al., 2007), as the data structure has an essential role in the analysis process (Miles et al., 2014). This process was conducted in the form of a within-case analysis for each case company, followed by a cross-case analysis with a constant comparison of the paradoxes and coping practices across the cases (Beverland and Lindgreen, 2010; Eisenhardt, 1989). When analyzing the data, particular attention was directed toward the persistence of tensions because the researchers were critical of the paradoxical nature of tensions and were careful not to designate all tensions as paradoxical.



**Figure 1.** Illustration of the data structure.

The interviews were complemented with other sources of information (e.g., internal documents, company presentations, and annual reports). Triangulation of passive and active data (Dubois and Gadde, 2002) was applied to recognize the paradoxes, to verify the information, and to increase the reliability of the study (Beverland and Lindgreen, 2010).

#### 4. Findings

The findings progress from the identification of paradoxes to the recognition of coping practices. Despite conducting also within-case analysis, we report only the cross-case analysis and then use tables to provide some case-by-case evidence. Table 2 is organized based on the identified paradoxes such that we illustrate the quotes related to each paradox for each case company. Table 3 provides evidence of coping practices and interview passages from different cases. The cross-case analysis moves beyond single case studies explaining the findings to develop theoretical insights (Eisenhardt and Graebner, 2007).

##### 4.1. Paradoxes in servitization

Based on the vast interview data and literature analysis, the following four paradoxes were identified: 1) effectiveness in the customization of solutions vs. efficiency in product manufacturing, 2) building a customer orientation vs. maintaining an engineering mindset, 3) organizing product and service integration vs. separated services and product organizations, and 4) exploratory innovation in solutions vs. exploitative innovation in product manufacturing. In the following sections, these findings are discussed in relation the previous servitization literature.

#### 4.1.1. Effectiveness in customization of solutions vs. efficiency in product manufacturing

As depicted in Figure 2, the first identified paradox emerges between effectiveness in customization of solutions and efficiency in product manufacturing and service delivery. When servitizing, the case companies could not choose between the customization of solutions and efficiency in product manufacturing but instead had to achieve both. The customization of solutions is used to increase customer value, but customization also complicates manufacturing and delivery; the efficiency of manufacturing and delivery are central to profitability. Efficiency improvements by increasing the standardization or repeatability of solutions become difficult (Davies et al., 2006; Kowalkowski et al., 2015) because the customization of solutions is a crucial component of differentiation (Martinez et al., 2010; Visnjic Kastalli et al., 2013). These circumstances present a paradoxical challenge that persists and cannot be easily resolved. While the paradox partially reflects the product-service continuum (Oliva and Kallenberg, 2003), at its core, the identified paradox emphasizes the need for efficiency in product manufacturing vs. effectiveness in customization (more broadly, efficiency (of operations) vs. effectiveness (towards customers)).

While this paradox was identified in each case, the interview passages describe various conflicts between the customization of customer solutions and the achievement of scale-related efficiencies in production and delivery. The paradox reflects the complexity of more extensive and complex projects, where both the solution and the delivery are highly customized, with the emphasis changing from the efficiency of production to the efficiency of delivery (e.g., in case D). Then, again, when solutions are less complex, the interviewees more strongly emphasize the efficiency

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of production while still noting the underlying optimization challenge between the customization of solutions and the efficiency of delivery (e.g., Case A).

Based on the data, the paradox between effectiveness in the customization of solutions and efficiency in product manufacturing clearly spurs other paradoxes and should therefore be the primary focus when analyzing the servitization of manufacturing companies. Thus, we positioned this paradox at the center of our model (Figure 2). Interview excerpts (the following and that in Table 2) provide insight into how our interviewees described this critical issue in different cases:

*“We have the factories that we have to fill... ...And basically no one was responsible for making sure that these factories have a workload. [Other unit’s] equipment is quite standard... ...But then this [other] unit’s, I mean the customers were very diverse... ...and we try to understand them, which means that we try to adapt... ...It generates difficulties, then, for our production, because they have to adapt, and there are certain difficulties then, because the debit and the profit are based on them manufacturing standardized products.”*

(AM12)

This first paradox sheds light on the tension between the customization of complex customer solutions vs. scale-related economies in production and delivery. All the studied case companies customize solutions for their customer needs, while the interviewees extensively described how the customization of solutions (products + advanced services) causes tensions in maintaining efficiency in product manufacturing and service delivery. Customization decreases repeatability (Davies et al., 2006) and increases both production and transaction costs, eventually decreasing profitability (Kohtamäki et al., 2013a; Roehrich and Caldwell, 2012; Williamson, 1985), as

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suggested in the power quote from case A, the quotes in Table 2 (also cases B, C and D), and by some prior studies. We are not the only researchers to encounter this finding. For instance, Raja et al. (2017) identified the dilemmas faced in customizing advanced services while simultaneously trying to scale up these services for a production setting. In essence, this situation reflects a similar idea. Additionally, Davies et al. (2006) and Kowalkowski et al. (2015) identified the same tension but did not interpret it as a paradox. Thus, the results underline the need for the case companies to optimize and balance between customization and efficiency, which is difficult to implement in a global, multi-divisional organization. We interpret this found tension as a paradox and find the paradox in each of the four empirical cases, in addition to witnessing the importance of this paradox in spurring the other three paradoxes (Figure 2).

