Spiraling between learning and alignment toward digital service innovation

Peer-reviewed author version

Coreynen, Wim; MATTHYSSENS, Paul; Struyf, Bieke & VANHAVERBEKE, Wim
(2024) Spiraling between learning and alignment toward digital service innovation.
In: Journal of Service Management, 35 (2), p. 306-331.

DOI: 10.1108/JOSM-12-2022-0400
Handle: http://hdl.handle.net/1942/42238

Spiraling between learning and alignment toward digital service innovation

Authors (preliminary in alphabetical order):
Wim Coreynen[1,2,3,*], w.coreynen@vu.nl
Paul Matthyssens[4,3], paul.matthyssens@unimib.it
Bieke Struyf[5], struybi@cronos.be
Wim Vanhaverbeke[3], wim.vanhaverbeke@uantwerpen.be
[1]Vrije Universiteit Amsterdam
[2]Utrecht University
[3]University of Antwerp
[4]University of Milano-Bicocca
[5]The Cronos Group

Abstract

Purpose – This study aims to develop insight and theory on the process toward digital service innovation (DSI), and how companies deal with the rising complexity associated with DSI through organizational learning and alignment, both inside and outside of the organization.

Design/methodology/approach – In-depth, longitudinal case studies of three manufacturers are developed as illustration, based on purposeful sampling. Per case, multiple semi-structured interviews are conducted, and insights are validated through additional data gathering. Each company's DSI process is reconstructed through critical incident technique. Next, through systematic combining, a middle-range theory is developed by proposing a theoretical frame and propositions concerning the relations between DSI, learning and alignment.

Findings – We posit that, as companies gradually develop and progress toward DSI, they deal with a rising degree of complexity, fueling their learning needs. Companies that are apt to learn pass through multiple cycles of learning and alignment to overcome specific complexities associated with different DSI stages, with each cycle unlocking new DSI opportunities and challenges.

Originality – This study applies a stage-based view on DSI combined with complexity management and organizational learning and alignment theory. It offers a theoretical frame and propositions to be used by researchers for future DSI related studies, and by managers to evaluate alternative DSI related strategies and implementation steps.

Keywords – Digital service innovation, Digital transformation, Servitization, Complexity, Learning, Alignment.

Paper type – Research paper

1. Introduction

These days, we see the collision of two trends: technological innovation and service innovation (Opazo-Basáez *et al.*, 2021; Vendrell-Herrero *et al.*, 2023). Both trends impact on each other, thereby generating new business opportunities and disruption in markets *(Frank et al.*, 2019; Kolagar *et al*., 2021). The latest digital technologies, such as the Internet of Things (IoT), cloud computing, and artificial intelligence (AI), enable companies to provide more and better value for customers through smart products and advanced services (Ardolino *et al*., 2018; Vendrell-Herrero *et al*., 2021), often enabled through digital platforms (Cusumano, 2022; Markfort *et al*., 2021). Digital service innovation (DSI) combines both digital and service innovation logics, leading to digital servitization and other innovative, digitally-enabled business models (Opazo-Basáez *et al*., 2021; Raddats *et al*., 2019; Vendrell-Herrero *et al*., 2023).

Existing studies have used a process perspective to describe several transformation paths for DSI (Baines *et al*., 2020; Coreynen *et al*., 2017; Dmitrijeva *et al*., 2022; Tian, Coreynen, *et al*., 2021) and smart solution strategies (Huikkola, Einola, *et al*., 2021; Kamp *et al*., 2017; Pardo *et al*., 2020) enabled by different capability configurations and success drivers (Huikkola *et al.*, 2022). Notwithstanding their vast amount of recommendations, the

transition toward DSI is still considered highly complex (Bustinza *et al*., 2018; Eloranta *et al*., 2021). When companies enhance their DSI maturity (Kolagar *et al.*, 2021; Polova & Thomas, 2020), they continuously struggle with new tensions and barriers both inside and outside of the organization (Tóth *et al*., 2022). Such complications and complexities (Vasconcelos & Ramirez, 2011) force companies to continuously seek solutions through organizational learning (Friedl *et al*., 2022; Kohtamäki & Partanen, 2016). Then, they need to adapt by seeking organizational alignment, both within the company and with external actors (Alghisi & Saccani, 2015; Struyf, Matthyssens, *et al*., 2021; Zhang *et al*., 2022). However, enhancing DSI maturity is challenging. First, companies find it difficult to explore and exploit the (financial) potential of technological and service innovation simultaneously (Coreynen *et al*., 2020; Kohtamäki, Parida, *et al*., 2020; Vendrell-Herrero *et al*., 2023). Second, when offering digital or digitally-enabled services (Raddats *et al*., 2019), companies need to align both front- and back-end operations, such as sales, engineering, and production (Coreynen *et al*., 2018). Third, in increasingly connected and complex markets, they also have to (re)align with suppliers (Vendrell-Herrero *et al*., 2017) and customers (Kamalaldin *et al*., 2020) as well as with ecosystem partners (Kohtamäki, Parida, *et al*., 2019; Kolagar *et al*., 2022).

Existing literature does not seem to answer explicitly how the development and upscaling process toward mature DSI evolves. Several research topics have been suggested, such as the pathways and stages for companies to adopt digital technology and advance their service business (Opazo-Basáez *et al*., 2021; Paschou *et al*., 2020), the approaches to manage and overcome complexity associated with DSI (Eloranta *et al*., 2021; Sjödin *et al*., 2020), and the sequencing of learning and alignment when building the optimal configuration of smart products (Vendrell-Herrero *et al*., 2021) and digital service business models (Huikkola *et al*., 2022). Therefore, this study answers the call of prior studies by focusing on the following research questions: what are the pathways for companies to evolve from a low DSI position to

reaching high DSI maturity? And how do they manage complexity, both inside and outside of the organization, through learning and alignment along the way?

In our effort to decipher the DSI process, we first discuss prior work from both a complexity management (Eloranta *et al*., 2021; Vasconcelos & Ramirez, 2011) and dynamic capabilities perspective, the latter specifically relating to organizational learning (Chiva *et al*., 2010; Chiva & Habib, 2015) and alignment (Gebauer *et al*., 2010; Matthyssens & Vandenbempt, 2010). Next, we describe three illustrative cases with different DSI pathways, introducing a stage-based view on learning and alignment undertaken during different interaction cycles. Via systematic combining, a theory of the middle ground is developed (Edmondson & McManus, 2007). We construct a theoretical framework that maps the DSI process of the cases along two dimensions, indicating growing complexity on one end and growing levels of DSI on the other. The frame displays companies' growing learning needs along the DSI process, leading into different learning and alignment cycles. These insights are then used to develop several theoretical propositions. Finally, we conclude by summarizing the theoretical contributions and managerial implications of the study and offering suggestions for future research.

2. Theory

2.1 Conceptualizing Digital Service Innovation

Given that DSI combines both digital and service innovation logics, we first explain both types of innovation before discussing DSI as a third, hybrid form of innovation.

Digital transformation, also referred to as "digitalization" (Gebauer *et al*., 2021), is broadly defined as *"a socioeconomic change across individuals, organizations, ecosystems and societies that are shaped by the adoption and utilization of digital technologies"* (Dąbrowska *et al*., 2022, p. 2). For companies specifically, it differs from digitization,

meaning the shift from analogue to digital data and processes (Storbacka, 2018), as digitalization also influences their business models and ways of providing value to customers (Kowalkowski *et al*., 2022). Digital technologies drive major innovations such as process and product innovation in organizations (Ardolino *et al.*, 2018; Opazo-Basáez *et al*., 2021; Vendrell-Herrero *et al*., 2023). Though such innovations unlock many opportunities, companies can only move beyond operational benefits if technology is brought to the core of corporate strategy and the business model (Siedler *et al*., 2021).

Servitization means the transformation of companies from offering products and/or support services to advanced services (Baines & Lightfoot, 2013; Kowalkowski *et al*., 2017). Instead of innovating and selling standard products, companies can pursue service innovation by customizing their offering depending on the customer's wishes, making their products available for use (e.g., through leasing), or charging customers depending on their use of the product or service (Tukker, 2004; Witell & Löfgren, 2013). Like digital transformation, servitization requires companies to not just change their product and/or service offering, but also fundamentally rethink their strategy and business model (Markfort *et al*., 2021; Raddats *et al*., 2019).

DSI has evolved into a third, blended type of innovation. It is defined as "*the development of new services by means of digital technologies … that exploit product connectedness in order to create value via digitally enhanced provider-customer relationships*" (Opazo-Basáez *et al*., 2021, p. 98) and "*the use of new digital solutions to meet the needs of new and existing customers and target markets*" (Kolagar *et al*., 2021, p. 152). Also, it supports companies' transition to digital servitization, whereby companies change from a product-centered business model to a service-centered one with the support of digital technologies (Favoretto *et al.*, 2022). In summary, DSI complements traditional sources of digital innovation, namely process and product innovation, on the one hand, and service

innovation, such as customization and pricing innovations, on the other, and it is the foundation for companies to change their business model through digital servitization (Opazo-Basáez *et al.*, 2021; Vendrell-Herrero *et al.*, 2023). This conceptualization of DSI is visualized in Figure 1.

