Bringing Industrial Software to Market: Managerial Challenges and an Agenda for Future Research

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Abstract

Industrial manufacturers are increasingly developing and marketing industrial software systems (ISS) in addition to their traditional hardware-based products. ISS are complex market offerings with a software core complemented by services that enable industrial customers to increase the efficiency and effectiveness of their value creation processes through connectivity, data, and automation. When bringing ISS to market, manufacturers often face serious roadblocks. Our research sheds light on these roadblocks and develops an agenda for future research. This study conceptualizes ISS based on focus group discussions with top-level and senior managers as well as additional desk and literature research. As a result, this study carves out ISS research priorities, spanning the five areas of (1) marketing strategy, (2) marketing organization,

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(3) innovation, (4) sales, and (5) customer behavior. Overall, this paper is the first to conceptualize ISS, to position its concept in the marketing literature, and to propose an agenda for future research.

1 Introduction

It is our belief that every industrial company in the coming age is also gonna have to be a software and analytics company. Jeff Immelt (CEO General Electric 2001–2017)

Challenged by fierce competition and accelerating advancements in information technology, industrial firms are increasingly commercializing innovative market offerings from the digital realm (Allmendinger & Lombreglia, 2005; Kohtamäki et al., 2019; Liozu & Ulaga, 2018; Valencia et al., 2015). Manufacturers like Boeing (AnalytX), General Electric (Predix), Johnson Controls (Digital Vault), and Schneider Electric (EcoStruxure) have introduced *industrial software systems* (ISS) consisting of a software core complemented by services that enable industrial customers to increase the efficiency and effectiveness of their value creation processes through connectivity, data, and automation (see further examples in Table 1).

However, manufacturers often struggle when bringing ISS to market and top management's digital ambitions frequently fail to translate into targeted bottom line results. Despite their experience in marketing high-technology products, goods-centric firms often lack the capabilities for commercializing ISS. Take, for example, General Electric's *Predix*, a cloud-based ISS for the collection and analysis of industrial data. After redefining its digital business in 2016, General Electric projected revenues from software to be $12 billion by 2020, but growth proved sluggish with marginal increases from $3.6 billion in 2016 to $3.9 billion in 2018 (GE, 2021; Mann and Gryta, 2020; Venkatraman, 2017).

Academic literature has remained largely silent regarding the unique roadblocks manufacturing firms face when bringing ISS to market. Prior literature has provided substantial insights on the marketing of new products (e.g., Howell et al., 2005), industrial services (e.g., Eggert et al., 2011), solutions (Macdonald et al., 2016; Tuli et al., 2007), and smart product–service systems (e.g., Chowdhury et al., 2018; Lerch & Gotsch, 2015). However, we argue that ISS are conceptually distinct from the aforementioned market offerings. First, ISS function like an operating system for customers' business processes, orchestrating value creation processes across the firm. Second, due to increasingly digitalized supply chains (Ageron et al., 2020; Garay-Rondero et al., 2019) ISS transcend customers' organizations and may impact cooperating companies. Third, as a consequence of the first two characteristics, customers face substantial path dependencies when implementing an ISS and suppliers are confronted with unique challenges when marketing and selling ISS.

Table 1 Examples of ISS

Company description	ISS	Application
ABB operates in robotics, power, heavy electrical equipment, and automation technology	Asset and workforce management	Helps managers to, among other things, increases resource utilization and equipment reliability, improves management of people as well as their skills and tasks, and optimizes complex maintenance tasks
Boeing designs, manufactures and sells civil and military aerospace products worldwide	AnalytX	Offers three categories of analytics, namely, a set of analytics enabled software applications, consulting services, and self-service analytics
Bosch building technologies is part of the German engineering company operating in various industries	Connected Buildings	Offers applications and services in the areas of elevator monitoring, space management, light monitoring, air quality monitoring
Daimler Trucks is the brand under which the German automotive corporation sells trucks	Fleetboard Driver	Reports time management and tracks deployment analysis in order to motivate truck drivers
Deere & Company is an American manufacturer of, among other things, agricultural, construction, and forestry machinery	MyJohnDeere	This software-based offering, among other things, gathers equipment data via sensors, and shows availability across systems
GE operates in nine industry sectors, among others, the renewable energy sector	Digital Plan of the Day	Schedules work orders, considers parameters like power price, labor cost, overtime, production forecast (based on wind speed), turbine status, and tasks priorities, and depicts crew availabilities
Honeywell is an American conglomerate which offers, among other things, engineering services and aerospace systems	Symphonite (Integration and Analytics)	Combines information from multiple sources into a single unified repository to, among other things, keep track of progress and as a common source of data

(continued)

Table 1 (continued)

Company description	ISS	Application
Johnson Controls is an multinational conglomerate that produces fire, HVAC, and security equipment for buildings-	Johnson Controls Digital Vault	Integrates data from a wide range of internal and external sources to help you make sense of your entire building: energy usage, security breaches, equipment performance, and space utilization
Mitsubishi Heavy Industries is a Japanese engineering, electrical equipment and electronics company. Its offerings include, e.g., aerospace and automotive components, power generation equipment, machine tools and more	Electronic Road Pricing system	Provides a technology platform that uses global navigation technology to better manage traffic congestion, while developing useful value-added services
Schneider Electric is a French corporation operating in energy management, industrial automation, and industrial services	EcoStruxure Machine Expert	Software solution for developing, configuring, and commissioning the entire machine in a single software environment, including logic control, motion control, remote IO systems, safety control, motor control, and related network automation functions

Sources: Company websites

Learning how to market ISS to industrial customers is a pivotal task on the manufacturers' journey toward digitization. Against this backdrop, we develop and discuss a research agenda aimed at advancing managerial practice and academic knowledge on marketing ISS. To that end, we guided two focus groups with senior and top-level managers from leading manufacturing firms and carved out 12 research priorities within the five topic areas of (1) marketing strategy, (2) marketing organization, (3) innovation, (4) sales, and (5) customer behavior.

Our conceptual and qualitative research makes several contributions to academic research and managerial practice. For academic research, our study conceptualizes and positions ISS in the literature on digitalization in industrial markets (e.g., Ardolino et al., 2018; Chowdhury et al., 2018; lansiti & Lakhani, 2014; Porter & Heppelmann, 2015; Suppatvech et al., 2019). Our study thereby lays the foundation for an academic inquiry of ISS and provides the first insights derived from our qualitative study. For managerial practice, our study identifies the characteristics of ISS and their corresponding marketing challenges. Our study also provides guidance on how to deal with these challenges when bringing ISS to industrial markets.

The remainder of this article is structured as follows. We first conceptualize ISS and position the concept in the extant academic literature. Next, we describe our focus group studies used to identify ISS research priorities. Finally, we develop a research agenda and discuss managerial implications.

2 Conceptualizing ISS

2.1 Theoretical Grounding of ISS

From a theoretical perspective, an ISS is a *system* which connects various elements and processes in a customer firm's value chain, such as production machines, storage systems, and billing and controlling procedures. As such, implementing an ISS entails far-reaching consequences for customers in three ways: (1) ISS impact and determine customer's business processes; (2) as ISS orchestrate increasingly digitized supply chains, their influence transcends the customer's organization and may impact cooperating companies; (3) customers opting to purchase an ISS enter substantial path dependencies. We expand on each of these aspects in the following.

First, ISS act as an operating system for customers' business processes, orchestrating the value creation processes of previously isolated building blocks. Specifically, ISS connect both physical elements (e.g., machinery with storage equipment) and non-physical elements (e.g., purchasing or workforce scheduling processes) with each other, turning these elements into a fine-tuned system promoting each other's usage. To accomplish such connections, customers need to make far-reaching changes to their operations, such as connecting ISS with their existing equipment, designing an integrated workflow, and educating their staff to use the ISS (Ghobakhloo, 2020).