**Table 2.** Paradoxes in servitization: within-case analysis.

Paradoxes/ companies	Company A	Company B	Company C	Company D
<p><b>Effectiveness in customization of solutions vs. efficiency in product manufacturing</b></p>	<p>“...life cycle projects take two, three, four, five years to materialize... And then you see this product business, that it’s very quick and very result-orientated. So it’s very difficult to get something strategic [done] at the same time.” (AM12)</p>	<p>“That our production, to which we try to produce product strategy... ..So that we can efficiently produce what is needed.” (BM20)</p> <p>“We invented a very good solution. But god damn, this costs 5000€ / (solution), that we can put this plan in the garbage can, this is useless. As such, a very good thing, but does not fit to our business model. On the one hand, we did development work by big money, but in everything, the driver was that we should get in to great volumes.” (BM8)</p>	<p>“You need to implement the knowledge near the customer, but at the same time centralize for efficiency.” (CM12)</p> <p>“Starting point is that you set yourself to the role of the customer... Then again, we need to search cost efficiencies.” (CM13)</p> <p>“You need to be close to the customer, be in same culture and speak same language, but at the same time, you need to have global technology link, to be able to use economies of scale.” (CM12)</p>	<p>“We want to modularize and productize strongly and on the other hand sell; we want to sell bigger and bigger solutions, so it’s not easily doable. But, we have a couple of modularization projects going on, that we could produce bigger solutions easier.” (DM3b)</p> <p>“Questions that whether certain processes fit more to CAPEX business, or service business. Do we optimize cost competitiveness from the CAPEX business perspective or should we try to produce CAPEX solutions where we would utilize same spare parts as what we sell elsewhere, for instance.” (DM14)</p>
<p><b>Building customer orientation vs. maintaining engineering mindset</b></p>	<p>“...get everybody to become customer-focused, creative, and innovative rather than only technically focused.” (AM3)</p> <p>“Value thinking, this is a really big and necessary change in the organization, in other words, that we will not think that everything that we get from this is product-oriented... ..More looking from outside in than inside out. That’s a big change.” (AM9)</p>	<p>“That type of technical knowledge is possible to transfer from one unit to another. But service culture, that is much harder, that won’t transfer with a few employees. You need to have a big enough organization to be able to do that.” (BM7)</p> <p>“...biggest challenge was to combine business knowledge and technical knowledge, and this we did not see at the beginning” (BM8)</p>	<p>“Customers provide some idea about their needs, but that is not the only truth. Instead, we have to bring our own [the company’s] competence broadly in.” (CM13)</p> <p>“... we provide the customers almost everything we can offer. And then, of course, that kind of cooperation, it has to be based on trust and added value, of course, all the time.” (CM5)</p> <p>“...less disturbances in the process, and also, of course, in the service delivery process, so that the service we provide is of good quality and it causes no problems for the customer.” (CM5)</p>	<p>“I have seen really good engineers, who are excellent when speaking about technology features and functionalities, they understand products and the industry really well. But what they don’t have, don’t understand, is that solution selling is about consulting.” (DM5)</p> <p>“[The challenge is to] ...consider from customer perspective... what they really need. One problem is to always see that they have challenges in certain issues. We go there to sell something very different... ..If we sell these long-term solutions, we should create a better picture that we manage the whole life cycle of the product. Now that doesn’t happen.” (DM3b)</p>



<p><b>Organizing for product and service integration vs. separated services and product organizations</b></p>	<p>“Service and [<i>product solutions</i>] in harmony together selling toward the same customer. But in reality, what it is, I think we are very much split in the silos still. I mean in [<i>product solutions</i>] and services.” (AM12)</p> <p>“...CAPEX is one and OPEX is another division. Now we are trying to mix the money between divisions and this is then the mindset that is quite difficult for the people who say hey, what is he doing, he’s taking money from me and putting it there, you understand? What shall I say to my boss, we [<i>one business unit</i>] have a negative margin and they [<i>another business unit</i>] have a much more positive margin?” (AM5)</p>	<p>“Well, we have these different business units. So, it complicates the situation; the product unit is counting how much [<i>money</i>] they need to get, and of course the service unit is counting because they also need to get their share of it. So, this is a big problem.” (BM4)</p> <p>“Every now and then, we discuss that who is in charge, or who takes the case if we have two options, modernization or (product)...” (BM21)</p>	<p>“...in our current structure, the backlog is generated by the cooperation among our business units. We have five business units that are still somewhat operating like silos...” (CM5)</p> <p>“...The problem is that when selling the machine, CAPEX is not that keen to offer services because they are selling their own efficiency, and the measure of their own bonuses is how many products you sell. So, you don’t get any extra from selling the services...” (CM11)</p> <p>“...because every unit wants to maximize its own share, and I guess we have been considered then just as creating costs for them. This is some sort of sub-optimization from our side, too.” (CM4)</p>	<p>“...it’s quite clear in our strategy that services are a really important factor for this company. But the further you go down in the organization, there are many people who do not regard services as an important thing or do not understand the customer value or the internal value that you get from an ongoing business compared to the business on the CAPEX side. Maybe they don’t understand what kind of margins we are talking about when we talk about service compared to conventional CAPEX.” (DM2)</p> <p>“Measures have been set a bit randomly. We don’t have measures that would drive toward one target. We allow one playing to his own goal, another to another goal, and not to the company’s goal. We have also contradictory measures that make our work more difficult...” (DM3b)</p>
<p><b>Exploratory innovation in solutions vs. exploitative innovation in product manufacturing</b></p>	<p>“...this type of change in management, that’s really the ultimate challenge. To really get this message through the organization and get everybody to become customer-focused, creative, and innovative rather than only technically focused. And still to be able to continuously develop that to some profitable business.” (AM3)</p> <p>“...one transformation within competences is to move from these sales of spare parts and individual field service jobs into these longer agreements. So, we must improve our processes there and be able to maintain our good profitability in the midst of all this change.” (AM7)</p>	<p>“The challenge is that we need to maintain and develop our own capabilities in large scope to follow up the development of our own products...and in addition to be able to offer services.” (BM1)</p> <p>“Starting from our vision, how these different solutions relate to it. IoT has been coming, and it has been part of our strategy for long... We’ve had a pretty strong service for long, as well as procedures and solutions... Obviously, new opportunities emerge all the time, our (remote) data is increasing, and so is knowledge that can be utilized to create value for the customer.” (BM14)</p>	<p>“...we have people who are innovating new services for customers, making the bundles with products and services and developing agreement models. And then, the challenge is that for this kind of concept development, we do not have the same kind of strict practices as for the traditional research and development. So, I would say that the development of new concepts is more driven by, steered by our strategy process.” (CM5)</p> <p>“...have to develop new services and products, what competitors don’t have, so that we can grow in the markets.” (CM3)</p>	<p>“It’s a fundamental change really, going from only thinking about the technology, only thinking about the hardcore equipment to start thinking of all the services related to that and also to think about the customer from a different perspective and angle as well. To not only think that the satisfaction from the on-time delivery and good high-quality equipment, but really, customer satisfaction comes from how well we are responding on small spares. How well we are responding to their big strategic decision making, consulting, that part. So, the barrier really is internal for us, to change our behavior.” (DM2)</p> <p>“There, they are not capable of thinking of the whole product concept... And then that what services it would require. And we are not that far in modularization.” (DM3b)</p>