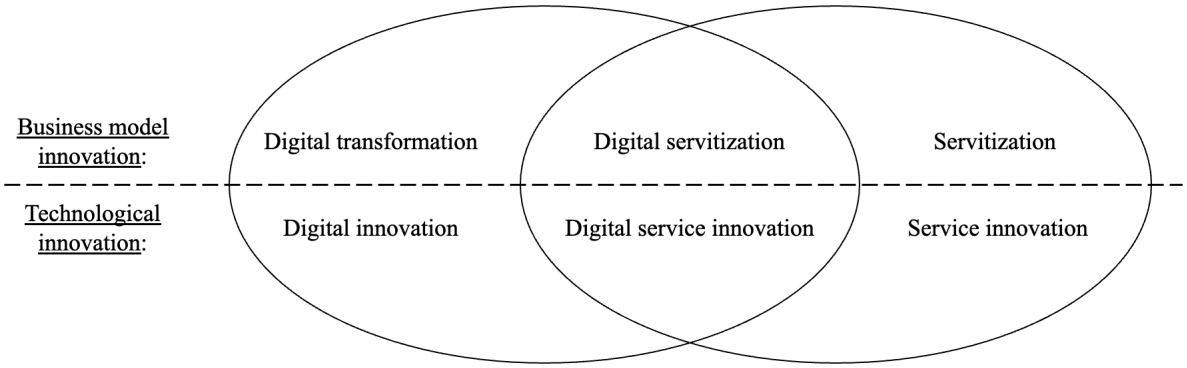


Figure 1. DSI conceptualization

2.2 DSI as a complex transformation process

Despite the opportunities unlocked by digital and service innovation, companies struggle to capture their combined potential (Gebauer, Arzt, *et al.*, 2020; Kohtamäki, Parida, *et al*., 2020). Case research describes DSI as a transformation process, unveiling several pathways (Coreynen *et al*., 2017; Tian, Coreynen, *et al*., 2021), pinpointing principal stages of organizational change (Baines *et al*., 2020), and unfolding managerial heuristics (Huikkola, Kohtamäki, *et al*., 2021). Such studies have shown that developing and upscaling DSI is highly complex (Bustinza *et al*., 2018; Eloranta *et al*., 2021; Sjödin *et al*., 2020). For instance, Lütjen *et al*. (2017) identified several strategy-, implementation- and market-related barriers associated with three consecutive stages, and Vendrell-Herrero *et al*. (2021) showed the need for growing analytic capabilities associated with smart product development and offer hybridization. To manage these issues, the literature posits that companies apply a stepwise

and iterative approach, breaking down complex DSI systems into smaller and more manageable parts (e.g., Eloranta *et al*., 2021; Sjödin, Parida, Kohtamäki, *et al*., 2020).

The literature only recently started to explicitly apply a complexity perspective to DSI and digital servitization (Eloranta *et al*., 2021; Paiola & Gebauer, 2020). Table 1 provides a non-exhaustive overview of the connections already made and summarizes complexities relating to the technological, organizational, and managerial issues associated with DSI development and upscaling. The table is developed based on a narrative literature review in which we chose to include papers that were published as off 2017, the year the digital servitization concept was first introduced (Favoretto *et al*., 2022).

Table 1. Summary of the DSI complexity literature

Complexity factor	**Description**	**Illustrative references**
Offer	DSI encompasses a growing range of digitally enhanced products and services that become increasingly complex (e.g., tailor-made, outcome-based solutions).	Coreynen *et al*. (2017), Raddats *et al.* (2019, 2022), Frank, Mendes, *et al*. (2019), Paiola & Gebauer (2020)
Increasing ecosystem dependency	Advanced services require tight collaboration with customers and other ecosystem partners. New capabilities and relational ties are essential to facilitate value co-creation, delivery, and capture.	Vendrell-Herrero *et al*. (2017), Sklyar *et al*. (2019), Kohtamäki *et al*. (2019), Kamalaldin *et al*. (2020), Tronvoll *et al*. (2020), Sjödin *et al*. (2020), Gaiardelli *et al*. (2021)
Organizational realignment	DSI often entails a lengthy organizational change process to ensure that a viable business model is designed and installed, necessary capabilities are acquired, mindsets are realigned, and resources can be flexibly arranged.	Bustinza *et al*. (2018), Lenka *et al*. (2018), Yeow *et al*. (2018), Raddats *et al*. (2019) Tronvoll *et al*. (2020), Struyf *et al*. (2021)
Paradoxical tensions	Conflicting demands and tensions stemming from the digitalization, servitization and coopetition paradox, the need for exploration and exploitation, and the simultaneous existence of a product and service logic.	Bengtsson *et al*. (2016), Coreynen *et al*. (2020), Kohtamäki, Einola, & Rabetino (2020), Gebauer, Fleisch, *et al*. (2020), Brax *et al*. (2021), Davies *et al*. (2021)
Business environment	Raising customer demands, unexpected, disruptive global	Ambroise *et al*. (2017), Ziaee Bigdeli *et al*. (2018),

	events, and the diversity of numerous stakeholders and service components are becoming increasingly intertwined, rendering the business environment complex.	Bustinza, Gomes, *et al*. (2019), Rapaccini *et al*. (2020), Eloranta *et al*. (2021)

We follow Scott's conceptualization of complexity as "*the number of different items or elements that must be dealt with simultaneously by an organization*" (Scott, 1992, p. 230). Furthermore, we consider the distinction between complications (i.e., algorithmic or "procedural" complexity), which concerns the difficulty of solving a given, well-defined task, and complexities (i.e., natural or "contextual" complexity), where the challenge is to find both the problem and the solution in the absence of information (Vasconcelos & Ramirez, 2011), to argue two points. First, as companies initially venture into DSI and later enhance their DSI maturity, both procedural complications and contextual complexities increase. Second, to overcome them, companies need to continuously learn (e.g., about new technologies, customers) and align (e.g., internally between departments, externally in the ecosystem), unlocking new DSI opportunities with each cycle. We return to these two issues later in the Discussion section.

2.3 Organizational learning and alignment

Companies need dynamic capabilities to innovate and sustain performance (Teece, 2007). A dynamic capabilities perspective is often applied to DSI and digital servitization, highlighting ample capabilities as enablers (e.g., Coreynen *et al*., 2020; Fischer *et al*., 2010; Rodríguez *et al*., 2021). For instance, Huikkola *et al*. (2022) showed how companies become smart solution providers by managing a complex interplay of different dynamic capabilities, and Lütjen *et al*. (2019) identified several dynamic capabilities to manage ecosystems for service innovation. Specifically, the ability to learn is increasingly being associated with business model innovation, specifically digital servitization (Brenk *et al*., 2019; Friedl *et al*.,

2022). Furthermore, in order to implement and benefit from what has been learnt, companies also need to continuously align (Matthyssens & Vandenbempt, 2008), both within the organization (Huikkola *et al*., 2016) as well as outside with customers, suppliers, and ecosystem partners (Struyf, Matthyssens, *et al*., 2021). In the following subsections, we describe both capabilities—organizational learning and alignment—as enablers to progress in DSI while dealing with its many complications and complexities.

2.3.1 Organizational learning

The organizational learning literature distinguishes between two types of learning: adaptive and generative (Argyris & Schön, 1974; Chiva *et al*., 2010; Chiva & Habib, 2015; Senge, 1990). Adaptive learning permits organizations to maintain their present policies and achieve current objectives by adjusting or adapting their behavior (Argyris & Schön, 1974). It takes place when goals, values, and strategies are taken for granted, and existing competences, technologies, and paradigms are refined without examining their underlying beliefs and assumptions (Chiva *et al*., 2010). For instance, while some companies continuously upgrade technologies to further improve efficiency, decrease costs, and improve quality, others expand their service offering by gradually moving from basic services (e.g., repair) to more advanced ones (e.g., preventive maintenance). Adaptive learning is usually exercised through deductive reasoning, whereby companies focus on improving their mental model, knowledge, processes, and routines (Chiva & Habib, 2015).

Generative learning requires organizations to look differently at the world and transcend themselves, whether by better managing the business or understanding customers from an overall, holistic perspective (Chiva *et al*., 2010; Senge, 1990). It occurs when organizations modify their underlying norms, policies and objectives (Argyris & Schön, 1974). For instance, companies that switch from a product-dominant to a service-dominant

logic start to consider the needs of customers as a whole and view them as co-creators of value (Vargo & Lusch, 2004, 2018). To better understand customers and support them in their needs, heavily technology-oriented companies can switch from selling high-tech products to providing cloud-based services, while service-oriented companies may integrate novel technologies (e.g., AI) into their offering. Therefore, generative learning is generally associated with more radical innovation (Kang *et al*., 2007).

2.3.2 Organizational alignment

In order to optimally exploit DSI, companies pursue alignment between their innovation strategy and the internal organization, on the one hand, and with the outer environment, on the other hand (Chorn, 1991; Venkatraman, 1989). We describe both types of organizational alignment—internal and external—in relation to DSI here.

Internal alignment covers both vertical and horizontal organizational dimensions, such as strategy, culture, and organizational design (Chorn, 1991). Vertically, there needs to be alignment across all levels of the organization (i.e., corporate, business, and functional) in terms of stating objectives, making decisions, and implementing actions to achieve those objectives (Kathuria *et al*., 2007; Quiros, 2009). Some companies aim for higher profits by implementing efficient, cost-saving technologies, while others prefer to adopt new pricing strategies to lock in customers and have more stable revenues. Horizontally, activities across functions need to complement and support each other as well. For example, the marketing and purchasing departments need to collaborate and integrate activities to produce better customer value (Kathuria *et al*., 2007; Matthyssens *et al*., 2016), and salespeople have to develop new competences to sell digitally-enabled, outcome-based offerings (Jovanovic & Morschett, 2021; Vendrell-Herrero *et al*., 2021).

External alignment also covers both vertical and horizontal dimensions, this time outside of the organization and relating to the supply chain and broader ecosystem. Vertically, companies can form strategic partnerships across the supply chain with suppliers and customers to define, design, and deliver new value propositions (Kamalaldin *et al.*, 2020; Ziaee Bigdeli *et al.*, 2018). Horizontally, they can also form partnerships and align with other parties such as knowledge-intensive business service (KIBS) providers (Bustinza *et al*., 2018; Bustinza, Lafuente, *et al.*, 2019) to cocreate and coproduce value (Kohtamäki, Parida, *et al*., 2019; Kohtamäki & Rajala, 2016). However, such digital service ecosystems may add partner orchestration complexities (Tian, Vanderstraeten, *et al.*, 2021), especially when scaling up DSI (Di Pietro *et al.*, 2017).

3. Case illustrations

3.1 Methodology

Three in-depth case studies were developed as illustration based on the following arguments. First, case studies are advised for exploratory research into managerial challenges (Yin, 2017) and complex social phenomena (Bryman & Bell, 2015), for which the DSI development and upscaling process and its different stages toward mature DSI classify. Applying a qualitative approach allows us to gather rich data (Eisenhardt & Graebner, 2007), which supports the discovery of different cycles of organizational learning and alignment. Additionally, the exploratory approach adds to our understanding of the relationship between DSI and its context (Dubois & Gadde, 2002; Woodside & Wilson, 2003), which is particularly important for DSI given its increasing interdependency with companies' surrounding ecosystems. Second, a retrospective, longitudinal approach is used to capture process dynamics, allowing for the identification of the main stages of learning and alignment throughout the company's evolution (Eisenhardt, 1989; Quintens & Matthyssens, 2010).