Example

For example, *Hitachi ABB*'s *asset and work management* connects assets to manage their usage more efficiently while also connecting different teams to foster collaboration (Hitachi ABB, 2021). Customers using this ISS need to connect it to their power plants and equipment to gain the necessary data, integrate ISS into performance engineering processes, and ensure that their staff consistently communicates and shares information via the ISS within the organization. In contrast, traditional industrial offerings typically do not *orchestrate* value creation but create value as an inherent part of customers' business processes. For example, a customer buying a machine to weld metal will integrate that particular offering, i.e. the welding machine itself, within a larger production process of which welding is only one of several consecutive steps. ◀

Second, as intertwined supply chains are becoming increasingly digital (Deloitte, 2018; Salvini et al., 2020), the impact of an ISS frequently transcends the customer's organization. ISS often include interfaces for customers' downstream customers, thus placing ISS at the critical intersection between companies' boundaries. For a customer purchasing an ISS, this entails high coordination efforts to connect partnering companies to the system. This coordination comprises, for example, informing partnering companies of the ISS, convincing them to join, ensuring their system access, establishing joint transaction processes, and providing IT support (Ageron et al., 2020; Ghobakhloo, 2020; Voigt et al., 2019). Once implemented, decreased transaction costs may pay off the initial effort.

Example

An example is Honeywell's *Symphonite,* which improves supply chain and production management processes (Honeywell, 2021). In contrast, traditional industrial offerings typically do not transcend the customer's company borders. Take the example of GE's *power by the hour,* which allows customers to pay for jet engine usage per hour (Girotra & Netessine, 2011), yet it does not impact supply chains beyond the focal customer firm. ◀

Third, as a consequence of the two previous points, customers enter substantial path dependencies when implementing an ISS. These path dependencies arise out of two cost considerations by customers. For one, the implementation of an ISS requires substantial effort by a customer, as an ISS alters value chain processes with far-reaching consequences even on the customer's supply chain. Consequently, the decision to undertake the implementation effort for an ISS often manifests in a lock-in for customers. To illustrate, consider Schneider Electric's *EcoStruxure Machine Expert,* which provides a software environment for the development, configuration, and commissioning of machines (Schneider Electric, 2021). Once customer employees are trained on this ISS and operational processes run smoothly, customers' switching costs are high. For two, this lock-in will likely manifest itself in subsequent purchases of both software (e.g., user licenses, upgrades) and hardware from the supplier of the ISS. As to the latter, the ISS supplier's hardware might be easier to connect to the ISS, thus ensuring that operations continue to run smoothly when integrating new offerings (Backhaus & Voeth, 2004). As a result, customers might experience a lock-in regarding the supplier's product portfolio beyond the ISS. Conversely, in hardware-based exchanges, switching costs are typically lower and future transactions are less affected compared to an ISS purchase.

2.2 Positioning ISS in Extant Literature

While academic marketing literature has not yet examined ISS, it has spawned four adjacent research areas: industrial innovations, servitization, new product selling, and smart product-service systems. We elaborate on each in the following areas in the fol-

lowing. First, academic literature on industrial innovations has examined the strategic shifts industrial companies need to undertake when adding new offerings to their portfolio (Calantone et al., 2002; Cooper, 2019; Hsu, 2005). In particular, academic literature suggests that companies need to carefully consider the possible risks and opportunities when adding new offerings to their portfolio in order to balance established businesses and innovations defining the future (O'Reilly & Tushman, 2004). In this context, ISS constitute an industrial innovation, which makes a strategic shift necessary.

Second, servitization literature (Kindström & Kowalkowski, 2014; Raddats et al., 2019) advanced our understanding of industrial suppliers' evolution from product manufacturers to service providers. For example, servitization literature has stressed the importance of building relationships between suppliers and customers, as exchanges of service offerings require a different way of thinking about customer–supplier relationships than product-based exchanges (e.g., Grönroos & Voima, 2013). Although manufacturers introducing ISS follow the path of servitization, ISS are a distinct subset within this journey, as ISS impact customers particularly severely.

Third, academic sales literature has examined the necessary requirements for selling new products, such as innovations (Alavi et al., 2021; Chen et al., 2015; Hohenberg & Homburg, 2016; van der Borgh & Schepers, 2018), intangibles (Alavi et al., 2019), industrial services (e.g., Eggert et al., 2011), and solutions (Nordin & Kowalkowski, 2010; Ulaga & Loveland, 2014). For example, sales literature has put particular emphasis on value-based selling which focuses on communicating the value of an offering instead of focusing on its technical specifications and costs (Terho et al., 2012, 2015, 2017). This literature might inform how to effectively sell ISS because these systems promise customers enhanced value by orchestrating processes within and beyond a customer's company (Vial, 2019). However, the academic sales literature is silent on how specifically suppliers should sell ISS to customers.

Fourth, research on *smart product-service systems* (Chowdhury et al., 2018) or *digitalized product-service systems* (Lerch & Gotsch, 2015) has recently emerged at the intersection of information systems and operations management literature. Chowdhury et al., (2018, p. 30) define smart product-service systems as "the combinations and interactions between smart technologies, physical products, services, and business models." An example is remote monitoring, which "enables manufacturers to remotely monitor and diagnose customers' machines using embedded sensors and wireless connectivity" (ibid, p. 28). Smart product-service systems are similar to ISS as they comprise software elements (Kohtamäki et al., 2019), e.g., to analyze machine data. However, smart product-service systems differ from ISS as they typically aim to increase the value of a particular element within a customer's value chain, for example by ensuring a particular machine's uptime (Ulaga & Reinartz, 2011). In contrast, ISS *orchestrate* the value creation across multiple value chain processes of customers.

To summarize (see also Table 2), academic marketing literature has covered related phenomena yet missed a distinct focus on the important and challenging endeavor of selling ISS. ISS (1) increase the interdependencies between value chains, (2) foster

Table 2 Positioning ISS in Marketing Literature Streams

Literature stream	Exemplary references	Focus of literature stream	Relation between literature and ISS concept	Contribution of ISS to literature stream
Industrial innovations	Calantone et al. (2004); Cooper (2019); Hsu (2005)	Examines the necessary shifts when introducing new offerings to your portfolio	ISS constitute an industrial innovation which makes strategic shifts within companies necessary	ISS impact customers' value chain processes considerably while previous innovations did not impact their customers in the same way
Servitization	Raddats et al. (2019); Kindström and Kowalkowski (2014)	Servitization literature, among other things, advances the understanding of manufacturers' evolution from product manufacturers to providers of services	Companies introducing ISS follow a servitization path moving away from product-based exchanges	ISS should be seen as a distinct subset within the servitization journey of industrial manufacturers as their impact on customers is particularly severe due to their process-oriented nature
Sales	van der Borgh and Schepers (2018); Alavi et al. (2021); Eggert et al. (2011); Nordin and Kowalkowski (2010)	Among other things, academic literature on sales examines the necessary requirements for companies when selling new products, such as innovations, intangibles, industrial services, and solutions	ISS constitute systems whose sales process differs from feature-driven product sales and are offerings new to the sales force	Academic sales literature has remained silent on the sales process of selling process-oriented, supply chain impacting, and path dependency causing offerings like ISS
Smart product-service systems	Chowdhury et al. (2018); Lerch and Gotsch (2015)	Explores the phenomenon of offerings with enlarged share of information within the product offering	Smart product-service systems and ISS comprise software elements	ISS and smart product-service systems have resembling features. However, ISS achieve to influence a whole range of value chain processes at customers while smart product-service systems focus on single process steps

interactions across firm boundaries within increasingly digitized supply chains, and (3) create strong path dependencies. Considering the importance of ISS in industrial marketing practice and the unique marketing challenges, we identify a need for a better understanding of ISS and develop a research agenda for this important yet under-researched field. Based on two focus groups with senior and top-level managers from leading manufacturing firms, we next develop and validate this ISS research agenda.