#### 4.1.2. Building a customer orientation vs. maintaining an engineering mindset

The second paradox emerges between the case companies' intentions to create a more customer-oriented organizational mindset and to preserve their long-established engineering mindset. The technology firm's desire to develop a customer orientation is not a novel idea (Martinez et al., 2010; Oliva and Kallenberg, 2003) and highlights the importance of tight collaboration between the solution provider and the customer (Ayala et al., 2017; Batista et al., 2017; Huikkola et al., 2013). However, the paradox theory provides the central perspective on this issue – solution providers mostly cannot decide 'either-or'. Instead, product-related engineering identity persists, while customer-oriented service-related ideas are integrated into the organizational strategy and structure. Thus, the question about the mindset and organizational identity of a solution provider, "who we are" as an organization (Clark et al., 2010: 416) and who are we becoming as an organization (Gioia and Patvardhan, 2012), is rather complex and paradoxical. This reason is exactly why this issue of mindset should also be perceived through the paradox lens; an organization should not try to force a change in the organizational mindset from an engineering to a customer orientation but instead to accept 'both-and'. Thus, while moving downstream and emphasizing a customer orientation (Ng et al., 2012; Vargo and Lusch, 2008), an engineering orientation remains important, eliciting the second paradox.

The case companies were found to excel at technology development but also lacked an in-depth understanding of the objectives of solution selling—customer value, business impact, customer engagement, and problem solving. Consistently throughout the case companies, the case firms struggled to update their existing engineering identities with a solutions mindset that would be more geared toward servicing (case B) the customer (A, C, D) (Galbraith, 2002). One cannot be

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sacrificed for the other, as these two organizational mindsets (customer orientation vs. an engineering mindset) must coexist to create an effective solution provider organization that can deliver customized engineering products and services. This paradox was present in all the case companies (Cases A, B, C and D) and was also described by the interviewees in all cases.

Customer orientation is crucial for understanding a customer's business (Hinterhuber, 2008; Töytäri et al., 2015), which is necessary when customizing solutions and advanced services that support the customer's business. However, an engineering mindset is critical for maintaining a culture that supports the development of highly innovative products and solutions. Case companies struggled to balance between the technical and product-related engineering mindset and the customer-oriented service culture:

*“It is hard to get to value thinking because we have learnt to think about our costs, our products, our profitability, and our next year's budget. Everyone is worried about that considering last year, and when you come to that point to say that we should think about the customer, everyone is saying that they don't have time... ..It is big cultural issue, to change the culture and the mindset toward customers and to see the world from there.”*

(DM4)

#### 4.1.3. Organizing for product and service integration vs. separated service and product organizations

The third paradox emerges between organizing for product-service integration and keeping service and product organizations separate. The case firms had separated products and services into different business units to facilitate service sales and delivery, which in turn promoted product and

service performance (Gebauer et al., 2005; Oliva & Kallenberg, 2003). However, in addition to maximizing product and service sales, the case companies offer complex solutions that integrate products and services. These different divisions or units, such as product and service units, had different goals, measurement and follow-up systems, and incentives, facilitating the optimization of unit-level targets, causing so-called sub-optimizing behaviors. Interviewees' excerpts (Table 2) describe how sub-optimization between products and services diverted the bundling of integrated solutions. The sub-optimization of the CAPEX and OPEX was an important factor supporting unit-level performance, but sub-optimization diminished effective collaboration between units and thus the design and delivery of integrated solutions (customized products + advanced services). The case interviewees (in all cases) noted that product-oriented (CAPEX) decisions often dominate and overshadow the service business and especially the more complex and long-term solution business. Thus, expansion toward solutions became challenging because the organization must generate alternative bridging practices for bundling products and services across divisional boundaries while maintaining high product and service sales. As the quote below illustrates well (more examples in Table 2), the paradox cannot be easily resolved. This paradox tends to persist, even if the product and service activities are organized under the same business lines. It may be that this paradox is not new at a conceptual level but was already identified early in the management literature, as argued by Jarzabkowski et al. (2013). However, the servitization literature has not yet identified this situation as a paradox but rather something that should be resolved, which seems to be almost impossible, according to our findings.

*“At certain times, services have been a separate business unit, and at some times, part of the production line...when we have been separate, the cooperation has been quite complicated and full of tension.” (CM4)*

#### 4.1.4. Exploratory innovation in solutions vs. exploitative innovation in product manufacturing

The final paradox emerges between exploratory innovation in solutions and exploitative innovation in product manufacturing. Through the case analysis, servitization was found to be a thorough transition process requiring an explorative learning capacity from companies developing customized products and advanced services while maintaining the incremental development of product manufacturing and service delivery. On the one hand, innovation regarding customized solutions and advanced services requires a radical rethinking of product-service concepts, business logic, and customer value propositions (Kowalkowski et al., 2015; Visnjic Kastalli et al., 2013). Additionally, companies must develop their engineering, product development and innovation, and production incrementally (Visnjic et al., 2016). Thus, the case companies faced a paradox related to ambidextrous innovation and had to radically invent a new servitized solution business model while simultaneously attempting to preserve the traditional product-oriented business model. These results confirm that servitization in manufacturing requires ambidexterity, which involves accomplishing continuous management of the co-existence of product- and service-centric capabilities (Kowalkowski et al., 2017b) and operating in several fields to explore and exploit technologies in different settings (Raja et al., 2017).