3.2 Case selection

Purposeful sampling was used to maximize learning through the identification of information-rich cases (Patton, 2005). Industry experts from the branch federation of high-technology industry in Belgium identified five manufacturing companies as exemplar DSI cases, among which three were selected as illustration based on their different DSI development and upscaling processes: Case A demonstrates the move of an equipment manufacturer toward smart products (i.e., merging digital technology with service elements), while Cases B and C exhibit two product suppliers implementing a digital platform to serve customers (i.e., merging service with digital elements).[1] The cases thus cover both service focus dimensions: the product and customer process (Coreynen *et al*., 2017; Kindström & Kowalkowski, 2014). Moreover, all three companies ultimately bank on data collected via smart products/digital platforms to further enhance DSI: In Case A, data insights impact on the core of the product, while Cases B and C use insights to further enhance customer relations. Table 2 provides an overview of the case companies' characteristics.

Table 2. Overview case characteristics

	Case A	**Case B**	**Case C**
Industry	Construction	Furniture	Construction
Size	Large	Medium	Large
Starting position	Technology-oriented	Service-oriented	Both service- and technology-oriented
DSI driver	Be closer to the end-customer	Complex production	A customer request
DSI outcome	Smart products	Digital platform	Digital platform

[1] The names of the companies, their employees, partners, and specific technologies have been anonymized to ensure confidentiality.

3.3 Data collection and analysis

Critical incident technique (CIT) (Flanagan, 1954) guided our data collection and analysis efforts. In-depth case studies were developed based on semi-structured interviews, industry expert discussions, a focus group, and company workshops. The interviews followed a semi-structured format, allowing us to gather rich qualitative data necessary to reconstruct the case and present it vividly, as is typical for illustrative case studies. Table 3 offers an overview of the interviews conducted per case, which were later transcribed verbatim.

Table 3. Overview interviews

	Interviewees	**Duration**
Case A	1. Chief Technology Officer	01:00
	2. Digital Project Manager	00:55
	3. Founder Design and Innovation Agency	00:45
Case B	4. Marketing Director	00:55
	5. Digital Lead	01:00
Case C	6. Chief Product Officer	01:00
	7. Former Industry 4.0 Project Manager	01:10
	8. Current Industry 4.0 Project Manager	02:20

Other data sources: (a) industry expert discussion, (b) workshop participation, (c) official company websites, (d) online videos and news articles, and (e) internal documents.

Insights from the semi-structured interviews were validated in consecutive expert discussions, a focus group, and workshops. The data gathered during these interactions were supplemented with secondary data from official company websites, online videos, and news articles, and internal documents. Having multiple respondents and sources enables us to boost validity and gain a multidimensional, multi-actor view that suits the research topic at hand (Edmondson, 2016; Yin, 2017; Zuiderwijk-van Eijk *et al*., 2016). In the following section, the different pathways of Cases A, B and C toward DSI are described, and a descriptive summary of the cases is presented in Table 4.

3.4 Case descriptions

3.4.1 Case A: Smart climate solutions for the construction sector

Case A describes a family-owned, international business that produces healthy indoor and outdoor living spaces at reduced energy costs for the construction sector. Founded more than a century ago, the company evolved from purely producing fittings to offering innovative total ventilation and sun protection solutions. Today, the company counts over 1,300 employees worldwide, and the rate of employees employed in research and development (R&D) is more than 10 percent. Though innovation initially consisted of developing high-quality hardware, the company gradually started to focus on improving customer experience by adding sensors and software to their products. The transition toward smart products also supported the company in expanding its customer base from the Business-to-Business (B2B) to the B2B-to-Consumer (B2B2C) space.

Stage 1 – In 2015, the company's digital journey kicks off in the R&D department after the Chief Technology Officer (CTO) returns from an inspiring trip to China. An external consultant is hired to facilitate a strategic workshop wherein different teams are asked to imagine what the world would look like in twenty to fifty years, and which opportunities this would present for the company. After the workshop, the teams feel a disconnect between the company's current direction and the digital opportunities presented by the consultant, such as digitally enhanced sales and potentially new digital business models. At the time, the company is already experimenting with IoT sensors in its existing ventilation systems, and an in-house engineering team has also already developed its first web application. However, the new app insufficiently considers the experience of the end-user; according to the CTO later, it was "a super-mega-crappy engineers' app". The workshop has made the team aware of the increasing importance of the app, which would not suffice to realize the company's future goals.

Stage 2 – Not having the required skills inside the organization, the company reaches out to a design and innovation agency, which was suggested by one of its employees who had collaborated with the agency during a former employment. In the following years, a close partnership is developed whereby the agency guides the company throughout the entire innovation process, from idea development and business model strategy to change management. The agency inspires the company to think differently about design, for example, by using color codes instead of technical terms as the app's language. They also suggest several ideas for new business models, such as selling insights from customer data collected through the app. Though the company initially is interested in the idea, it quickly becomes apparent that the amount of data needed to grow the business would have to increase significantly.

Stage 3 – Despite the company's first steps in the data business, the current back end is not ready. The Enterprise Resource Planning (ERP) system, which they built in house, is already challenged by the company's internationalization efforts, and the development of smart products as well as the new data business further push system requirements. To overcome this bottle neck, new partnerships with IT providers are established to set up an improved ERP system that can handle "the massive amount of data that is on the way", according to the company's Digital Project Manager. Furthermore, the improved ERP system would allow the company to benefit from increased connectivity, e-commerce, and other potential digital opportunities.

Stage 4 – The first smart products are successfully launched in 2018, but internal and external tensions are rising. The gap between the construction sector's digital immaturity and the company's digital ambitions leads to tensions between the need to maintain day-to-day operations and the urge for continued, exploratory innovation. With most activities still in a "business-as-usual mode", according to the Digital Project Manager, the company hesitates to

reorganize sales, adding: “We’re gathering valuable information, but at a certain moment you want to partially recuperate that investment. That’s when you start to realize that your business model is still based on the traditional sales of albeit smart products.” Pushing for organizational change is particularly difficult. To partially reduce this tension, the company acquires a start-up company, which enables them to spot pioneering projects in the construction sector more quickly. Additionally, the start-up offers access to new markets and supports the development of more advanced total solutions, including construction elements that the company does not manufacture.

3.4.2 Case B: A digital platform for customized furniture fittings

Case B exhibits a family-owned, medium-sized company that has become a renowned player in the local furniture industry since its establishment over half a century ago. Today, its 350 employees service over 9,000 B2B customers, mostly kitchen installers. For long, the company focused on the distribution of furniture fittings only, until it launched its own product line in 2014. Despite this sidestep toward manufacturing, the company states that its strength still lies in service addition, particularly customization. The past ten years, the company has seen a revenue growth of nearly fifty percent.

Stage 1 – By 2014, a continuous emphasis on serving customer needs has generated so many options for customized furniture fittings that customers suffer from “choice paralysis”, according to the Marketing Director. A small, in-house team is tasked to develop an online configurator to support customers in their configuration and purchasing process, but the configurator fails at producing the desired results. The company starts looking for a partner to further professionalize the configurator, and a match is found with a software provider that up until that moment was only responsible for maintaining the company’s website. Though the company is not entirely sure that the software provider’s skills are up to the task, the

Marketing Director is charmed by their "professional and down-to-earth approach" and appoints them as their IT partner.

Stage 2 – The new partnership triggers the need for a Digital Lead (DL) with a strong IT profile that can coordinate different digital projects cross-company. In 2016, the new DL is appointed to upgrade the configurator and turn the company's basic website into a user-friendly, digital platform. At the time, customers are hesitant to use the company's website, afraid of making mistakes when purchasing products. Also, most customers do not have a computer in their workshop, so calling the company's salesperson remains their preferred way of placing orders. Tasked with the assignment to lower the platform's adoption barrier and achieve a 100 percent digital order intake, the DL proactively reaches out to customers. The decision to involve customers early in the development process is marked as one of the critical success factors, according to the DL. However, a switch in mindset among the company's salesforce is also necessary. Feeling threatened, salespeople are hesitant to introduce the new platform to their customers. To deal with this issue, the DL starts to accompany them on customer visits, thereby not only lifting the company's service profile but also boosting confidence among the sales team in the advantages of the digital platform.

Stage 3 – The digital platform, which includes a revised website, web shop and configurator, is launched in 2017. To increase its adoption even further, the company designs a new web application, which offers users the experience of a mobile app while it is in fact delivered through a regular web browser. With the app, the company also enables customers to access the platform on their smartphones. By 2019, already 90 percent of customers are ordering online. Moreover, the company realizes that insights from these transaction data offer new business opportunities, such as improving their current services and moving into data-enabled sales.

Stage 4 – The existing back end, however, is not up to par. Replacing the company's thirty-year-old, in-house developed ERP system turns out to be more challenging than expected. The hampering integration across the new ERP, Customer Relationship Management (CRM) and web shop systems leaves the company with insufficient data to generate the envisioned insights, and progressing toward more data-enabled sales are put on hold. Instead, the company finds a new growth path in the acquisition of a large, international customer. With new priorities set for the next years, the company continues to build on the platform's previous success with regular system updates as well as the launch of a new app aimed at their acquired *customer's* clients to further boost sales.

3.4.3 Case C: A digital platform for aluminum products for the construction sector

Case C shows a family business that has grown into a multinational company with about 2,300 employees in over 40 countries since its foundation in the late 1960s. The company caters to the construction sector by manufacturing aluminum products, such as frames for windows, doors and building exteriors, which are delivered via a network of installers that customize their products to the specific installations in which they are integrated. While these services have been offered from the company's early beginnings, the benefits of digitalization are also recognized early on. For instance, the company already experimented with digitally connecting manufacturing equipment in 1980s, so production information could be exchanged more easily inside the company.