3 Developing a Research Agenda for ISS

3.1 Methodology

We conducted two focus groups with high-ranking executives from industrial manufacturers to understand challenges arising from the theoretical particularities of ISS outlined previously and to carve out potential research priorities for ISS. We chose focus groups as they are useful to disclose shared and tacit beliefs which emerge in the course of interaction with others in a local setting (Kindström et al., 2018; Macnaghten & Myers, 2004).

In our first focus group, we gathered six top-level and senior managers of industrial manufacturers with 11 to 46 years of experience to engage in a discussion about challenges when marketing new offerings from the digital realm. The moderator of the focus group briefly named the discussion topic and asked participants to share their experiences with offerings from the digital realm. The moderator iteratively asked for reasons (Corbridge et al., 1994; Reynolds & Gutman, 1988) *why* organizations experience challenges with offerings from the digital realm, and encouraged the participants to provide their views on each other's experiences. The discussion concluded with brief recommendations by participants on what they would have done differently if starting all over again.

Our second focus group comprised four senior managers of industrial manufacturers and proceeded in two steps. First, participants discussed common trends in their journey toward digitalization as well as marketing challenges in small groups with other managers from industrial manufacturers. Subsequently, participants joined a formal focus group discussion, moderated by an experienced academic who encouraged the participants to share their thoughts and insights. Similar to the first focus group, the discussion uncovered a plethora of challenges common among participants.

Both focus groups were audiotaped and transcribed verbatim. Two researchers analyzed the transcripts by reading all transcripts independently, marking sections, and extracting all relevant themes before grouping the statements, and finding key challenges when bringing ISS to market (cf. Matthyssens & Vandenbempt, 1998). For a detailed list of participants of both focus groups, see Table 3.

Results of both focus groups suggested a multitude of challenges and resulting priorities for academic research. We cluster these into five generic themes, which constitute

Table 3 Participants of the Focus Groups

Focus group	ID	Gender	Industry	Job title	Industry experience in years
1	Alpha	Male	Medical technology	Head of business segment	16
	Beta	Male	Intralogistics	Senior project manager	46
	Gamma	Male	Industry machinery	Vice president sales	21
	Delta	Male	Manufacturing	Managing director	19
	Epsilon	Male	Automotive	CEO	11
	Zeta	Male	Mechanical engineering	Plant manager	18
2	Eta	Female	Transportation	Product and project manager	2
	Theta	Male	Mechanical engineering	Plant manager	13
	Iota	Male	Agriculture	CEO	6
	Kappa	Male	Utilities	Head of business segment	17

important functions in industrial firms and reflect established areas in the academic marketing literature (Kotler & Keller, 2016): (1) marketing strategy, (2) marketing organization, (3) innovation, (4) sales, and (5) customer behavior. Table 4 provides a detailed overview of the emerging research questions. In the following sections, we induce these questions from prevailing managerial challenges in bringing ISS to market.

3.2 Research Priority 1: Marketing Strategy

The focus group participants suggested that ISS entail a fundamental shift in a supplier's marketing strategy. For this reason, ISS-specific challenges arise in all decision areas related to formulating a marketing strategy: (1) setting an adequate objective of introducing ISS, (2) deciding on the adequate targeting and positioning of ISS, and (3) setting an adequate product portfolio strategy, that is, the integration of ISS with the traditional hardware-based businesses.

Marketing objectives. Practitioners displayed uncertainty regarding the overarching objectives of firms when introducing ISS. For example, Theta stated:

> [One issue is] the unclear company purpose of [ISS]. Why are we doing it? Is it for the customer? Is it for us? What's the benefit from it?

Table 4 Research Priorities on Bringing ISS to Market (1/2)

Research area	Research priority	Research questions
1. Marketing strategy	1.1. Marketing objectives	**How can suppliers effectively set *strategic objectives* for the introduction of ISS?** a) How can suppliers predict whether entering the market for ISS is strategically advantageous? b) What role can ISS play for a supplier (e.g., source of revenue versus securing traditional business with customers)?
	1.2. Targeting and positioning	**How can suppliers effectively *target* customers and *position* ISS?** a) How can suppliers determine whether and which (new) customer segments to target with ISS? b) How can suppliers assess customers' value-add and translate it into value propositions for ISS?
	1.3. Product portfolio strategy	**How can suppliers effectively integrate ISS into their *product portfolio strategy*?** a) How should suppliers assign resources to ISS relative to traditional businesses? b) How can suppliers seize synergies and manage conflicts between ISS and traditional businesses?
2. Marketing organization	2.1. Organizational structures	**Which changes in organizational *structures* are required to bring ISS to market?** a) When should suppliers integrate ISS into their established organizational structures and when should they outplace them into a separate entity? b) Which organizational structure does the ISS business require - depending on whether it is part of the established organization or outplaced into a separate entity?
	2.2. Organizational culture	**How can suppliers achieve the *cultural* changes required to bring ISS to market?** a) Which specific mindset shifts are necessary for marketing ISS and how can these be implemented? b) How can suppliers avoid that focusing on ISS demotivates employees in traditional business units?

(continued)

Table 4 (continued)

Research area	Research priority	Research questions
3. Innovation	3.1. Innovation processes	**How do suppliers need to *adjust their innovation processes* for developing ISS compared to traditional products?** a) How does developing ISS differ from developing traditional products? b) Which working methods are most conducive to developing ISS compared to traditional products (e.g., co-creation, agile methods such as design thinking, lean start-up, scrum, …)?
	3.2. Innovation competencies	**How can suppliers build the required *competencies* for developing ISS?** a) Which competencies are most critical for product development to develop ISS? b) Which forms of collaboration are most conducive to developing ISS (e.g., internal partners, competitors, universities, incubators, acquisitions, joint ventures, …)
	3.3. Pricing of innovations	**How can suppliers effectively *price* ISS?** a) Which pricing models are best suited to accommodate customers' low willingness to pay for ISS? b) To what extent should suppliers adjust prices of ISS when taking into consideration the data of customers to which they gain access as a basis for future innovations?
4. Sales	4.1. Selling competencies	**How can suppliers develop the competencies of their sales staff to sell ISS?** a) Which new competencies are most critical for sales staff to communicate the value of ISS (e.g., technical know-how, consulting, educating, value communication, …)? b) How can suppliers build up these competencies most effectively for salespeople with different dispositions (e.g., learning-oriented, failure-avoiding, performance-oriented, …)?

(continued)

Table 4 (continued)

Research area	Research priority	Research questions
	4.2. Sales structures and systems	**How should suppliers *reorganize* for the sales of ISS?** a) Should suppliers build separate sales teams for ISS and how should they manage the interface to traditional sales teams? b) Which new roles are required for selling ISS (e.g., customer success manager, …)? c) How should sales of ISS be reflected in sales force compensation plans?
5. Customer behavior	5.1. Buying	**How does customers' *buying* change for ISS?** a) How do customers' buying centers and processes change when purchasing ISS compared to traditional products? b) How do customers judge ISS compared to traditional products?
	5.2. Post-purchase outcomes	**What is the effect of buying an ISS on *subsequent customer outcomes*?** a) How do customers derive value-in-use from ISS compared to traditional products? b) How does buying an ISS affect the subsequent relationship between a customer and a supplier?

Similarly, participant Iota said:

> It starts with the board to understand what is digital and what is not. Do you have a vision for the company? Do you have a strategy in this direction? Did I decide—if I want to play—what kind of role I want to play in the ecosystem of the solution [that] a customer wants?