These parallel development paths — one toward the incremental development of standardization, repeatability and efficient manufacturing and the other a more explorative logic toward customized solutions and advanced services — require very different types of innovation practices and capabilities. Whereas the incremental development of product manufacturing demands the capabilities of continuous improvement and exploitative learning, customized solutions — a concept that is significantly distinct from the companies' prior business logic — require

explorative learning and continuous, more exploratory innovation, as demonstrated by the case interviews. Interviewees in different cases describe the paradox between explorative innovation towards new solutions, in contrast to exploitative, incremental learning in development and manufacturing, the order-delivery processes. The cases point to a paradox between learning and innovating towards complex solutions involving both new technologies and business models while maintaining and developing the current operational model. We coin this paradox exploratory innovation in solutions vs. exploitative innovation in product manufacturing. In the quote below, the interviewee from the case company B emphasizes the exploration of new product-service solutions and related automation and technologies while acknowledging the role of traditional products and services. Similar descriptions were heard from other interviewees in different cases (A, C and D). The exploration of new integrated solutions must be implemented in parallel with traditional product and service delivery.

*“...strategically, we are selling this concept to customers... ...We want to be a technology leader, which has both automation and related technologies. Then again, more traditional product and service trade is important... ...we get deeper by installing these sensors.”*

(BM13)

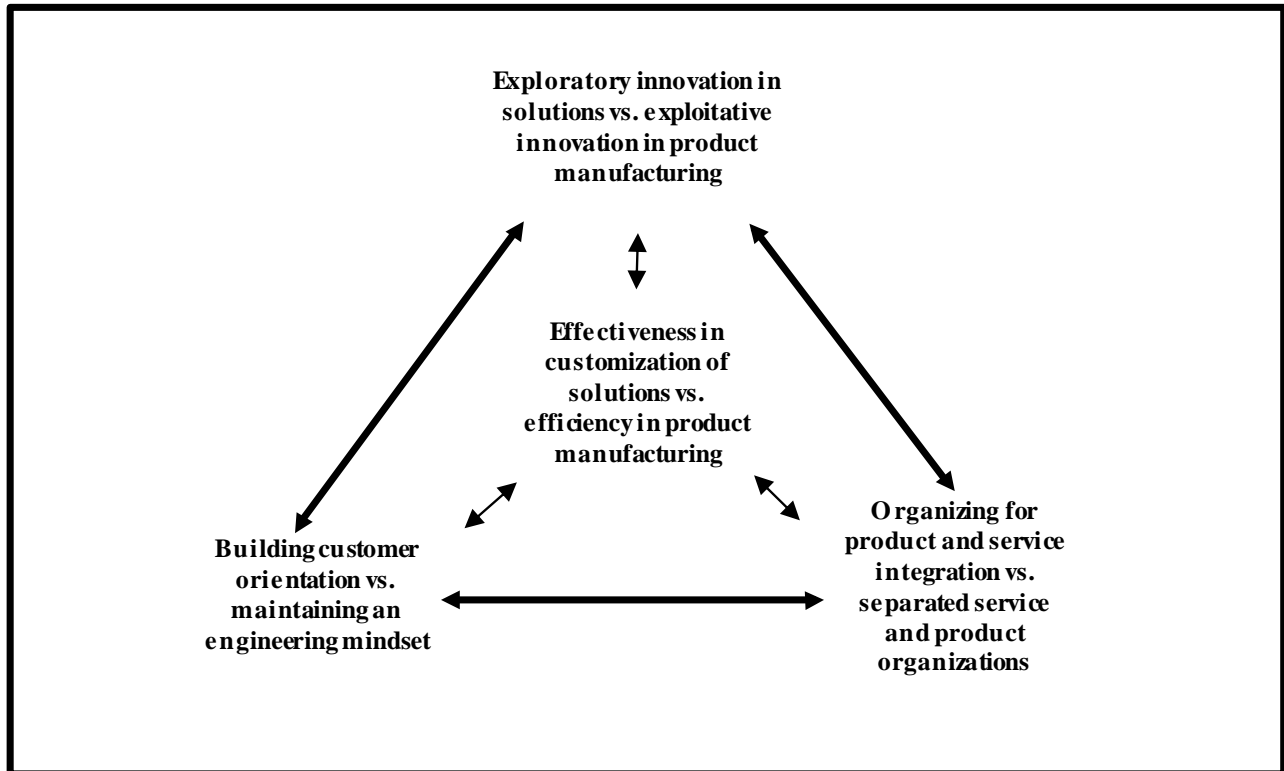
Whereas the exploitation logic expects practices for continuous incremental innovation in product development and operations, the exploration logic calls for a more radical rethinking of offerings and process innovation and explorative learning capabilities. Incremental development requires relatively few resource reconfiguration capabilities, whereas radical innovation toward solutions demands a significant reconfiguration of capabilities (Huikkola et al., 2016). This finding echoes Brax’s (2005; Gebauer and Fleisch, 2007) arguments that servitization requires a radical shift in an

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operational model – we find that servitization requires coping with the paradox between exploitative and explorative learning, which involves very different types of innovation and learning capabilities. This paradox may become frustrating for developers attempting to meet these very different types of learning requirements, as suggested by the ambidexterity literature (Fischer et al., 2010; Raisch and Birkinshaw, 2008). Companies may even experience what the literature has coined as the exploitation trap, which steers a company to focus on profits resulting from exploitation at the cost of exploration (Sirén et al., 2012). This path-dependent exploitation trap inhibits servitization. Thus, a paradox emerges from the companies' aspirations to continue the incremental development of product lines while simultaneously implementing radical innovation in search of new customized solutions and advanced services (Story et al., 2016).

The four servitization paradoxes identified from the case companies and discussed above are interdependent, as shown in Figure 2. The model emphasizes the role of the central paradox between effectiveness in the customization of solutions and efficiency in product manufacturing, which spurs the surrounding paradoxes. Although customer orientation plays an important role in the customization of solutions, customer orientation should not diminish the role of the engineering mindset embedded in the product engineering organization, which remains important for developing new products and exploring integrated solutions. A manufacturing company must extend such an organization to exploratory developments of innovative customized solutions while maintaining the incremental, exploitative development of product manufacturing, as well as product and service delivery. Finally, the servitizing organization should manage the integration of customized products and advanced services into customized solutions despite having to work across the organizational boundaries created by the separate product and service divisions. Thus,

the interdependence between the paradoxes truly challenges companies in their servitization attempts.