Stage 1 – Around 2010, a customer approaches the company with an idea for a paperless production environment to improve workflow and optimize operations. The company's automation manager at the time further explores the idea with other customers, and the initial feedback is positive. However, the company is less supportive because earlier investments in digital technology have not yet paid off, and they decide not to allocate

funding to the project. Instead, the manager works out a solution with company's main software provider, which seriously reduces their development costs, accelerating the project's kick off.

Stage 2 – At the start of the 2010s, local industry organizations are heavily promoting the benefits of industry 4.0, confirming the manager's confidence in digital innovation as the key to secure the company's future. Up to that point, earlier steps taken in developing and testing the digital production platform have remained mostly under the company's radar, but internal presentations held by likeminded colleagues finally convince the company and a further rollout of the platform is included in the strategy and budget. However, the automation manager, who has now become responsible for industry 4.0 applications, is skeptical about their current software provider. Although continuing the collaboration makes sense—the company and the software provider have a history together, so their processes are already aligned—the application that the software provider has developed is quite general, and it does not fully match with the customers' wishes for product variety and customization.

Stage 3 – A few years later, the application shows its first cracks. Customers start to report technical errors, and the company's own technical support team, who do not have direct access to the underlying software, is unable to solve them. However, the software provider caters to many other clients and does not feel a similar sense of urgency. The company does not realize the importance of its technical support team in further developing and fine-tuning the platform—earlier projects had only required limited customer service—and they delay in finding a solution to the problem. As the number of unresolved issues piles up, belief in the platform starts to falter. The sales team needs to deal with a growing number of dissatisfied customers, who have become increasingly concerned about the malfunctioning platform, which has become an integral part of their operations and is now endangering their

own business. One customer, after waiting for assistance for more than two years, even offers the company with a formal notice of default.

Stage 4 – Although a new ticketing system has alleviated some of the technical support team's concerns, the software provider continues to resolve issues at a painfully slow pace. Disappointed in the delayed response from the company to take proper action and lack of additional resources, the industry 4.0 project manager leaves the organization and is replaced. Despite these difficulties, the project registers a 50 percent success rate by early 2020, and an online dashboard for customers to continuously monitor production is added to the platform. Also, international rollout of the application has commenced.

Table 4. Case summaries

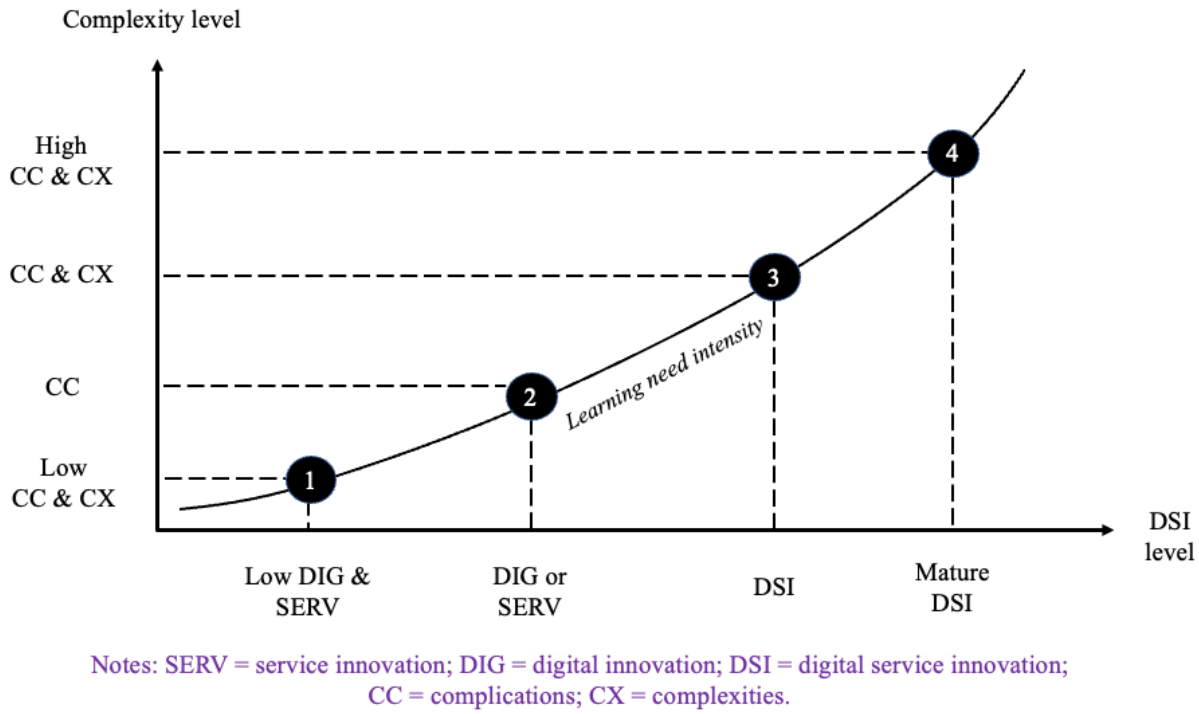
	Case A	**Case B**	**Case C**
Stage 1	The CTO initiates a strategic workshop with a consultant. Ideas evoked during the workshop are considered too far-fetched. The company starts integrating sensors into its existing products.	A strong focus on customization has led to choice paralysis among customers. An in-house developed configurator does not generate the desired results. Collaboration with an existing software provider is intensified.	A customer suggests an idea to improve workflow, setting in motion a bottom-up initiative to develop a digital production platform. The company is reluctant to allocate funding to the project.
Stage 2	Current skills prove insufficient to build a user-friendly web app. The company starts collaborating with an innovation agency that supports them in product design and business model innovation.	A digital expert is hired to upgrade the configurator and develop a digital platform. Customers are involved in the development process. Salespeople are hesitant to promote the new platform.	Promotional campaigns boost the company's confidence in the benefits of industry 4.0. Funding for the platform is provided. The current software provider is chosen to develop the app.
Stage 3	The new data business demonstrates the need for an upgraded ERP system. New partnerships with IT providers are set up to accelerate its roll-out.	A new web app further pushes customer to the platform. The company considers new business opportunities based on customer data.	The software provider is not pressured to solve technical issues. The company delays in finding a solution. Customers become concerned about their own operations.

Stage 4	Tensions rise between the need to run day-to-day operations and pursue future DSI ambitions. A start-up is acquired to overcome some of these issues.	Upgrading the back end turns out difficult. A new growth path is found in the acquisition of a large customer. The company continues with regular system updates and the launch of a new app.	The software provider continues to resolve technical issues at a slow pace. An online dashboard is added. International rollout of the platform has commenced.

4. Discussion and theory development

4.1 A DSI process and complexity framework

The cases show that, as companies develop and scale up DSI, they deal with a rising degree of complexity. We argue that companies gradually enhance their DSI maturity by managing complications and complexities. We visualize this process in Figure 2, moving from a low digital innovation (DIG) and service innovation (SERV) position to increasingly combined DSI levels on the x-axis, and from managing rising procedural complications (CC) to later also more contextual complexities (CX) on the y-axis. We posit that the rising complexity associated with DSI requires higher levels of learning, which we refer to as "learning need intensity". As companies progress toward DSI, their learning need intensity exponentially grows, henceforth we display the learning curve as a convex curve with four DSI-complexity stages. We discuss this framework, moving through each stage from Figure 2's bottom-left corner to its upper-right corner, using the cases' relevant findings as illustrations and referring to earlier DSI literature.



Notes: SERV = service innovation; DIG = digital innovation; DSI = digital service innovation; CC = complications; CX = complexities.

Figure 2. DSI process and complexity framework

First, when companies focus on neither DIG nor SERV, they provide relatively standard products, and basic services are offered mainly reactively to the customer. Case A initially manufactured and sold standard ventilation and sun protection equipment, and although some administrative processes had already been digitized, customer and supplier relations were still conducted in a highly personal manner (e.g., product demonstrations, sales); in Case B, customers would call the company's sales representative to order specific furniture fittings. In this DSI stage, complications and complexities are rather limited, and the need for learning and alignment is experienced as low.

In a second stage, companies start to focus either on DIG or SERV. The DIG approach, on the one hand, focuses on exploring new technologies for mostly process innovation (e.g., smart manufacturing) or product innovation (e.g., smart products) purposes (Opazo-Basáez *et al.*, 2021; Vendrell-Herrero *et al.*, 2023). This transformation increases the number of complications, as new digital knowledge and skills need to be acquired and integrated. Case A initially integrated sensors in its ventilation products, but because they

were unable to build a user-friendly web app, they started collaborating with a design and innovation agency; Case C intensified collaborating with its software provider to develop a digital production platform. The SERV approach, on the other hand, focuses customers by making products available via different pricing options (e.g., leasing, pay-per-use) or customizing products to their needs (Tukker, 2004; Witell & Löfgren, 2013). Case B focused on customization of its own furniture line to build strong customer relationships. At best, servitization is supported by digital administrative processes.

At this early DSI stage, companies seek to cope with complications by (re)training staff, hiring new employees, and aligning internal departments. For instance, managers who are used to selling expensive, high-tech equipment (e.g., ventilation systems) may not be eager to switch to selling (seemingly cheaper) pay-per-use contracts (Gebauer *et al*., 2005). Also, front-end employees in sales and delivery may be more used to selling standard products (e.g., furniture fittings, aluminum products) rather than serving to customers' unique needs (Ulaga & Loveland, 2014). In summary, companies experience that they have to rethink their business model and reconfigure their organizational design to match their new digital or service innovation strategy, including its development, sales, and delivery processes, organizational structure, and corporate culture (Fischer *et al*., 2010; Gebauer *et al*., 2010; Oliva *et al*., 2012).

Third, when companies start to focus on both DIG and SERV, they venture into the realm of DSI development. Here, companies use digital technology, either in the front or back end of the organization, to further enable service (Coreynen *et al*., 2017; Tian, Coreynen, *et al*., 2021). In the front end, smart products and platforms are used to better connect with customers, gather data to further improve products, and pro-actively attend to customer needs (e.g., preventive maintenance). Case A redesigned its web app connected to its ventilation systems; Cases B and C launched digital platforms for customers to configure and order

products. In the back end, smart manufacturing technologies enable companies to further customize products, offer specific advice to customers (e.g., on production), and even take care of some of their production and assembly processes (e.g., outsourcing). Cases A and B showed efforts to update their ERP and CRM systems to increase efficiency and boost data-enabled sales; in Case C, the platform has become an integral part of their customers' operations.