The reasons for this uncertainty about marketing objectives may stem from ISS' theoretical particularities. First, as outlined in Sect. 2.1, ISS orchestrate customers' value chain processes connecting previously isolated building blocks. Before introducing ISS, manufacturers need to decide which parts of customers' value chain processes they aim to orchestrate. However, the potential scope of action for ISS is broad and thus taking a decision in this respect is difficult. Second, as a consequence of the far-reaching impact ISS have on customers' value chain processes, customers enter substantial path dependencies. Industrial manufacturers have yet to fathom the potential impact of these path dependencies (e.g., greater future revenue opportunities). Due to the uncertainty about the impact ISS may have, industrial manufacturers experience challenges in defining clear objectives to be achieved.

Despite these challenges, practitioners discussed two potential benefits associated with ISS that they might take into account when setting objectives: ISS might (1) provide a direct source of revenue or (2) be a means of maintaining or strengthening customer relationships by adding value for customers. However, practitioners are in doubt whether these objectives materialize as they frequently observe that customers lack a willingness to pay for ISS. Additionally, customers may perceive the considerable influence of ISS on their business process as undesirable, damaging the relationship rather than strengthening it. For this reason, practitioners perceive uncertainty regarding which objectives they might achieve when embarking on a journey toward ISS.

Against this backdrop, the question of how to set marketing objectives when introducing ISS could prove to be a fruitful avenue for future research. More specifically, future research might examine the specific benefits to be expected when bringing ISS to market, thereby supporting the decision process for managers. We revisit this suggestion when discussing the research priority of post-purchase outcomes of ISS.

Targeting and positioning. Second, participants mentioned targeting new customer segments and positioning ISS as particular challenges. For example, Theta raised the difficulty "finding the correct market and the correct customer to start with." Theta elaborated further:

> We have a lack of understanding of the value for the customers with these [ISS]. What's the real value of connecting a machine, for example? Or all of a sudden, gathering all the data that we want as a company, what's the value for the customer of that?

Again, we trace this difficulty back to the unique characteristics of ISS. Suppliers seem to lack a clear understanding of the value-enhancing potential of ISS due to the deep intervention of ISS in customers' business processes. Therefore, suppliers struggle with targeting customers with the readiness to implement and make use of ISS' possibilities in their value chain processes. Further, as ISS transcend customers' organizations and not only influence ISS users but also other companies within intertwined and increasingly digital supply chains (Ageron et al., 2020; Garay-Rondero et al., 2019), targeting customers becomes more challenging. Specifically, beyond understanding their customers, suppliers need to understand their customers' customers and partners. Since targeting is lacking, so is suppliers' ability to effectively position ISS for targeted segments.

Manufacturers' challenges to target and position digital offerings beyond their traditional hardware has recently been observed by Chowdhury et al. (2018), who noted—for the specific service of remote machine monitoring—that "manufacturers are still struggling to articulate value propositions […] that would be appealing to customers." A potential reason discussed by Liozu and Ulaga (2018, p. 98) is that "[d]igital offers are new for everyone, including customers" and "[m]ost value propositions are based on unproven assumptions […]." The newness of ISS to hardware-centric companies goes beyond mere additional machine functions, thus breaking new ground (Kleinschmidt & Cooper, 1991; Song & Montoya-Weiss, 1998) as they push into their customer's processes and adjacent companies in the supply chain.

Building on these notions, we perceive it as important for future research to provide actionable guidance to industrial manufacturers on how to target and position ISS. Specifically, academic marketing research should examine how suppliers can determine whether and which (new) customer segments—possibly in different positions in the value chain—to target, how to assess the needs of these customers and thus potentials for creating value, and how to develop effective value propositions.

Product portfolio strategy. Third, practitioners perceived it as challenging to integrate ISS into their existing portfolio. Product portfolio strategies set rules for a company's resource allocation and organizational design, mitigate a company's financial risk (Festa et al., 2021; Kolte et al., 2018; Rossi et al., 2020) through managing its offerings in a portfolio approach, and evaluate necessary strategic trade offs (Ansoff & Leontiades, 1976). In this respect, the participants of our focus group struggled to decide how to assign resources to their ISS businesses. ISS businesses are often small in volume (suggesting low priority) and difficult to grow, but of high strategic importance for the survival of the company (suggesting high priority), potentially promising long-term revenues as they create path dependencies for customers. This struggle becomes apparent in the statement of participant Iota:

> The board has to show to the employees that this is important, up to the fact that a board member says, "I will run the digital venture" even though they only have 20 people. Unfortunately, most board members will say: "I'm responsible for 10,000 people. Why should I go in a digital venture and run a 20-people company?"

Managers' struggles become especially problematic in times of crises, as Epsilon noted:

> We have to consistently pursue our plans and not cut new fields of business in times of sales crises. We must not cut what is going to be our future main business.

To decide on the resources to be allocated to marketing ISS, suppliers need to understand the path dependency caused by a customer's decision for an ISS. Specifically, industrial manufacturers may decide to allocate more resources for marketing ISS in case these investments have high financial returns via future revenues with the customer. Because research on the path dependencies induced by ISS is lacking, choosing an appropriate product portfolio strategy is difficult.

Building on the quotes and considerations above, we regard the question of how to assign resources as an interesting research avenue. Importantly, this question can hardly be evaluated in isolation, as it overlaps two adjacent research questions: (1) The question is strongly linked with the overarching objectives of the suppliers related to ISS. For example, research may examine which types and amounts of resources are most conducive to reaching varying types of marketing objectives (e.g., source of revenue versus means to strengthen customer relationships; see previous elaborations). (2) It is worth noting that ISS businesses compete for resources with traditional businesses. To decide how to allocate resources, suppliers require a thorough understanding of the synergies

and conflicts between these businesses. Interestingly, understanding synergies and conflicts may not be straightforward. ISS could potentially *complement* a supplier's traditional business as they increase the value customers derive from previously purchased equipment through software interfaces that facilitate the optimization of machine use by customers. Yet, ISS might also *substitute* parts of the traditional future business as they substantially change a customer's value chain processes. To illustrate, consider a production process where output can be improved by adding a new machine to the fleet or by optimizing work processes using ISS. If customers decide to improve output through the heavier use of ISS, this may significantly impair prospective hardware sales. We encourage future research to tap into such questions when researching effective product portfolio strategies for ISS businesses.

3.3 Research Priority 2: Marketing Organization

The participants of our focus groups emphasized the challenge to configure the organizational setup. Issues are of both (1) structural and (2) cultural nature. We discuss both issues in this section.

Organizational structures. Both focus groups saw challenges in deciding which organizational setup to choose for their ISS business. Specifically, they controversially discussed either placing the ISS business in separate organizations in order to assign more freedom and flexibility to the team or integrating it into the traditional core organization to maintain control, facilitate knowledge exchange, and secure consistent communication vis-à-vis customers. For example, Eta stated that suppliers "need to integrate these business units closely into the core business." Conversely, Theta recommended granting high independence to the ISS business:

> We have to create a distinct digital team that can be integrated […] into the traditional team [later]. So we have to start differently and not with the existing people, at least not all of them, and then maybe bring it back if it still fits. […] We said we have to give them a little bit more freedom.

The decision on whether to integrate or to separate digital teams from the existing organization is also influenced by the third characteristic of ISS, the creation of path dependencies. In particular, ISS may create path dependencies as a result of the considerable impact on customers' business processes and the impact on customers' supply chains. This path dependency may create future (financial) benefits for other parts of the organization. However, it remains unclear *whether* and *how* organizations can realize these benefits. The realization and magnitude of these benefits may also be influenced by the degree of integration between business units. Overall, the optimum level of integration between units remains a serious challenge for companies introducing ISS.