**Figure 2.** Paradoxes in servitization.

#### 4.2. Coping with the paradoxes in servitization

By definition, paradoxes cannot be resolved, and companies must therefore cope with them. Figure 3 provides a summary of the identified coping practices, while Table 3 presents illustrative quotes from different case companies. In this section, we identify the coping practices paradox by paradox, starting from the central paradox.

Companies must cope with the paradox between effectiveness and efficiency – effectiveness in the customization of solutions and efficiency in product manufacturing – to carve out the profit impact



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from advanced services and integrated solutions (Gebauer et al., 2005; Visnjic Kastalli and Van Looy, 2013). We found three coping practices. First, is the management system to balance between solutions and products, suggesting that measurement, follow-up, and reward practices should enable balancing between effectiveness in the customization of solutions and efficiency in product manufacturing. Our results underline the importance of crafting a management system and guidelines that enable balancing between effectiveness and efficiency. This means balancing between effectiveness and efficiency when setting up measurement systems, targets, follow-up and rewarding practices. Balancing is important also when making strategic decisions about investments, or when creating yearly budgets. Second, from our global solution providers, we identify the role of modular integrated solutions in customizing solutions while maintaining a high utilization rate of factories. Mass customization of integrated solutions has been observed to be an important means to improve operations and thus cope with the paradox between effectiveness and efficiency. Third, our interviewees underlined the role of end-to-end coordination: the integrated collaboration between customized product and service units to effectively coordinate operations within an end-to-end process. Thus, companies have developed end-to-end coordination through different types of practices; they have integrated service business and project business in the same business line, established a shared support service, or recruited end-to-end director to ensure improved coordination. As argued by (Kowalkowski et al., 2015: 63) “*Becoming an industrializer*” may be far from easy, but these managerial coping practices may help companies substantially.

Regarding the coping practices for building a customer orientation vs. maintaining an engineering mindset, we identify the role of strategy work: the process of reviewing and revising strategies in

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participative strategy workshops to bridge product- and service-related activities to produce solutions. Common tools and activities facilitate the strategic intent to integrate products and services not only to bridge strategic thinking across units but also to increase the visibility of integrated solutions (Fang et al., 2008; Kohtamäki et al., 2013b). Within the practice of strategy, many of our interviewees underlined the importance of promoting life cycle thinking as a means to increase the common understanding about the integration of services in a product's life cycle (Rabetino et al., 2015). Life cycle thinking may serve as an effective practice to bridge customer orientation and the engineering mindset. Many interviewees believed that such thinking may provide a common basis to integrate products and services. These coping practices are inherently social (Schatzki, 2006), facilitating the creation of a shared understanding of why and how an organization is moving toward integrated solutions.