When companies venture into DSI, on top of the mostly procedural complications mentioned earlier, contextual complexity (i.e., outside of the organization) rapidly increases. On the one hand, customers may not be willing to share valuable information outside of their own operations (Matthyssens & Vandenbempt, 2010), or they may not have similar digital resources or skills to easily connect with the provider (Kamalaldin *et al*., 2020). In Case B, customers do not have computer access in their workshop. On the other hand, customers that *are* digitally able to connect, may expect their provider to continuously maintain and update their products (e.g., through software updates) for continuous service provision (Tóth *et al*., 2022). They may even transfer responsibility over their own operations to the provider, increasing their risk profile (Snieška *et al.*, 2020; Ziaee Bigdeli *et al.*, 2018). In Case A, customers expected ventilation systems to be updated to also monitor air quality and prevent the spread of COVID-19; in case B, a dissatisfied customer even issued a formal notice of default to the company.

Fourth, when companies combine advanced levels of DIG and SERV, they drastically enhance their DSI maturity. Today, the three reported cases have started integrating front-end with back-end operations to further improve efficiency and scale up DSI. Moreover, Cases A and B are leveraging their data to explore new business opportunities. However, DSI not only affects individual companies' business models, it also requires alignment with other players in the supply chain and the broader ecosystem (Bustinza, Gomes, *et al*., 2019; Kohtamäki,

Parida, *et al.*, 2019). From an R&D and production perspective, companies need to increase collaboration with suppliers and KIBS providers to cocreate and coproduce value (Kohtamäki & Rajala, 2016; Vendrell-Herrero *et al*., 2018), as exhibited in Case A's collaboration with other pioneering companies in the construction sector. From a sales and delivery perspective, companies that deal exclusively through distributors may not have access to the end-customer (Marcon *et al*., 2022; Paiola & Gebauer, 2020), as also seen in Case A's efforts to expand from B2B to B2B2C via its smart products.

In addition, when creating and managing DSI platforms, network orchestration becomes a core activity to obtain the needed resources (Kolagar *et al*., 2021) and generate market acceptance (Chandler *et al*., 2019; Tian, Vanderstraeten, *et al*., 2021), as observed in Cases B and C's difficult development of their respective digital platforms. Finally, companies can also form cross-border strategic alliances to enter international markets (Vendrell-Herrero *et al.*, 2018). Case B acquired an international customer and launched a new app to also reach their acquired *customer's* clients, and Case C rolled out its app to foreign markets after building sufficient experience in its own local market.

4.2 DSI learning and alignment cycles and propositions

In the previous subsection we posited that, as companies pass through different DSI stages, their learning need intensity exponentially grows. Here, we further argue that they overcome complications and complexities associated with each stage by sequencing different learning and alignment cycles. Following the four stages of the DSI process and complexity framework of Figure 2, the cases' learning and alignment cycles, their opportunities and challenges are analyzed deeper in Table 5. Combined with the literature, we offer several theoretical propositions.

Table 5. Organizational learning and alignment cycles

	Learning	Alignment	Opportunities	Challenges
Cycle 1	Mostly adaptive, such as refining current skills and technologies.	Mostly internal, such as between R&D, production, sales, and delivery.	Incremental product/service improvement; Increasing efficiency.	Lack specific IT knowledge and skills; Allocate funding.
Cycle 2	From adaptive to generative, such as exploring new (data) business models.	Mostly internal (see above); Some external, such as involving customers, suppliers, and consultants.	Business model improvements; Customer insights through data collection.	Internal resistance to change; Digitalization paradox.
Cycle 3	Mostly generative, such as exploiting new (data) business models.	Mostly external, such as complex relationship building with partners.	Platform-enabled smart manufacturing; Radical business model change.	Difficult resource integration with partners; Convincing customers.
Cycle 4	Balancing both adaptive and generative learning.	Balancing both internal and external alignment.	Value co-creation with customers; New revenue models with ecosystem partners.	Difficult orchestration of the service ecosystem; Lacking IoT mindset in the sector.

In the first cycle, when companies focus exclusively on digital innovation or non-digital forms of service innovation, they apply mostly adaptive learning to overcome procedural complications inside the organization, whereby existing skills and technologies are refined to achieve current goals. Case A first started leveraging IoT technology to upgrade its ventilation systems with sensors, Case B expanded its customization services for furniture fittings, and Case C started experimenting with an internal, digital platform to optimize workflow. To use an analogy: when companies apply adaptive learning, they stay mostly stay within their innovation lane by focusing either on digital or service innovation.

In cycles two and three, when companies first combine both digital and service innovation logics and later further progress toward integrated DSI development, generative learning techniques are increasingly required. Here, companies challenge and modify

underlying norms and objectives by infusing their technology mindset with service elements, or *vice versa*. To do so, companies start working more closely with customers and suppliers, they obtain new knowledge by hiring employees with specific skills, or they learn from other companies such as consultants. Case A first started working more closely with an innovation agency on product development and design, Case B initially employed a digital expert to develop and implement the online platform, and in Case C, a customer initially approached the company with an idea for a paperless production environment. To continue the analogy: when applying generative learning, companies switch innovation lanes, moving from digital to service innovation, or *vice versa*, toward real DSI.

DSI can only be successful if the different stakeholders are aligned with each other. Therefore, learning has to alternate with phases of alignment. Inside the organization, the people that drive DSI have to overcome resistance among decision makers, colleagues and employees (Gebauer *et al*., 2010; Lenka *et al*., 2018). Although Case A is now producing smart ventilation systems, the traditional business of selling products is still conducted as before; in Case B, the Digital Lead had to overcome resistance among the company's salesforce to use and promote the online platform; and in Case C, it was the company's leadership that initially hesitated to allocate funding, because other digital investments had not yet been paid off. This initial lack of return and reluctance to make further investments in IT is known as the "digitalization paradox" (Kohtamäki, Parida, *et al*., 2020).

Besides internal alignment, companies also have to align with crucial external partners, such as customers, suppliers, and other actors, to get used to the new ways of working between organizations in the emergence of an ecosystem-based DSI setting (Matthyssens *et al*., 2016; Struyf, Galvani, *et al*., 2021). Sometimes sensitive information must be shared to make DSI successful. Therefore, tactics to create interorganizational trust between partners is crucial (Kamp *et al*., 2017; Kohtamäki, Parida, *et al*., 2019). Case A still

encounters difficulties in introducing new ventilation solutions to the conservative construction sector, Case B initially stumbled on customers' hesitance to use their platform, and Case C experienced difficulties with its software supplier to efficiently solve technical issues. Based on the above discussion of cycles one till three, we offer the following two propositions:

Proposition 1a: *Combining both digital and service innovation, the path to DSI is paved with complications and complexities requiring a major increase in (a) learning capacity, evidenced by the enhanced need for generative learning, and (b) alignment capacity, evidenced by the enhanced need for market and ecosystem alignment.*

Proposition 1b: *DSI is an iterative process between learning and alignment, where companies start with "close to home" applications, building on adaptive learning and executing through internal alignment structures and existing customer relations, and gradually "spiral out" toward generative learning backed by new forms of internal alignment and ecosystem engagement.*

In cycle four, when DSI has become an iterative process between learning and alignment, new technical and business opportunities as well as unexpected challenges continue to emerge. We call this the "DSI mirage effect": when companies think they are nearing their final DSI destination, it has seemingly moved further down the road. Case A first started with integrating sensors into its products, continued by developing a user-friendly app for customers to interpret the data more easily, to then updating its ERP systems to handle the large amounts data, and lastly buying a start-up to balance exploring new business opportunities while maintaining regular business operations; Case B started with product customization, continued with developing a digital platform for customers to order products online, and finally acquired an international customer to tap their local market. Therefore,

adjusting and pivoting the DSI upscaling process is imperative to be successful, and agile management in the company (Sjödin *et al*., 2020) as well as adaptive alignment with partners (Di Pietro *et al*., 2017; Randhawa *et al*., 2022) are crucial factors in leading DSI ecosystems. Based on cycle four, we offer two more propositions:

Proposition 2a: *As companies progress toward DSI maturity and deal with rising complexity through cycles of learning and alignment, new market opportunities are unlocked through a co-evolution of market learning and alignment.*

Proposition 2b*: Continuous challenges during the DSI process may lead companies to persist in seeking and interpreting market/ecosystem parties' input during DSI from an adaptive learning perspective (i.e., problem solving) rather than seeking path-breaking ideas and tapping their potential through generative learning.*

5. Conclusions

5.1 Implications for theory

This study offers several theoretical contributions, managerial implications, and suggestions for future research. The study contributes to the DSI literature in three ways. First, building on prior digital transformation and servitization studies, it merges both digital and service innovation logics to create a new conceptual lens to plot and discuss companies' pathways toward DSI development, upscaling, and maturity. Second, drawing from the complexity management literature, we associate rising levels of complexity with DSI enhancement, triggering new stages of learning and alignment. While increasing their DSI maturity, companies' learning need intensifies exponentially. The presented model shows the

co-evolution of learning and alignment passing through different stages with each stage displaying different market opportunities and challenges.

This leads into our third and final contribution, namely the connection between different types of organizational learning (i.e., adaptive and generative) and alignment (i.e., inside and outside of the organization) to reach higher levels of DSI. Through different learning and alignment cycles, companies develop new digital abilities, access additional user data, and grasp new market opportunities. In order to do so, though, learning and alignment must "spiral out" from adaptive learning and incremental digital service adaptations for known customers toward more daring generative learning and radical forms of DSI co-created with a wider set of ecosystem partners. However, companies may be blinded by operational challenges, and their adaptive learning style might blur their DSI driven search for more path-breaking opportunities.