These differing views between integration and separation of teams call for a thorough academic investigation in which conditions favor one of the two organizational setups

over the other. A theoretical lens that future marketing research may test is the *ambidextrous organization* (O'Reilly & Tushman, 2004, 2016). According to this lens, to balance the established products of the past and prepare for innovations that will define the future, organizations should "separate their new, exploratory units from their traditional, exploitative ones, allowing them to have different processes, structures, and cultures; at the same time, they maintain tight links across units at the senior executive level" (O'Reilly & Tushman, 2004, pp. 75–76) to balance established products and prepare for future-shaping innovations. It would be interesting for future research to conceptualize and empirically test which specific organizational structures and links between them best foster ambidexterity when it comes to ISS.

Organizational culture. Focus group participants consistently emphasized the need for cultural change in order to bring ISS to market. Organizational culture refers to "a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Schein, 2004, p. 17). Two particular challenges referred to (1) which specific actions to take and (2) how to avoid demotivating traditional businesses along the way.

Regarding the first, while both focus groups agreed that cultural changes are necessary, their ideas on these changes remained unspecific. Themes comprised a fuzzy set of mindset shifts, such as the need for customer centricity, speed, and the willingness to accept failures. However, as Eta pointed out with regard to the latter, "the culture of accepting failure is often not there, which makes it harder to actually use an agile approach." The question of how to bring about required changes seemed even more elusive. Theta noted:

> Most of our businesses in our group sell hardware, so we have formed this successful culture around the successful business with hardware. […] It's tricky to change an existing successful business and remodel it. […] This is a cultural issue.

This quote illustrates how an industrial manufacturer's main business contributes to the identity of a company (Tripsas, 2009). Hardware has typically shaped industrial manufacturers' identities and, thus, organizational cultures. In contrast, software offerings like ISS have not yet been part of industrial manufacturers' identities and cultures. Indeed, ISS are fundamentally different as deduced by the three intrinsic factors of ISS elaborated on in Sect. 2.1. Given the three factors intrinsic to ISS, manufacturers face severe challenges upon the introduction of ISS. Specifically, considering the first intrinsic factor of ISS, their focus on processes, it is impossible to foresee and remedy all potential risks (Rossi et al., 2020). Accordingly, ISS suppliers are bound to take greater risks and will inevitably make mistakes. For this reason, the challenge for the management of ISS suppliers is to act as a broker between units with traditional views while promoting an understanding of risk-taking by new business units. Some participants emphasized these

challenges to be a primary reason for placing ISS business in a separate organizational entity. For example, participant Iota noted:

> Most organizations fail with cultural change because the organization does not fit [...] the culture you want to build. So you have to change the organizational structure. Otherwise, you will always fail to change the culture.

This view is echoed by recent managerial literature. For example, Liozu and Ulaga (2018, p. 11) state that "[i]n a company that lacks digital maturity, the risk is high that the core business will reject integration of a new data-driven model in the same way that a body rejects a transplanted organ. This rejection can deal a mortal blow to a company."

As to the second challenge, participants discussed that a supplier's new focus on ISS may lead to demotivation in traditional business units. For example, Eta stated:

> In every presentation, you find something about digital solutions […] In the traditional business, people feel left out and are not valued enough because they are actually making most of the money.

In other words, leading cultural change is a difficult task for organizations, but crucial for their success when introducing ISS. Maybe managers can ensure employees' buy-in via the third characteristic of ISS, path dependencies considerably influencing customers' business processes and supply chains. These path dependencies might convince more members from the traditional hardware unit that they may benefit as well. However, path dependencies induced by ISS are difficult to grasp and have yet to be quantified.

Summarizing our previous elaborations, we propose that future research should examine how suppliers can achieve the cultural changes required to bring ISS to market. Specifically, future studies might explore *which* specific mindset shifts are necessary for marketing ISS and *how* to implement them. In addition, future research may explore remedy strategies on how to balance employee motivation across all business units (Kotter, 2012).

3.4 Research Priority 3: ISS Development

Our analysis revealed profound challenges in practice and thus opportunities for academic research concerning a supplier's (1) development processes, (2) required competencies, and (3) the pricing of ISS.

Development processes. Participants in our focus groups frequently emphasized challenges in the development processes of ISS. One challenge that consistently emerged was *customer focus*, which participants regarded to be important but lacking in their innovation of ISS. For example, participant Iota stated:

> So in our organization, the classic, traditional one, we spend a lot of time and money on the telematics systems of machines. What is the acceptance rate of the customer? Less than 1%. Why? Because it has been built by engineers […] that have never, ever spoken to any customer. So the customer value-add might be completely different.

The reasons for challenges throughout development processes likely stem from ISS's influence on customers' business processes and impact on cooperating companies via increasingly digitized supply chains. First, suppliers need a deep understanding of their customers' business processes. As customer firms' value chain processes are often idiosyncratic, development processes need to ensure high adaptability of ISS. Second, as ISS transcend customers' borders into increasingly digitized supply chains, development processes need to ensure that ISS provide interfaces between the focal customer company and its cooperating companies. Again, interfaces may vary between customers, requiring high adaptability of ISS. Considered together, widely varying customer processes and varying positions in the supply chain make it challenging to design development processes.

Notably, as the previous quote suggests, innovators still seem to fall into the trap of neglecting customers in their development processes. This is surprising because customer focus in development processes has been prescribed by both managerial literature (e.g., Christensen et al., 2016) and academic literature (e.g., Bolton, 2004; Heinonen & Strandvik, 2015) for a long time. It has been particularly emphasized when designing and developing digital innovations (Ardolino et al., 2018; Kohtamäki et al., 2019; Liozu & Ulaga, 2018; Sklyar et al., 2019), also to avoid over-engineering (e.g., Kerievsky, 2002).

The lack of customer focus in ISS development processes suggests interesting avenues for academic research. For example, why are ISS development processes particularly afflicted with a lack of customer focus? Does the lack of customer focus result from factors intrinsic to ISS (such as their process-oriented nature, impact on supply chains, and path dependency) or extrinsic to ISS (such as deficits in internal collaboration and available competencies; see the following research priority)? Based on these findings, how should suppliers adjust their innovation processes for developing ISS compared to traditional products?

To improve customer focus, the second focus group discussed agile methods of innovation for ISS. Such methods to "eliminate wasted time and resources by developing the product iteratively and incrementally" have gained popularity in managerial practice (Blank, 2013, p. 68). Waste of time and resources may be particularly pronounced in companies focused on achieving the highest levels of technical performance when innovating products. Achieving similar levels of technical performance for ISS includes high development costs. With ISS serving as an additional input for the optimization of a customer's processes, industrial manufacturers are increasingly acknowledging the importance of co-creation when innovating ISS (Song & Montoya-Weiss, 1998). For example, Eta stated:

> We are trying out things like co-creations, scrum frameworks, design thinking, and I think this works quite well. We are also testing our ideas on minimum viable products and […] proof of concept with the customer.

Building on these notions, future research may also examine which agile methods are most conducive to innovation processes of ISS and compare their effectiveness to innovation processes of hardware-based products.

Development competencies. Participants perceived it as highly challenging to build the right competencies needed to develop ISS. Two challenges emerged from the focus groups: first, participants were uncertain which specific competencies they required in different areas of their innovation unit. Themes included technical skills, such as data analytics and software coding, but also know-how about customers' problems to be solved. Given the considerable impact on customers' processes, participants frequently stressed the staff's ability to grasp their customers' problems. As participant Iota noted:

> It's not about technology, it's about mindset. […] If I don't understand the customer's business, how can I solve their problems?

Second, given the lack of clarity regarding which competencies are required, participants perceived great challenges in developing these competencies and were questioning whether the existing workforce could be skilled up. For example, participant Iota proceeded:

> The IT guys you have in your company, they will never, ever be able to build a software platform for customers.