**Table 3.** Coping with the paradoxes in servitization.

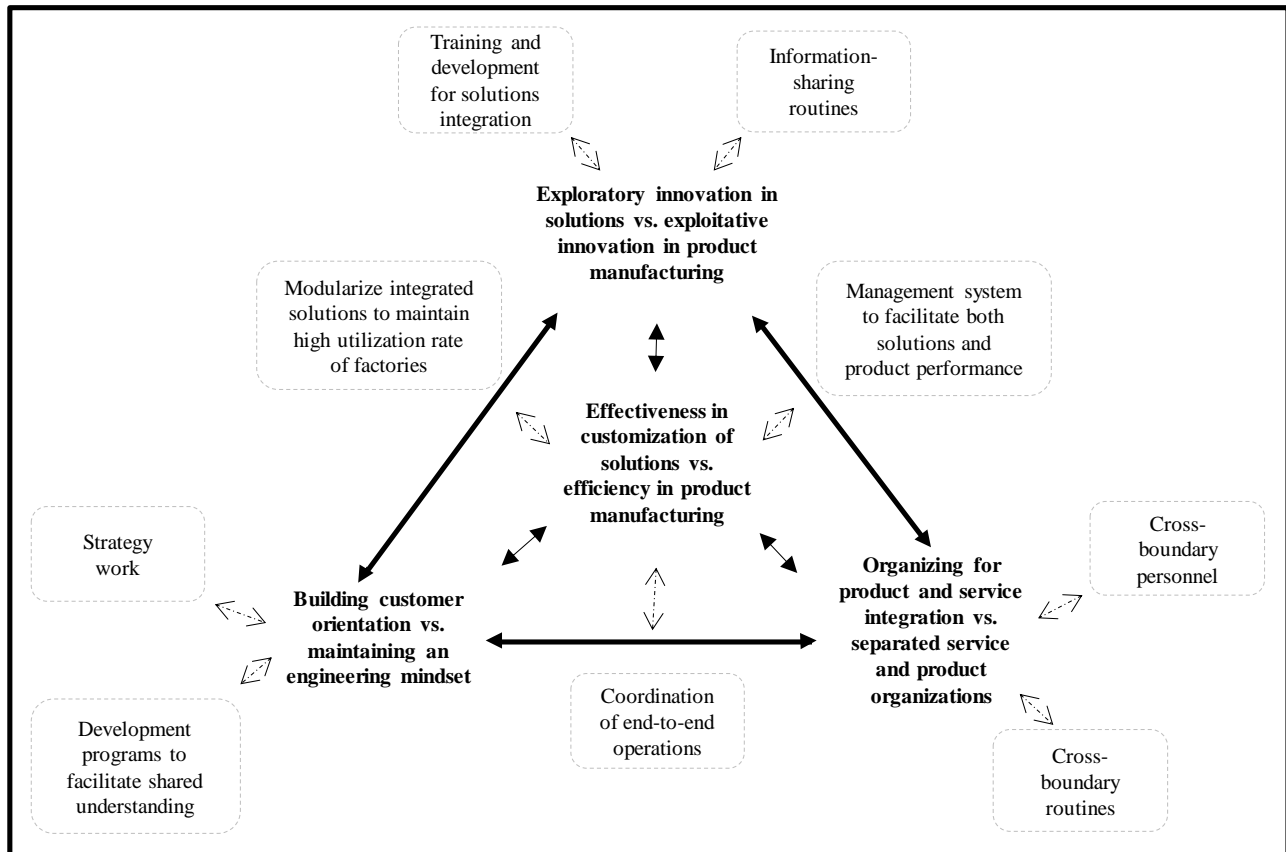
Paradoxes	Coping practices	Case A	Case B	Case C	Case D
Effectiveness in customization of solutions vs. efficiency in product manufacturing	Management system to facilitate both solutions and product performance (A,B,C,D)	"...management support and management pressure also to that those plans are actually followed up on, so that they are actually done with good enough quality and followed each month, that how is this progressing compared with the schedule." (AM7)	"We have this bonus system. We have different measures, like turnover, profitability and growth, job satisfaction, security and such things... when they are at a certain level, we get a bonus" (BM3)	"...we opened shared databases and made shared customer project metrics for sales, product managers and project managers to build up a shared understanding and language..." (CM2)	"... remuneration is something that has changed, the people who are working on services might not be so interested in the bonus structure that we had in the past, so that has been changing to try to motivate the services guys more." (DM2)
	Modularizing integrated solutions to maintain high utilization rate of factories (A,B,C,D)	"We have for all the products, not identical, but some level of product configurators. So, even though I talk about customization, I think it's mass configurators, configurability of some sort. Could be also some customization there. And for that, we have a process which we call it simply non-standard requests." (AM6)	"We have started the product modularity from customer surface and searched the variation and modularity guidelines from there – what the modularity requires." (BM31)	"...at the moment, we are working with the modularization of our offering. And when we have the standard basic sales items and modules in place, then we could consider having that kind of agreement configurator." (CM5)	"The thing that we have been able in our product development to modularize our core products has enabled simplified and agile production..." (DM1)
	Coordination of end-to-end operations (A,B,C,D)	"VP who is in charge of sales, he's in charge of the factory. So he has the product, profit and loss tools for the whole chain. So he has the factory under him, and then, he has to make sure that it's running in the optimum way. And I see this is a positive thing in that respect because now, we really have a responsibility. If we have certain issues, then is this product-line head who has to, or the business-line head, who has to come up and make a decision." (AM12)	"Our group has joint support service, which serves all of our businesses. Now, after three major acquisitions, we have three major business areas, [names removed]. And for all those, we are doing development, and we also support businesses in difficult situations in their day-to-day operations." (BM22)	"We have the service business and the project business in the same business line. In doing so, we have succeeded pretty much to overcome the internal borderlines and eliminate challenges. So when we look at these businesses as a whole and measure it as a whole." (CM1)	"When we have standardized components and good connections to their producers, this also allows us to plan and optimize the whole chain better than before..." (DM1)
Building customer orientation vs. maintaining engineering mindset	Strategy work (A,B,C,D)	"I propose targets to my team as a strategy that all of them understand their role in regarding how to operationalize the actual targets and strategy... We are now trying to find the right way to go." (AM9)	"...in strategy work, we have long-range planning, mid-range planning and annual planning, and they are all critical..." (BM17)	"We update annually our strategy and our annual plan. In strategy, we update our external and internal image, goals both for financial targets and business goals." (CM9)	"Now it seems to function, perspectives from different markets, business units are combined, and the fluent discussion of where to focus and where to invest." (DM19)
	Development programs to facilitate shared understanding (A,B,C,D)	"...we launched a big transformation program, we merged into end-to-end operations, from R&D to production to sales to, in some cases, actually the services. We essentially want to put management teams of a certain operation around a table where there are all the aspects." (AM6)	"...to fully leverage the new size of the company to really address our customers as one unified entity, then it was decided together with our CEO and the executive board to kick off a business process harmonization program called One [Company name]. And I was leading the program at the time, so kicking it off and working with the executive team and also the all the businesses for the first couple	"We have this so-called 'shared journey forward' campaign, or such, like we talk about a program, through which we want a broader scope of offerings to the customers and operate by using common practices at the customer surface." (CM13)	"Then, this service program was newly launched... this strategic program gets a lot of visibility. And the purpose is that this year, we would get new advancements in localized capabilities." (DM21)

			of years to identify the business models in the organization.” (BM12)		
Organizing for product and service integration vs. separated services and product organizations	Cross-boundary personnel (A,B,C,D)	“...we have people that have a dual roles, so they are involved in other [internal] organizations. Then, of course, we are building the connection more and more when new building projects are coming in and there are offers going on, we connect much faster now to service these. After salespeople, we connect with the contracting guys also.” (AM2)	"We have here the broad organization, and from our side support organization. Branch or market is not alone, but from [city name removed] headquarters, we have these people to see these things through with us." (BM3)	"...it's an ad-hoc team for a project, but we have four named services guys from different units who should be involved in each project." (CM5)	"...there's the sales case owner, and normally that sales case owner is still the CAPEX sales guy. But we are heading more and more, that the sales case owner might be the site-account manager, who is actually sitting in the services organization. Nevertheless, the services guys are part of the sales team, that's for sure today." (DM2)
	Cross-boundary routines (A,B,C, D)	"...this kind of corporate PMO, Project Management Office, where the idea was to collect and roll out the best project management framework and skills... let's say strong professional skills." (AM6)	"We have to try to build this network so that these people who work with our (products) or sales or services, when they are at the customer surface, they operate in the same office space, to enable natural communication. This, we haven't wanted to break at any way. This is why things work through to the grassroots level." (BM21)	"In the previous position, I responded to the quality management systems and business, and I responded both to the volume of service business and to the volume and profitability of the capital business. So, in a way, I looked at it as a whole and it did not become such a sub-optimization, which could easily have happened if someone considered a service business and some other considered the project business." (CM1)	"I think we have had some cross-functional themes so people from the services organization have met with the product people in formalized workshops and tried to see, where are there gaps." (DM2)
Exploratory innovation in solutions vs. exploitative innovation in product manufacturing	Training and development for solutions integration (A,B,C, D)	"...this is value-based business training that all of the salespeople around the world in services have to attend." (AM9)	"We have continuous training... we have individual training plans... we have developed our service concept for a long time. You cannot start this kind of concept all at once, but we have built it and then brought it to markets." (BM1)	"...we had this services management program that was one week of intensive training two times by [name removed] actually. It was so the framework broadly was this solution business, but it was a very good training program for services management as a whole." (CM5)	"...we have launched these training programs based on our assessments, for instance, value selling (theme). And then, we have programs organized by outsiders (consulting companies), where we have taken (product) sellers to be 'converted' into service sellers." (DM22)
	Information-sharing routines (A,B,C,D)	"...share the action planning and budget targets together, let's plan customer meetings together, and let's share memos from customer meetings." (AM3)	"...we have brought these common tools, for example, service reporting systems, where we reasonably have everything in one big system. Then, the information can be extracted ... So you can learn from what's happening elsewhere. So then, you get some picture of how things are going elsewhere." (BM19)	"And that's why it's very important to have some kind of common tools where people can share the information..." (CM5)	"...we have three different core systems we are using. One is the product document management system, we have [name removed], which is taken gradually into use, this is where all the services are described. Then, we have the ERP system SAP, which then gets the item from the PDM system, and all the commercial things are put on top of that services item in the ERP system. And then, obviously, the CRM system is important because they will need to have a view of the full offering for the sales to be utilized." (DM2)