5.2 Implications for practice

For managers, first, we raise awareness about the meaning of DSI and its subcomponents, enabling managers to pinpoint their companies' current position and discuss potential future DSI avenues for growth. Second, it highlights the importance of two organizational skills, namely learning and alignment. After learning, both internal alignment—meaning, vertically across all hierarchical levels, and horizontally between different departments and business units—and external alignment—so, with suppliers, customers, complementors, and other eco-system actors—needs to take place. Third, it shows that DSI, as a destination, is never quite reached, as each learning and alignment cycle unlocks more business opportunities. Therefore, managers should build a perspective on dynamic capabilities that allow a widening of their companies' learning and alignment cycles.

5.3 Future research opportunities

As with any theoretical or conceptual work, future empirical research is needed. The DSI complexity framework and propositions on learning and alignment are derived from an extensive review and discussion of the literature as well as three cases as illustration. This middle-range theory can be used to pursue further research. For instance, does a wider conception of organizational learning and alignment lead to enhanced DSI (e.g., in the form of radically new digital services targeting new market opportunities) and ultimately success (e.g., dealing simultaneously with the digital and service paradox)? If so, how do these relationships look like: are they linear (i.e., learning and alignment lead to DSI, which then leads to success) or non-linear, such as U-shaped (i.e., the costs associated with learning and alignment are initially higher than the value generated by DSI, but become lower as companies further progress in DSI), as found earlier (Fang *et al*., 2008; Kohtamäki, Parida, *et al*., 2020)? Are these relationships moderated by other factors, such as relevant capabilities supporting DSI (Marcon *et al*., 2022) or the business environment wherein companies are active (Ambroise *et al*., 2017; Kohtamäki, Henneberg, *et al*., 2019)? And what type of dynamic capability is needed to guarantee the co-evolution of learning and alignment during DSI? These are only a few of many future research opportunities, summarized in Table 6.

Table 6. Research opportunities

Text	**Text**	**Illustrative references**
Text	Text	Text

References

Alghisi, A., & Saccani, N. (2015). Internal and external alignment in the servitization journey – overcoming the challenges. *Production Planning & Control*, *26*(14–15), 1219–1232. https://doi.org/10.1080/09537287.2015.1033496

Ambroise, L., Prim-Allaz, I., Teyssier, C., & Peillon, S. (2017). The environment-strategy-structure fit and performance of industrial servitized SMEs. *Journal of Service Management*, *29*(2), 301–328. https://doi.org/10.1108/JOSM-10-2016-0276

Ardolino, M., Rapaccini, M., Saccani, N., Gaiardelli, P., Crespi, G., & Ruggeri, C. (2018). The role of digital technologies for the service transformation of industrial companies. *International Journal of Production Research*, *56*(6), 2116–2132. https://doi.org/10.1080/00207543.2017.1324224

Argyris, C., & Schön, D. A. (1974). *Theory in Practice: Increasing Professional Effectiveness*. Jossey-Bass Publishers.

Baines, T., & Lightfoot, H. (2013). *Made to Serve: How manufacturers can compete through servitization and product service systems* (1 edition). Wiley.

Baines, T., Ziaee Bigdeli, A., Sousa, R., & Schroeder, A. (2020). Framing the servitization transformation process: A model to understand and facilitate the servitization journey. *International Journal of Production Economics*, *221*, 107463. https://doi.org/10.1016/j.ijpe.2019.07.036

Bengtsson, M., Raza-Ullah, T., & Vanyushyn, V. (2016). The coopetition paradox and tension: The moderating role of coopetition capability. *Industrial Marketing Management*, *53*, 19–30. https://doi.org/10.1016/j.indmarman.2015.11.008

Brax, S. A., Calabrese, A., Levialdi Ghiron, N., Tiburzi, L., & Grönroos, C. (2021). Explaining the servitization paradox: A configurational theory and a performance measurement framework. *International Journal of Operations & Production*

Management, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/IJOPM-08-2020-0535

Brenk, S., Lüttgens, D., Diener, K., & Piller, F. (2019). Learning from failures in business model innovation: Solving decision-making logic conflicts through intrapreneurial effectuation. *Journal of Business Economics*, *89*(8), 1097–1147. https://doi.org/10.1007/s11573-019-00954-1

Bryman, A., & Bell, E. (2015). *Business Research Methods*. Oxford University Press.

Bustinza, O. F., Gomes, E., Vendrell-Herrero, F., & Baines, T. (2019). Product–service innovation and performance: The role of collaborative partnerships and R&D intensity. *R&D Management*, *49*(1), 33–45. https://doi.org/10.1111/radm.12269

Bustinza, O. F., Herrero, F. V., Gomes, E., Lafuente, E., Basáez, M. O., Rabetino, R., & Vaillant, Y. (2018). Product-service innovation and performance: Unveiling the complexities. *International Journal of Business Environment*, *10*(2), 95. https://doi.org/10.1504/IJBE.2018.095819

Bustinza, O. F., Lafuente, E., Rabetino, R., Vaillant, Y., & Vendrell-Herrero, F. (2019). Make-or-buy configurational approaches in product-service ecosystems and performance. *Journal of Business Research*. https://doi.org/10.1016/j.jbusres.2019.01.035

Chandler, J. D., Danatzis, I., Wernicke, C., Akaka, M. A., & Reynolds, D. (2019). How Does Innovation Emerge in a Service Ecosystem? *Journal of Service Research*, *22*(1), 75–89. https://doi.org/10.1177/1094670518797479

Chiva, R., Grandío, A., & Alegre, J. (2010). Adaptive and Generative Learning: Implications from Complexity Theories. *International Journal of Management Reviews*, *12*(2), 114–129. https://doi.org/10.1111/j.1468-2370.2008.00255.x

Chiva, R., & Habib, J. (2015). A framework for organizational learning: Zero, adaptive and

generative learning. *Journal of Management & Organization*, *21*(3), 350–368. https://doi.org/10.1017/jmo.2014.88

Chorn, N. H. (1991). The "Alignment" Theory: Creating Strategic Fit. *Management Decision*, *29*(1). https://doi.org/10.1108/EUM0000000000066

Coreynen, W., Matthyssens, P., De Rijck, R., & Dewit, I. (2018). Internal levers for servitization: How product-oriented manufacturers can upscale product-service systems. *International Journal of Production Research*, *56*(6), 2184–2198. https://doi.org/10.1080/00207543.2017.1343504

Coreynen, W., Matthyssens, P., & Van Bockhaven, W. (2017). Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers. *Industrial Marketing Management*, *60*, 42–53. https://doi.org/10.1016/j.indmarman.2016.04.012

Coreynen, W., Matthyssens, P., Vanderstraeten, J., & van Witteloostuijn, A. (2020). Unravelling the internal and external drivers of digital servitization: A dynamic capabilities and contingency perspective on firm strategy. *Industrial Marketing Management*, *89*, 265–277. https://doi.org/10.1016/j.indmarman.2020.02.014

Cusumano, M. A. (2022). The Evolution of Research on Industry Platforms. *Academy of Management Discoveries*. https://doi.org/10.5465/amd.2020.0091

Dąbrowska, J., Almpanopoulou, A., Brem, A., Chesbrough, H., Cucino, V., Di Minin, A., Giones, F., Hakala, H., Marullo, C., Mention, A.-L., Mortara, L., Nørskov, S., Nylund, P. A., Oddo, C. M., Radziwon, A., & Ritala, P. (2022). Digital transformation, for better or worse: A critical multi-level research agenda. *R&D Management*, *n/a*(n/a). https://doi.org/10.1111/radm.12531

Davies, P., Parry, G., Phillips, L. A., & Ng, I. C. L. (2021). Boundary negotiations: A paradox theoretical approach for efficient and flexible modular systems. *International Journal*

of Operations & Production Management, *41*(5), 574–597. https://doi.org/10.1108/IJOPM-08-2020-0543

Di Pietro, L., Edvardsson, B., Reynoso, J., Renzi, M. F., Toni, M., & Guglielmetti Mugion, R. (2017). A scaling up framework for innovative service ecosystems: Lessons from Eataly and KidZania. *Journal of Service Management*, *29*(1), 146–175. https://doi.org/10.1108/JOSM-02-2017-0054

Dmitrijeva, J., Schroeder, A., Ziaee Bigdeli, A., & Baines, T. (2022). Paradoxes in servitization: A processual perspective. *Industrial Marketing Management*, *101*, 141–152. https://doi.org/10.1016/j.indmarman.2021.12.007

Dubois, A., & Gadde, L.-E. (2002). Systematic combining: An abductive approach to case research. *Journal of Business Research*, *55*(7), 553–560. https://doi.org/10.1016/S0148-2963(00)00195-8

Edmondson, A. C. (2016). Wicked Problem Solvers. *Harvard Business Review*, *94*(6), 52–59, 117.

Edmondson, A. C., & McManus, S. E. (2007). Methodological fit in management field research. *Academy of Management Review*, *32*(4), 1246–1264. https://doi.org/10.5465/amr.2007.26586086

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *The Academy of Management Review*, *14*(4), 532–550. https://doi.org/10.2307/258557

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory Building from Cases: Opportunities and Challenges. *Academy of Management Journal*, *50*(1), 25–32. https://doi.org/10.5465/AMJ.2007.24160888

Eloranta, V., Ardolino, M., & Saccani, N. (2021). A complexity management approach to servitization: The role of digital platforms. *International Journal of Operations & Production Management*, *ahead-of-print*(ahead-of-print).

https://doi.org/10.1108/IJOPM-08-2020-0582

Fang, E. (Er), Palmatier, R. W., & Steenkamp, J.-B. E. M. (2008). Effect of Service Transition Strategies on Firm Value. *Journal of Marketing*, *72*(5), 1–14. https://doi.org/10.1509/jmkg.72.5.1

Favoretto, C., Mendes, G. H. S., Oliveira, M. G., Cauchick-Miguel, P. A., & Coreynen, W. (2022). From servitization to digital servitization: How digitalization transforms companies' transition towards services. *Industrial Marketing Management*, *102*, 104–121. https://doi.org/10.1016/j.indmarman.2022.01.003

Fischer, T., Gebauer, H., Gregory, M., Ren, G., & Fleisch, E. (2010). Exploitation or exploration in service business development?: Insights from a dynamic capabilities perspective. *Journal of Service Management*, *21*(5), 591–624. https://doi.org/10.1108/09564231011079066

Flanagan, J. C. (1954). The critical incident technique. *Psychological Bulletin*, *51*(4), 327–358.