While this view may favor hiring fresh talent rather than training the existing workforce, participants perceived the former as equally challenging. To make hiring decisions, managers need to know which competencies to search for, where to find potential candidates, and how to evaluate applicants' profiles. Eta recalled their challenges in this respect:

> One of our main problems was finding resources at all and also having the people with the right skillset. […] Even though we hired people, we hired the people with the wrong skillsets, and the timing was sometimes not right. […] So at the moment, in my view, the problem is that a lot of data analysts were hired but not the developers who are coding the application.

The participants controversially discussed two potential solutions to overcome difficulties in competence building: *hiring from customers* and *entering partnerships*. As to the first, Iota explained:

> First thing I did, 50% of the people I hired were customers. They know exactly what they need and what the pain points are. And still, 35% of my people are former customers […] So whatever we want to bring out as a solution, they talk with their network and know exactly what does or doesn't make sense.

However, other participants raised the issue that hiring from customers' companies may be perceived as hostile and thus threaten business relationships with these companies. In regard to the second, participants discussed the possibility of partnering with exter-

nal organizations (such as universities, incubators, or joint ventures with competitors) to develop innovations. For example, Iota stated:

> We don't have a clue about what the customer wants—one software to run their entire business. We only know part of the business. So we need partners [who] have been established in this business for years and who happen to have this knowledge.

As this illustrative quote suggests, ISS have a considerable impact on the value chain processes of customers. To achieve such a considerable impact on customers' processes, suppliers require extensive knowledge of customers' business processes. Accessing such knowledge is possible through collaborations as the previous quote by Iota suggests. However, other participants were more skeptical about collaborations, as Eta warned:

> Many of us are working together with external partners. […] But I would always see this as negative because if you work with external resources developing such a [software], you don't create the knowledge in your company.

In summary, given the great challenges as well as conflicting views in practice, we propose that future research should examine how suppliers can build the required competencies for innovating ISS. To answer this question, research should clarify which competencies are most critical for innovating ISS at different levels of the organization and which forms of collaboration are most conducive to developing these competencies and thus innovate ISS.

Pricing of ISS. Finally, participants discussed that their established pricing[1] models did not sufficiently reflect customers' perception of value and thus their willingness to pay for ISS. Delta explained:

> We come from a hardware business. We always calculate costs first, then develop the product, and only then conclude what the price should be. But it should be the other way around. […] How much are you willing to pay [for that value]?

Notably, marketing literature has been criticizing cost-based pricing for more than 60 years (Backman, 1953). Instead of pricing on the basis of costs, the literature recommends taking a product's value to customers into account (Anderson & Wynstra, 2010; Docters, 2004; Hinterhuber, 2008). In fact, "the graveyard of business is filled with the skeletons of companies that attempted to base their prices solely on costs" (Backman, 1953, p. 148). In this vein, ISS suppliers should price on the basis of the value that ISS provide to customers.

However, the participants in our focus groups perceived great uncertainty regarding how to price ISS on the basis of value. Again, this difficulty traces back to the intrinsic

[1] We adopt a broadened perspective of pricing not restricted to monetary terms. Specifically, in our understanding, pricing comprises all ways of monetization including the conversion of an asset to money as well as the conversion of an asset to a means of generating profit, e.g., data.

characteristics of ISS (see Sect. 2.1). First, ISS influence a customers' processes and supply chain considerably, creating value through the orchestration of value creation processes. However, as outlined previously, the value created by ISS is difficult to quantify, rendering value-based pricing difficult. At the same time, owing to ISS' considerable influence on customers' processes and supply chain, customers are likely to perceive the implementation process as risky and thus show a reduced willingness to pay and collaborate. Eta noted:

> A problem is our customers' willingness to pay and not only to pay but also, for example, to share the data so that you can actually develop your [ISS].

Second, ISS create path dependencies benefitting suppliers in the long run, which suppliers might take into account when pricing ISS, thereby accommodating customers' reduced willingness to pay. However, as mentioned previously, the magnitude of path dependencies created by ISS remains unclear, rendering this option difficult.

Against this backdrop, we propose to examine how suppliers can effectively price ISS. More specifically, research may study which pricing models are best suited to accommodate customers' low willingness to pay for ISS given that customers will have to partially disclose important data on their input factors (e.g., materials management, or workflows of machine operators) when using the industrial manufacturer's machines. In addition, suppliers may benefit from guidance on how to take the value of their customers' data into consideration.

3.5 Research Priority 4: Sales

In-depth discussion with focus group participants revealed major challenges when selling ISS. These challenges can be grouped into two areas: (1) Identifying and developing necessary competencies for their sales force as well as (2) reorganizing sales structures, that is, integrating or separating sales teams and defining new roles. In this section, we discuss these challenges in more detail.

Selling competencies. Both focus groups agreed that selling ISS requires a novel set of competencies that are absent in traditional, hardware-based businesses. However, participants seemed uncertain (1) *which* specific competencies are necessary to sell ISS and (2) *how* to build these up.

As to the first, an overarching theme was salespeople's competence to convey the value of an ISS to customers. The need for enhanced value communication competencies results from the fact that customers do not easily comprehend the full value of an ISS. This is because ISS substantially influence customers' business processes and supply chains in an attempt to orchestrate these processes for the better. To effectively convey the value an ISS will generate to customers, salespeople need to be able to initially understand their customers' business processes in detail. Subsequently, salespeople can quan-

tify the value ISS may create via the orchestration of these business processes. As Delta puts it:

> To sell our software to an automotive company like Daimler or Volkswagen, you have to go deep into their processes, which requires substantial know-how. This is a problem: Where do I find people who have this know-how?

Yet, being able to identify and quantify value potentials is not enough. Salespeople additionally need to be able to adequately communicate the value of ISS to their customers. However, communicating the value of ISS is different from hardware-based offerings. Focus group participant Epsilon compares it with learning a new language:

> Already [learning the] vocabulary is extremely difficult. That means, how do I train and develop one of my most important resources, the people? How can I develop [the] know-how and capabilities of my employees so that they become competent contact persons who can credibly explain the value add of the [ISS]?

Put differently, ISS stretch the portfolio of salespeople from known tangibles and services to the novel area of software orchestrating customers' business processes. ISS challenge salespeople to add expertise in areas that are not only unfamiliar to them but highly difficult to acquire.

Academic research on servitization has acknowledged the challenge of selling intangibles as particularly difficult for the industrial sales force (Dubinsky & Rudelius, 1981; Plouffe et al., 2008; Sheth & Sharma, 2008). Specifically, selling intangibles requires a subtler level of persuasion via conveying an offering's fit for a specific customer problem (Ulaga & Loveland, 2014). Thus, where traditional product selling tends to focus on product features, new approaches, most prominently consultative selling (Moncrief & Marshall, 2005; Sheth & Sharma, 2008) and value-based selling (Alavi et al., 2021; Terho et al., 2012, 2015, 2017), have emerged focusing on creating value for customers. The literature on selling services and value-based selling may be an appropriate starting point for academia to understand selling ISS. Hereby, it may be particularly interesting to explore the extent to which competencies required for selling ISS overlap with those required for selling services.

Second, knowing *which competencies* the industrial sales force needs is of little value unless managers know *how* to equip salespeople with them. However, the focus group participants noticed severe difficulties in skilling up their salespeople, as Epsilon noted:

> Looking at my usual salesperson, aged 45 and up, they're missing some basic training to be upskilled. His comprehension of IT systems is very limited compared to the hardware knowledge he mastered perfectly over the past 20 years. Training him on new technologies is almost impossible. There may be younger salespeople who grew up with it and will pick it up on the spot as they have a different mindset.

To train their salespeople, participants' companies had tried different formats. For example, Eta recalls: "Some tried to educate their employees by doing web-based training,

announcing digital set champions, so promote the idea of that, do something like [a] hackathon." However, participants seemed generally dissatisfied with their success in training current employees. Thus, managerial practice would greatly benefit from academic research on *how* to enable their salespeople to sell ISS. Hereby, building on the quotes above and following previous literature, research may also take contingency factors into account, such as the type of salesperson and different types of trainings, e.g. individual trainings, on-the-job trainings, and webinars (e.g., Chen et al., 2015; Steenburgh & Ahearne, 2018).