Third, concerning the paradox between organizing for product and service integration vs. separated service and product organizations, the case companies utilized coping practices, such as having cross-boundary personnel, and establishing cross-boundary routines to bridge product- and service-related activities to facilitate solutions integration. While this was found to be a very difficult paradox to cope with, a variety of cross-boundary routines used to cope with this paradox were described, including project organization to deliver a solutions project and clarification of roles and responsibilities at different organizational levels and units. One of the cases (Case A) even piloted a separate unit for particularly complex project solutions (in addition to complex products and service organizations) but ended the pilot and merged the organization into a product division. The concept intended to integrate the management of the entire life cycle of customer solutions under a unit called integrated solutions, but the firm's customers did not want to commit to a 20- or 30-year contract, and the experiment ended. While coordinating activities across units was found to be challenging, coordination was also challenging across organizational levels and different markets served. Project managers played significant roles as boundary-spanning persons, but many other individuals also played important roles. Interviewees from different case companies emphasized the importance of bridging activities across organizational boundaries while establishing clear roles and responsibilities. Therefore, the clarification of roles should not lead to isolation but instead to continuous bridging efforts. Bridging activities are not so much about the organizational structure, as organizational silos seem to develop within various types of structures. Instead, bridging is a key activity within all types of organizational structures, as solutions integration and project delivery require heavy collaboration.

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Finally, regarding the paradox between exploratory innovation in solutions vs. exploitative innovation in product manufacturing, the case companies typically applied coping practices ranging from solutions-oriented training (sales, integration, and delivery) and development to increasing internal information-sharing routines. Information was shared not only through different systems (service reporting systems, document management system, ERP-system and CRM system) but also by planning customer meetings together, sharing the action planning and budget targets more broadly, and sharing memos from different customer meetings. Information-sharing routines and material tools enable companies to share knowledge about the interests of different units and to facilitate both exploratory innovation in solutions and exploitative innovation in product manufacturing. Practices focused on supporting solutions-related learning while maintaining high performance of existing operations. Table 3 provides some illustrative excerpts from the interviewees regarding different coping practices in all of our studied case companies, while Figure 3 synthesizes the paradoxes and coping practices.



**Figure 3.** The four paradoxes and their nine coping practices (identified by boxes and arrows with dashed lines) in servitization.

## 5. Conclusions

### 5.1. Theoretical contribution

This study set out to challenge the dichotomous ‘either-or’ thinking between industrial goods and services (product vs. service-logic) and the somewhat naïve emphasis on the benefits of services in contrast to products (Luoto et al., 2017). The study was designed to conduct a systematic analysis of servitization using paradox theory, with an emphasis on ‘both-and’ thinking. As such, the paradox approach provides a valuable lens to study servitization because servitizing companies face contradictions when reshaping their business models from product-based logic toward a

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services logic that occurs when providing complex solutions (Baines and Lightfoot, 2013; Davies et al., 2007; Kowalkowski et al., 2015; Lightfoot and Gebauer, 2011). This approach is relevant not only for the servitization research but also for managerial work.

As the first theoretical contribution, the present study identified four paradoxes in servitization: 1) effectiveness in the customization of solutions vs. efficiency in product manufacturing, 2) building a customer orientation vs. maintaining an engineering mindset, 3) organizing product and service integration vs. separated services and product organizations, and 4) exploratory innovation in solutions vs. exploitative innovation in product manufacturing. According to the first paradox, a servitizing organization often cannot choose between the customization of solutions and the efficiency of product operations but instead should achieve both. Customization increases customer value but complicates delivery; yet, the delivery should be made as efficient as possible ('both-and' instead of 'either-or'). The first paradox was placed at the center of the developed research model because it spurs the other three organizational paradoxes. As such, the first paradox is important for the servitization literature. This finding implies that servitization, as strategic intent, is inherently embedded in the effective customization of solutions, which generates a paradox with the efficiency of manufacturing or, more broadly, the efficiency of order delivery. The second paradox emerges from the premise that customized solutions require customer orientation while preserving an engineering mindset. This paradox extends the servitization theory from the perspective of organizational identity, i.e., organizational mindset and culture. While the importance of customer orientation has been emphasized extensively in prior servitization research (Green et al., 2017; Martinez et al., 2010; Ng et al., 2012), an engineering mindset maintains an essential role in a company developing products and



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manufacturing in the future and should be considered when implementing servitization in manufacturing companies. Third, the evidence reveals the existence of a paradox emerging between organizing for product/service integration and separated service and product organizations. This paradox emerges when a manufacturer intends to increase the sales performance of both products and services while trying to facilitate the integration of customized products and advanced services into solutions. An important finding is that solution providers cannot resolve this paradox by re-organizing product and service organizations – the paradox seems to persist. Thus, instead of trying to resolve the paradox, organizations should try to cope with it and find a balance between these opposing factors. As with other paradoxes, this paradox spurs others and is influenced by others. Organizational realities are dynamic, not stable. The fourth paradox uncovers that a manufacturing company should explore the development of customized solutions and the overall solution business model while maintaining the incremental development of its product manufacturing and product-service delivery. Thus, the manufacturing company should engage in ambidextrous innovation (Raisch and Birkinshaw, 2008) while combining explorative and exploitative learning (Fischer et al., 2010; Visnjic et al., 2017b).