Frank, A. G., Mendes, G. H. S., Ayala, N. F., & Ghezzi, A. (2019). Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective. *Technological Forecasting and Social Change*, *141*, 341–351. https://doi.org/10.1016/j.techfore.2019.01.014

Friedl, C., Matthyssens, P., & Van Bockhaven, W. (2022). *Strategic Flexibility in Servitization Strategy Transition: How Effectuation and Market Learning Help Overcoming Complexities*. IMP Conference.

Gaiardelli, P., Pezzotta, G., Rondini, A., Romero, D., Jarrahi, F., Bertoni, M., Wiesner, S., Wuest, T., Larsson, T., Zaki, M., Jussen, P., Boucher, X., Bigdeli, A. Z., & Cavalieri, S. (2021). Product-service systems evolution in the era of Industry 4.0. *Service Business*, *15*(1), 177–207. https://doi.org/10.1007/s11628-021-00438-9

Gebauer, H., Arzt, A., Kohtamäki, M., Lamprecht, C., Parida, V., Witell, L., & Wortmann, F. (2020). How to convert digital offerings into revenue enhancement – Conceptualizing business model dynamics through explorative case studies. *Industrial Marketing Management*, *91*, 429–441. https://doi.org/10.1016/j.indmarman.2020.10.006

Gebauer, H., Edvardsson, B., & Bjurko, M. (2010). The impact of service orientation in corporate culture on business performance in manufacturing companies. *Journal of Service Management*, *21*(2), 237–259. https://doi.org/10.1108/09564231011039303

Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the Service Paradox in Manufacturing Companies. *European Management Journal*, *23*(1), 14–26. https://doi.org/10.1016/j.emj.2004.12.006

Gebauer, H., Fleisch, E., Lamprecht, C., & Wortmann, F. (2020). Growth paths for overcoming the digitalization paradox. *Business Horizons*. https://doi.org/10.1016/j.bushor.2020.01.005

Gebauer, H., Paiola, M., Saccani, N., & Rapaccini, M. (2021). Digital servitization: Crossing the perspectives of digitization and servitization. *Industrial Marketing Management*, *93*, 382–388. https://doi.org/10.1016/j.indmarman.2020.05.011

Huikkola, T., Einola, S., & Kohtamäki, M. (2021). Typologies of Manufacturer Identities in the Age of Smart Solutions. In M. Kohtamäki, T. Baines, R. Rabetino, A. Z. Bigdeli, C. Kowalkowski, R. Oliva, & V. Parida (Eds.), *The Palgrave Handbook of Servitization* (pp. 41–56). Springer International Publishing. https://doi.org/10.1007/978-3-030-75771-7_3

Huikkola, T., Kohtamäki, M., & Rabetino, R. (2016). Resource Realignment in Servitization. *Research-Technology Management*, *59*(4), 30–39. https://doi.org/10.1080/08956308.2016.1185341

Huikkola, T., Kohtamäki, M., Rabetino, R., Makkonen, H., & Holtkamp, P. (2021).

Unfolding the simple heuristics of smart solution development. *Journal of Service Management*, *33*(1), 121–142. https://doi.org/10.1108/JOSM-11-2020-0422

Huikkola, T., Kohtamäki, M., & Ylimäki, J. (2022). Becoming a smart solution provider: Reconfiguring a product manufacturer's strategic capabilities and processes to facilitate business model innovation. *Technovation*, 102498. https://doi.org/10.1016/j.technovation.2022.102498

Jovanovic, J., & Morschett, D. (2021). International resource configuration of product-related services in the digital age – An analysis of its antecedents. *Journal of Service Management*, *32*(5), 813–834. https://doi.org/10.1108/JOSM-11-2020-0424

Kamalaldin, A., Linde, L., Sjödin, D., & Parida, V. (2020). Transforming provider-customer relationships in digital servitization: A relational view on digitalization. *Industrial Marketing Management*, *89*, 306–325. https://doi.org/10.1016/j.indmarman.2020.02.004

Kamp, B., Ochoa, A., & Diaz, J. (2017). Smart servitization within the context of industrial user–supplier relationships: Contingencies according to a machine tool manufacturer. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, *11*(3), 651–663. https://doi.org/10.1007/s12008-016-0345-0

Kang, S.-C., Morris, S. S., & Snell, S. A. (2007). Relational Archetypes, Organizational Learning, and Value Creation: Extending the Human Resource Architecture. *Academy of Management Review*, *32*(1), 236–256. https://doi.org/10.5465/amr.2007.23464060

Kathuria, R., Joshi, M. P., & Porth, S. J. (2007). Organizational alignment and performance: Past, present and future. *Management Decision*, *45*(3), 503–517. https://doi.org/10.1108/00251740710745106

Kindström, D., & Kowalkowski, C. (2014). Service innovation in product-centric firms: A multidimensional business model perspective. *Journal of Business & Industrial*

Marketing, *29*(2), 96–111. https://doi.org/10.1108/JBIM-08-2013-0165

Kohtamäki, M., Einola, S., & Rabetino, R. (2020). Exploring servitization through the paradox lens: Coping practices in servitization. *International Journal of Production Economics*, 107619. https://doi.org/10.1016/j.ijpe.2020.107619

Kohtamäki, M., Henneberg, S. C., Martinez, V., Kimita, K., & Gebauer, H. (2019). A Configurational Approach to Servitization: Review and Research Directions. *Service Science*. https://doi.org/10.1287/serv.2019.0245

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. https://doi.org/10.1016/j.jbusres.2019.06.027

Kohtamäki, M., Parida, V., Patel, P. C., & Gebauer, H. (2020). The relationship between digitalization and servitization: The role of servitization in capturing the financial potential of digitalization. *Technological Forecasting and Social Change*, *151*, 119804. https://doi.org/10.1016/j.techfore.2019.119804

Kohtamäki, M., & Partanen, J. (2016). Co-creating value from knowledge-intensive business services in manufacturing firms: The moderating role of relationship learning in supplier–customer interactions. *Journal of Business Research*, *69*(7), 2498–2506. https://doi.org/10.1016/j.jbusres.2016.02.019

Kohtamäki, M., & Rajala, R. (2016). Theory and practice of value co-creation in B2B systems. *Industrial Marketing Management*, *56*, 4–13. https://doi.org/10.1016/j.indmarman.2016.05.027

Kolagar, M., Parida, V., & Sjödin, D. (2022). Ecosystem transformation for digital servitization: A systematic review, integrative framework, and future research agenda. *Journal of Business Research*, *146*, 176–200. https://doi.org/10.1016/j.jbusres.2022.03.067

Kolagar, M., Reim, W., Parida, V., & Sjödin, D. (2021). Digital servitization strategies for SME internationalization: The interplay between digital service maturity and ecosystem involvement. *Journal of Service Management*, *33*(1), 143–162. https://doi.org/10.1108/JOSM-11-2020-0428

Kowalkowski, C., Bigdeli, A. Z., & Baines, T. (2022). Guest editorial: The future of servitization in a digital era. *Journal of Service Management*, *33*(1), 59–69. https://doi.org/10.1108/JOSM-01-2022-450

Kowalkowski, C., Gebauer, H., Kamp, B., & Parry, G. (2017). Servitization and deservitization: Overview, concepts, and definitions. *Industrial Marketing Management*, *60*, 4–10. https://doi.org/10.1016/j.indmarman.2016.12.007

Lenka, S., Parida, V., Sjödin, D. R., & Wincent, J. (2018). Exploring the microfoundations of servitization: How individual actions overcome organizational resistance. *Journal of Business Research*, *88*, 328–336. https://doi.org/10.1016/j.jbusres.2017.11.021

Lütjen, H., Schultz, C., Tietze, F., & Urmetzer, F. (2019). Managing ecosystems for service innovation: A dynamic capability view. *Journal of Business Research*. https://doi.org/10.1016/j.jbusres.2019.06.001

Lütjen, H., Tietze, F., & Schultz, C. (2017). Service transitions of product-centric firms: An explorative study of service transition stages and barriers in Germany's energy market. *International Journal of Production Economics*, *192*, 106–119. https://doi.org/10.1016/j.ijpe.2017.03.021

Marcon, É., Marcon, A., Ayala, N. F., Frank, A. G., Story, V., Burton, J., Raddats, C., & Zolkiewski, J. (2022). Capabilities supporting digital servitization: A multi-actor perspective. *Industrial Marketing Management*, *103*, 97–116. https://doi.org/10.1016/j.indmarman.2022.03.003

Markfort, L., Arzt, A., Kögler, P., Jung, S., Gebauer, H., Haugk, S., Leyh, C., & Wortmann,

F. (2021). Patterns of business model innovation for advancing IoT platforms. *Journal of Service Management*, *33*(1), 70–96. https://doi.org/10.1108/JOSM-11-2020-0429

Matthyssens, P., Bocconcelli, R., Pagano, A., & Quintens, L. (2016). Aligning Marketing and Purchasing for new value creation. *Industrial Marketing Management*, *52*, 60–73. https://doi.org/10.1016/j.indmarman.2015.07.016

Matthyssens, P., & Vandenbempt, K. (2008). Moving from basic offerings to value-added solutions: Strategies, barriers and alignment. *Industrial Marketing Management*, *37*(3), 316–328. https://doi.org/10.1016/j.indmarman.2007.07.008

Matthyssens, P., & Vandenbempt, K. (2010). Service addition as business market strategy: Identification of transition trajectories. *Journal of Service Management*, *21*(5), 693–714. https://doi.org/10.1108/09564231011079101

Oliva, R., Gebauer, H., & Brann, J. M. (2012). Separate or Integrate? Assessing the Impact of Separation Between Product and Service Business on Service Performance in Product Manufacturing Firms. *Journal of Business-to-Business Marketing*, *19*(4), 309–334. https://doi.org/10.1080/1051712X.2012.647797

Opazo-Basáez, M., Vendrell-Herrero, F., & Bustinza, O. F. (2021). Digital service innovation: A paradigm shift in technological innovation. *Journal of Service Management*, *33*(1), 97–120. https://doi.org/10.1108/JOSM-11-2020-0427