Sales structures. Equipping suppliers with the appropriate sales structures proves to be a key question for industrial manufacturers. Specifically, focus group participants discussed two topics: (1) building separate or integrated teams, and (2) defining and establishing new roles at the interface of sales, support, and marketing.

First, our focus groups debated whether separated or integrated sales teams are more effective in bringing ISS to market. The question of whether to sell ISS via separate sales teams solely dedicated to selling ISS or via integrated sales teams led by a field sales representative with additional support from ISS units is important when considering the three characteristics intrinsic to ISS. With regard to the first and second intrinsic factors of ISS, separate sales teams dedicated to selling ISS may be able to focus on building up specific knowledge about their customers' business processes and supply chains from scratch without the need to adhere to goals and guidelines a sales force focused on traditional hardware-based products may have. Additionally, the knowledge of industrial manufacturers' sales force with a focus on traditional hardware-based products may not coincide with the knowledge needed for new offerings (Atuahene-Gima, 1997; Micheal et al., 2003). This discussion was fueled by some participants who doubted the possibility of reskilling their current sales force to sell ISS. As Delta claimed:

> And now software comes in. Try to teach a hardware guy to sell software! That's a real problem. […] You can't teach a hardware guy to sell software. Forget it. Completely different culture.

For the same reason, his company chose to build a separate entity:

> We built up a separate entity and founded new companies in 29 countries. We built up everything from scratch. […] We even formulated all discount processes defining every single escalation level.

However, as indicated by the third intrinsic factor of ISS, i.e. the path dependency resulting from ISS' influence on customers' value chain processes and supply chains, integrated sales teams may be more suitable than separate sales teams to identify cross-selling potentials emergent from synergies created via ISS orchestrating the interplay between a supplier's other offerings, e.g. machines or services. Furthermore, arguing against separate sales teams, participants also discussed that building separate entities may cause channel conflicts between hardware sales and ISS sales. As Epsilon noted:

> But there's also a great risk entailed. How will you approach existing customers? The regular salesperson will say: "The [ISS salesperson] talks to my customer? This is *my* customer, not his one!"

Academic research may explore which sales team structure is most effective in bringing ISS to market. For example, academic research could consider which effects occur when companies name specialized experts who support generalist salespeople on an "as-needed" basis (Brown et al., 2005; Liozu & Ulaga, 2018) rather than fully disintegrating their sales teams (Micheal et al., 2003).

Second, participants debated the successful enablement of customers to fully utilize ISS after a sale. For example, Zeta noted the danger of internal fights and recommended: "There has to be an unambiguous allocation of who is responsible for solving a customer's problem in order to avoid confusion." To monitor and ensure that customers constantly derive high value while using an ISS, suppliers are establishing roles that go beyond traditional after-sales and support staff. Customer success managers monitor performance data and gauge the value customers capture when using ISS (Porter & Heppelmann, 2015). Customer success managers are widespread among digital companies—e.g., such as Microsoft and Google—but new for industrial suppliers (Eggert et al., 2020; Hilton et al., 2020; Hochstein et al., 2020; Novet, 2018). Academic literature on the role of customer success managers within the sales process for ISS is lacking, which provides a fruitful avenue for future research. Future research may thus investigate how suppliers of ISS can define and implement the role of customer success managers—and how to derive value from it.

3.6 Research Priority 5: Customer Behavior

When selling ISS, suppliers face different customer behavior. First, *buying centers* change, which ultimately alters the way customers perceive and judge a supplier's offerings. Second, ISS may influence *post-purchase* customer outcomes. Specifically, the way customers derive value-in-use from ISS has not been explored yet, and neither has the impact of ISS on the customer–supplier relationship.

Buying centers. Epsilon noted that "as the portfolio changes [toward ISS], contact persons change as well." This is because ISS are complex market offerings, influencing a greater number of stakeholders due to their intrinsic factors. First, as ISS influence customers' business processes and supply chains considerably, stakeholders involved in a wide variety of process steps may evaluate an ISS (i.e., from supply chain management over order intake and manufacturing to dispatch of the finished product). Second, as the decision for a particular ISS leads to path dependencies, top-level managers, strategists, and business planners may have a say when choosing an ISS.

In view of this, it is necessary to investigate how buying centers and purchasing processes change. These changes likely depend on a customer's size. For example, Epsilon stated:

> I would differentiate by customer segments. We have the segments of retail, national key accounts, and international key accounts. In retail, contact persons don't change. Those ones are small family-owned businesses which are happy to survive until the next generation takes over […] Then there are national key accounts and this is where it starts—contact persons change with new technologies.

More specifically, in big customer organizations, various functions, such as IT, data teams, facilities, and risk and legal may become involved (Liozu & Ulaga, 2018) when purchasing ISS. The enlargement of the customer's buying center might change decision processes and entail a different set of metrics to evaluate and judge the industrial software systems offered. Thus, future academic research may explore which changes in the buying center occur and which impact these changes have on decision-making processes.

Post-purchase outcomes. The focus group participants emphasized the importance of understanding customer outcomes after ISS purchases. Specifically, suppliers are interested in the value drivers for customers using ISS as well as the effects ISS may have on the relationships between suppliers and customers. As to the first, focus group participants were interested in understanding *how* customers may use ISS to serve their own purposes via, e.g., improving their value chain processes or facilitating exchanges along their supply chain. For these factors intrinsic to ISS, the beneficial influence of ISS for customers—and, thus, benefits for the supplier—is likely to materialize only over a longer term. In other words, suppliers care for their offering's performance in each customer's usage situation beyond the initial purchase. Regarding this issue, focus group participant Beta stated:

> I think that most [traditional organizations] don't arrive at the question how the [software] is actually used. They don't even put themselves in the customer's shoes to understand [the full value of a certain technology].

This quote by Beta suggests that many companies do not realize the high importance of assessing and understanding post-purchase outcomes resulting from the characteristics intrinsic to ISS. Suppliers expect the considerable influence of ISS on customers' business processes via the orchestration of previously isolated building blocks to provide value to customers. However, it remains uncertain whether and how customers derive this value.

Second, as ISS may create considerable path dependencies, the relationship between customers and the ISS supplier may change drastically over time. It is unclear whether the relationship between customers and ISS suppliers may worsen or improve over time. On the one hand, the experienced path dependency may be seen as a burden with high costs of switching due to employees being already trained to use the ISS and operations potentially being disturbed when integrating other suppliers' offerings due to a lower

degree of compatibility with the installed ISS. On the other hand, the experienced path dependency may be seen as a fruitful connection with increasing potential for value gains due to an intensified customer intimacy between customers and a supplier (Kai-Uwe Brock & Yu Zhou, 2012). Future research may, e.g., investigate which management styles may harm (boost) the customer–supplier relationship.

Against this backdrop, we propose that academic research examines *how* ISS benefit customers. In line with recent publications in marketing, scholars may explore the determinants of ISS' "value-in-use," that is, "all customer-perceived consequences […] that facilitate or hinder achievement of the customer's goals" (Macdonald et al., 2016, p. 98). For example, in the context of business solutions Macdonald et al. (2016) describe self-assessment of the customer's resources and individual goals of users to play key roles when judging business solutions. However, these findings are not easily transferable to ISS as their implementation follows a different logic, that is, enabling customers to increase efficiency and/or effectiveness of their value chain processes by *themselves*. Specifically, customers can reconfigure and refine all of ISS' components (Backhaus & Muehlfeld, 2005; Backhaus & Voeth, 2004) according to their requirements. Understanding ISS' value-in-use may also feed back into our previous research priorities and help suppliers make more effective targeting and positioning decisions, innovate better offerings, and build the right sales competencies.