As the second main contribution, this study identifies practices that facilitate coping with the paradoxes. The identified coping practices were linked to specific paradoxes, but they also clearly influence other paradoxes. These coping practices help companies balance and stretch resources for contradictory tasks related to solutions and the product manufacturing logic proposed in this study. Because companies cannot resolve these paradoxes, organizations should instead accept, appreciate, make sense of, and cope with them (Beech et al., 2004; Lewis, 2000; Poole and Van De Ven, 1989). We propose coping practices to address the paradox between effectiveness in the

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customization of solutions and efficiency in product manufacturing, practices for the paradox between building a customer orientation and maintaining an engineering mindset, practices regarding the paradox between organizing for product/service integration and separated service and product organizations, and practices for the paradox between exploratory innovation in solutions and exploitative innovation in product manufacturing.

The study uses the concept of practices from practice theory to discuss coping with the paradoxes. The term ‘coping practice’ emphasizes the active role of managers in leading employees to cope with the paradoxes. Coping with paradoxes is active and requires agency (Mantere, 2008). The use of practice theory here integrates the concepts of paradoxes and practices within the same study. As such, this study is grounded in paradigmatic approaches of these two different theoretical perspectives, as both perspectives highlight social constructionist, subjectivist ontological, and epistemological standpoints. As the practice theory sees the concept of practice as sayings and doings, it fits well into how managers should cope with the paradoxes in servitization. Organizational paradoxes may not be observed as objective facts but are socially constructed, important organizational phenomena embedded in organizational doings and sayings. Thus, bridging the paradox theory and the practice theory is relevant for this study.

In future servitization research, the paradox approach can provide an alternative approach to explain the “back-and-forth” servitization-deservitization movement (Böhm et al., 2017; Finne et al., 2013; Kowalkowski et al., 2017b; Valtakoski, 2017). The paradox theory provides needed explanations to tensions experienced by servitizing companies to enable the use of appropriate coping practices.

## 5.2. Managerial contribution

The paradox framework developed in this study enables companies to identify the organizational paradoxes that arise during servitization and accept the constant tensions that result from the strategic decision to expand toward solutions. As paradoxes in servitization persist, the study suggests that managers, instead of searching for ‘either-or’ solutions, should accept and embrace ‘both-and’ solutions. Identifying and coping with paradoxes is central for improving the implementation of servitization.

The present study identified nine coping practices from the studied solution providers, such as a management system to facilitate both solutions and product performance, modularizing integrated solutions to maintain a high utilization rate of factories, coordinating end-to-end operations, strategy work, development programs to facilitate shared understanding, cross-boundary personnel, cross-boundary routines, training and development for solutions integration, and information-sharing routines. The identified practices provide insights on how to cope with each paradoxes. These practices help to provide guidance for managers responsible for implementing servitization or digital servitization. The identified coping practices will not necessarily fit in all contexts, but can provide insights for organizations considering how to cope with the identified paradoxes. The study provides some comfort for managers seeking to balance the pressures emerging from the paradoxes. Additionally, the paradox approach enables a greater understanding of the obstacles to servitization and provides new insights in discussions on the servitization-deservitization movement (Böhm et al., 2017; Finne et al., 2013; Kowalkowski et al., 2017b; Valtakoski, 2017). The paradox approach may also shed light on new specific capability

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requirements that emerge during servitization, capabilities that enable coping with the paradoxes in servitization (Gebauer et al., 2017; Huikkola and Kohtamäki, 2017; Kindström et al., 2013).

### 5.3. Limitations and suggestions for future servitization research

This study has limitations that should be considered. First, the paradox model is not intended to be exhaustive but rather to represent the paradoxes and related coping practices found in these cases, given the data limitations. Despite our best efforts with the selected case companies, we do not intend to provide an all-encompassing picture of paradoxes or coping practices. Our detailed empirical data enabled us to capture a contributive collection of paradoxes and to encourage further research to delve deeper into the paradoxes of servitization. A narrower focus on some specific paradox and coping practices may achieve this goal. Additionally, a processual approach could provide further insights. Servitization research would benefit from processual research and narrative analysis when interpreting organizational dynamics and the role of discourses during the process. Further research is needed to provide richer illustrations of these paradoxes. Development of the paradox approach in the context of servitization is not an issue that can be covered by one or a few studies; instead, this approach is associated with a potential stream of empirical research that calls for significant conceptualization and theory development in future studies. Moreover, the paradox approach reflects a need to analyze the routines, practices, and capabilities required to balance the types of capabilities that manufacturers need in the context of contradictory demands.

The framework provides a potential tool for future research on the paradoxes experienced by manufacturing companies, particularly the inherent paradoxes faced by the case organizations analyzed in the present study. However, the framework does not scrutinize the paradoxes created

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by the external environment and its multiple stakeholders. Instead, the approach utilized and developed here is intended to facilitate recognition of the paradoxes faced internally by a manufacturing company in servitization. Although the paradox model is incomplete, we believe that it provides a valuable contribution to the existing research and useful avenues for further servitization research. Studies involving other cases may provide additional paradoxical challenge. Moreover, we call for studies on coping practices in servitization. In addition, the concepts of paradoxes and coping practices provide opportunities for studies on digital servitization, Internet-of-Things, and Artificial Intelligence, as well as many other related organizational phenomena.

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