Paiola, M., & Gebauer, H. (2020). Internet of things technologies, digital servitization and business model innovation in BtoB manufacturing firms. *Industrial Marketing Management*, *89*, 245–264. https://doi.org/10.1016/j.indmarman.2020.03.009

Pardo, C., Ivens, B. S., & Pagani, M. (2020). Are products striking back? The rise of smart products in business markets. *Industrial Marketing Management*, *90*, 205–220. https://doi.org/10.1016/j.indmarman.2020.06.011

Paschou, T., Rapaccini, M., Adrodegari, F., & Saccani, N. (2020). Digital servitization in

manufacturing: A systematic literature review and research agenda. *Industrial Marketing Management*, *89*, 278–292. https://doi.org/10.1016/j.indmarman.2020.02.012

Patton, M. Q. (2005). Qualitative Research. In *Encyclopedia of Statistics in Behavioral Science*. John Wiley & Sons, Ltd. https://doi.org/10.1002/0470013192.bsa514

Polova, O., & Thomas, C. (2020). How to perform collaborative servitization innovation projects: The role of servitization maturity. *Industrial Marketing Management*, *90*, 231–251. https://doi.org/10.1016/j.indmarman.2020.06.005

Quintens, L., & Matthyssens, P. (2010). Involving the process dimensions of time in case-based research. *Industrial Marketing Management*, *39*(1), 91–99. https://doi.org/10.1016/j.indmarman.2008.04.018

Quiros, I. (2009). Organizational alignment: A model to explain the relationships between organizational relevant variables. *International Journal of Organizational Analysis*, *17*(4), 285–305. https://doi.org/10.1108/19348830910992103

Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J., & Gebauer, H. (2019). Servitization: A contemporary thematic review of four major research streams. *Industrial Marketing Management*. https://doi.org/10.1016/j.indmarman.2019.03.015

Raddats, C., Naik, P., & Ziaee Bigdeli, A. (2022). Creating value in servitization through digital service innovations. *Industrial Marketing Management*, *104*, 1–13. https://doi.org/10.1016/j.indmarman.2022.04.002

Randhawa, K., Wilden, R., & Akaka, M. A. (2022). Innovation intermediaries as collaborators in shaping service ecosystems: The importance of dynamic capabilities. *Industrial Marketing Management*, *103*, 183–197. https://doi.org/10.1016/j.indmarman.2022.03.016

Rapaccini, M., Saccani, N., Kowalkowski, C., Paiola, M., & Adrodegari, F. (2020).

Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms. *Industrial Marketing Management*, *88*, 225–237. https://doi.org/10.1016/j.indmarman.2020.05.017

Rodríguez, M. A., Lepratte, L., & Rabetino, R. (2021). Dynamic Capabilities as Enablers of Digital Servitization in Innovation Ecosystems: An Evolutionary Perspective. In M. Kohtamäki, T. Baines, R. Rabetino, A. Z. Bigdeli, C. Kowalkowski, R. Oliva, & V. Parida (Eds.), *The Palgrave Handbook of Servitization* (pp. 181–195). Springer International Publishing. https://doi.org/10.1007/978-3-030-75771-7_12

Scott, W. R. (1992). *Organizations: Rational, Natural, and Open Systems*. Prentice Hall.

Senge, P. M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization*. Doubleday/Currency.

Siedler, C., Dupont, S., Zavareh, M. T., Zeihsel, F., Ehemann, T., Sinnwell, C., Göbel, J. C., Zink, K. J., & Aurich, J. C. (2021). Maturity model for determining digitalization levels within different product lifecycle phases. *Production Engineering*, *15*(3), 431–450. https://doi.org/10.1007/s11740-021-01044-4

Sjödin, D., Parida, V., Kohtamäki, M., & Wincent, J. (2020). An agile co-creation process for digital servitization: A micro-service innovation approach. *Journal of Business Research*, *112*, 478–491. https://doi.org/10.1016/j.jbusres.2020.01.009

Sklyar, A., Kowalkowski, C., Tronvoll, B., & Sörhammar, D. (2019). Organizing for digital servitization: A service ecosystem perspective. *Journal of Business Research*, *104*, 450–460. https://doi.org/10.1016/j.jbusres.2019.02.012

Snieška, V., Navickas, V., Haviernikovă, K., Okręglicka, M., & Gajda, W. (2020). Technical, information and innovation risks of industry 4.0 in small and medium-sized enterprises – case of Slovakia and Poland. *Journal of Business Economics and Management*, *21*(5), Article 5. https://doi.org/10.3846/jbem.2020.12279

Storbacka, K. (2018). Extending Service-Dominant Logic—Outside Marketing and Inside Managerial Practice. In *The SAGE Handbook of Service-Dominant Logic* (p. 1237). SAGE.

Struyf, B., Galvani, S., Matthyssens, P., & Bocconcelli, R. (2021). Toward a multilevel perspective on digital servitization. *International Journal of Operations & Production Management*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/IJOPM-08-2020-0538

Struyf, B., Matthyssens, P., & Van Bockhaven, W. (2021). Revitalizing Alignment Theory for Digital Servitization Transition. In M. Kohtamäki, T. Baines, R. Rabetino, A. Z. Bigdeli, C. Kowalkowski, R. Oliva, & V. Parida (Eds.), *The Palgrave Handbook of Servitization* (pp. 261–280). Springer International Publishing. https://doi.org/10.1007/978-3-030-75771-7_17

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319–1350. https://doi.org/10.1002/smj.640

Tian, J., Coreynen, W., Matthyssens, P., & Shen, L. (2021). Platform-based servitization and business model adaptation by established manufacturers. *Technovation*, 102222. https://doi.org/10.1016/j.technovation.2021.102222

Tian, J., Vanderstraeten, J., Matthyssens, P., & Shen, L. (2021). Developing and leveraging platforms in a traditional industry: An orchestration and co-creation perspective. *Industrial Marketing Management*, *92*, 14–33. https://doi.org/10.1016/j.indmarman.2020.10.007

Tóth, Z., Sklyar, A., Kowalkowski, C., Sörhammar, D., Tronvoll, B., & Wirths, O. (2022). Tensions in digital servitization through a paradox lens. *Industrial Marketing Management*, *102*, 438–450. https://doi.org/10.1016/j.indmarman.2022.02.010

Tronvoll, B., Sklyar, A., Sörhammar, D., & Kowalkowski, C. (2020). Transformational shifts through digital servitization. *Industrial Marketing Management*, *89*, 293–305. https://doi.org/10.1016/j.indmarman.2020.02.005

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

Ulaga, W., & Loveland, J. M. (2014). Transitioning from product to service-led growth in manufacturing firms: Emergent challenges in selecting and managing the industrial sales force. *Industrial Marketing Management*, *43*(1), 113–125. https://doi.org/10.1016/j.indmarman.2013.08.006

Vargo, S. L., & Lusch, R. F. (2004). The Four Service Marketing Myths Remnants of a Goods-Based, Manufacturing Model. *Journal of Service Research*, *6*(4), 324–335. https://doi.org/10.1177/1094670503262946

Vargo, S. L., & Lusch, R. F. (2018). *The SAGE Handbook of Service-Dominant Logic*. SAGE.

Vasconcelos, F. C., & Ramirez, R. (2011). Complexity in business environments. *Journal of Business Research*, *64*(3), 236–241. https://doi.org/10.1016/j.jbusres.2009.11.007

Vendrell-Herrero, F., Bustinza, O. F., Opazo-Basaez, M., & Gomes, E. (2023). Treble innovation firms: Antecedents, outcomes, and enhancing factors. *International Journal of Production Economics*, *255*, 108682. https://doi.org/10.1016/j.ijpe.2022.108682

Vendrell-Herrero, F., Bustinza, O. F., Parry, G., & Georgantzis, N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management*, *60*, 69–81. https://doi.org/10.1016/j.indmarman.2016.06.013

Vendrell-Herrero, F., Bustinza, O. F., & Vaillant, Y. (2021). Adoption and optimal

configuration of smart products: The role of firm internationalization and offer hybridization. *Industrial Marketing Management*, *95*, 41–53. https://doi.org/10.1016/j.indmarman.2021.04.001

Vendrell-Herrero, F., Gomes, E., Bustinza, O. F., & Mellahi, K. (2018). Uncovering the role of cross-border strategic alliances and expertise decision centralization in enhancing product-service innovation in MMNEs. *International Business Review*, *27*(4), 814–825. https://doi.org/10.1016/j.ibusrev.2018.01.005

Venkatraman, N. (1989). The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence. *The Academy of Management Review*, *14*(3), 423–444. https://doi.org/10.2307/258177

Witell, L., & Löfgren, M. (2013). From service for free to service for fee: Business model innovation in manufacturing firms. *Journal of Service Management*, *24*(5), 520–533. https://doi.org/10.1108/JOSM-04-2013-0103

Woodside, A. G., & Wilson, E. J. (2003). Case study research methods for theory building. *Journal of Business & Industrial Marketing*, *18*(6/7), 493–508. https://doi.org/10.1108/08858620310492374

Yeow, A., Soh, C., & Hansen, R. (2018). Aligning with new digital strategy: A dynamic capabilities approach. *The Journal of Strategic Information Systems*, *27*(1), 43–58. https://doi.org/10.1016/j.jsis.2017.09.001

Yin, R. K. (2017). *Case Study Research and Applications: Design and Methods* (6th edition). SAGE Publications, Inc.

Zhang, M., Chen, M., Zhang, M., & Liu, H. (2022). Environmental performance of servitized manufacturing firms: The (mis)alignment between servitization strategies and inter-organizational information technology capabilities. *Industrial Management & Data Systems*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/IMDS-04-2022-0226

Ziaee Bigdeli, A., Bustinza, O. F., Vendrell-Herrero, F., & Baines, T. (2018). Network positioning and risk perception in servitization: Evidence from the UK road transport industry. *International Journal of Production Research*, *56*(6), 2169–2183. https://doi.org/10.1080/00207543.2017.1341063

Zuiderwijk-van Eijk, A. M. G., Janssen, M. F. W. H. A., van de Kaa, G., & Poulis, K. (2016). The wicked problem of commercial value creation in open data ecosystems: Policy guidelines for governments. *Information Polity*, *21*(3). https://doi.org/10.3233/IP-160391