Academic research may also explore the effects of ISS on the customer–supplier relationship. This may feed back into our previously outlined research priority on marketing objectives, helping suppliers understand "[w]hy are we doing it? Is it for the customer? Is it for us? What's the benefit from it?" (see previous quote from H). For example, research could examine under which circumstances ISS foster customers' attitudinal loyalty toward a supplier, thus cross-fertilizing a supplier's hardware-based businesses (Björkdahl, 2009).

4 Discussion

In the digital economy, industrial manufacturers are increasingly complementing their hardware portfolios with ISS. As the introductory quote by the former CEO of General Electric, Jeff Immelt, suggests, this trend may be a necessity rather than a choice. However, when bringing ISS to market, manufacturers are facing severe marketing challenges. These challenges pertain to strategic and organizational choices, the functional management of innovation and sales, and customer behavior. Our study provides avenues for conducting research on how to solve these challenges and holds important implications for both academic research and managerial practice.

Table 5 Academic Literature on Digitalization in Industrial Markets

Reference	Academic field	Researched phenomenon	Key results	Methodology
Ardolino et al. (2018)	Production research	Influence of *digital technologies* on industrial supplier strategies to either become *availability providers* (from product to process-oriented services), *performance providers* (from standardized to customized solutions), and *industrialisers* (from transactional deals to long-term contractual agreements)	The traditional manufacturing company needs restructuring and extension with new functions such as customer success management, dev-ops, and a unified data organization	Case studies
Chowdhury et al. (2018)	Information management	*Smart Product-Service Systems (PSS)* are based on combinations and interactions between smart technologies, physical products, services, and business models employing output-based value propositions whereas these interactions are essential to fulfill the customers' needs	The main aspects of Smart PSS derived from literature are synthesized and structured into three themes: digital resource driven value systems and business models, boundary spanning, and dynamic capabilities	Literature review
Kohtamäki et al. (2019)	Business research	*Digital servitization* journey of companies "as the transition toward smart product-service-software systems that enable value creation and capture through monitoring, control, optimization, and autonomous function." (p. 4)	The paper identifies various emerging business models within digital servitization such as the models of outcome providers, platform providers, industrializers, product-oriented service providers, customized integrated solution providers	Literature review

(continued)

Table 5 (continued)

Reference	Academic field	Researched phenomenon	Key results	Methodology
Sklyar et al. (2019)	Business research	The authors examine *digital servitization* as the utilization of digital tools in the course of transformational processes in the endeavor of shifting to a service-centric business model and logic	The authors first identify key underlying processes of organizational change in the digital ecosystem and suggest within-firm centralization and integration to play a key role	Case studies
Suppatvech et al. (2019)	Marketing	*Internet of Things* (IoT) describes all the interconnections of physical objects through adding radio frequency identification and other sensors for various purposes, including identification, sensing, communication and data collection. Enables firms to offer innovative product service offerings, and redesigning current business models	The authors identify four archetypes of business models that are enabled by the IoT: add-on, sharing, usage-based, and solution-oriented	Literature review

4.1 Research Issues

Our study makes two major contributions to academic research. First, by conceptualizing ISS, our study enriches literature on digitalization in industrial markets (see Table 5). Prior literature has conceptualized phenomena such as digital technologies (Ardolino et al., 2018), smart product-service systems (Chowdhury et al., 2018), and digital servitization (Kohtamäki et al., 2019; Sklyar et al., 2019). Furthermore, managerial literature has discussed concepts such as smart, connected products (Porter & Heppelmann, 2015) and digital offers (Liozu & Ulaga, 2018). However, prior literature has neglected ISS, a phenomenon prevalent in many industrial markets. We take this step and conceptualize ISS. Our study hereby extends the nomological net of digitalization in industrial markets (Table 5 depicts an overview of research on digitalization in industrial markets) and provides a conceptual basis for research on ISS.

Second, our study provides a detailed research agenda for improving our understanding of marketing ISS. Using focus groups, we carve out 12 research priorities. Given their high relevance for managerial practice, we encourage academics to generate new insights on these issues. As Evert Gummesson stated: "New knowledge can be scientific discoveries but also innovative practice. Thus, the new can come both from academe and practice. And isn't theory just the conceptualization of empirical data from a company that has stood out in some way?" (Lee & Greenley, 2010, p. 8). In addition to identifying and clustering research priorities, we give reasons as to *why* each research priority is important to be investigated with respect to ISS. In particular, we derive each of the research priorities from factors intrinsic to ISS. Following this notion and emphasizing the importance of the theoretical difference of ISS to research on previous offerings, we hope that our article instigates future research on ISS.

4.2 Managerial Implications

The key goal of our study was to develop an academic research agenda and thus enable the development of guidance for managers by *future* studies. Notwithstanding this goal, our study itself provides two implications for managers of industrial companies.

First, our study should raise managers' awareness for the challenges they will likely face when entering a market for ISS. Specifically, managers will encounter problems when defining their objectives of entering this market, deciding which customers to target with which value proposition, integrating their software systems with traditional businesses, deciding for or against a specific organizational structure of their new business, reforming their organizational culture, developing innovation processes, building the competencies to successfully innovate according to these processes, pricing their software innovations, skilling up and reorganizing their sales force, understanding how customers' buying of ISS are different, and learning how buying an ISS affects their customer relationship. Moreover, our study provides reasons as to *why* each of the clusters is likely to pose a challenge for managers of industrial manufacturers.

Industrial manufacturers that aim to bring ISS to market are entering the unknown. The challenges outlined above exhibit high importance, rendering it difficult to prioritize one challenge over the other. Thus, managers may be well advised to tackle these challenges simultaneously. This endeavor poses a challenge in itself. To follow a structured approach, we could envision that managers may benefit from setting up a professional multi-project management office that systematically prepares marketing for the introduction of ISS.

Second, our study provides first guidance on how managers might deal with these challenges. Specifically, the quotes from our focus group study provide managers with ideas and insights from senior managers of leading industrial manufacturers. Managers may use these items to reflect on potential pathways when bringing ISS to market. To this end, Table 6 synthesizes key items extracted from our focus groups.

Table 6 Ideas and Insights from Focus Groups

Focus Area	Ideas and Insights
Marketing strategy	● ISS can be a direct source of revenue ● ISS may help to maintain or strengthen customer relationships ● You will encounter difficulties finding the right target customer ● ISS are new to market and thus value assumptions need to be proven to articulate appropriate value propositions ● ISS are small in volume and difficult to grow but strategically important ● You are likely going to have conflicts with the traditional business unit
Marketing organization	● Integrating business units may help to transfer knowledge between the core and the new organization ● Separation of structures gives new teams more freedom and enables them to move faster ● ISS teams need the culture of accepting failure ● Management needs to carefully avoid demotivation of the current workforce
Innovation	● ISS need a greater customer focus and thus agile methods to be developed ● The business unit needs a new set of technical skills including data analytics and software development ● Hiring customers may have a positive impact ● Consider the value of a customer's data for your company as a means for turning it into a long-term source of revenue when pricing your offerings
Sales	● Salespeople need to be able to consult customers as well as communicate the offering's value ● Estimate whether and which retraining of the current salesforce is possible in the first place ● Keep in mind that separated sales teams get into dispute about the ownership of the relationship between old and new units ● You need to define roles hold responsible when customers encounter problems to avoid confusion and ensure a customer's success ● When having multiple salespeople in charge, traditional incentive schemes may give rise to conflicts
Customer behavior	● Changing buying centers influence decision-making processes ● Consider the customer's revised resource allocation ● You need to take the customer's viewpoint to understand how your offering is actually used ● Make yourself clear why you are doing it and assess the effects on the subsequent customer relationship

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