



# Actors, resources, and activities in Digital Servitization: a business network perspective

Elisa Carloni<sup>1</sup> · Serena Galvani<sup>2</sup>

Received: 8 February 2023 / Accepted: 12 October 2023  
© The Author(s) 2023

## Abstract

Digital Servitization (DS), that is the development of new services through the use of digital technologies, is an emerging research stream characterized by an inherent complexity that requires understanding changes occurring over time and impacting relationships and network dynamics. Scholars have argued for the need to move towards an analysis of the micro-interaction processes and the adoption of a networking perspective. In this direction, this study aims to explore the contribution of the business network approach, compared to other existing frameworks, in the analysis of complex digital phenomena. To reach this aim, the study undertakes a single case study of an Italian manufacturer which is undertaking a DS process. The empirical analysis is guided by the three dimensions of the interpretative Actors-Resources-Activities (ARA) framework, developed within the Industrial Marketing and Purchasing (IMP) approach. The analysis has provided insights into each of the three layers of the ARA framework and has pointed to a continuous interrelation between the internal and external context and interdependence among the three layers. The study provides a theoretical contribution to the stream of literature dealing with the DS phenomenon by providing a unified theoretical approach - i.e., the business network approach - characterized by analytical completeness. Also, the research paves the way for the business network approach and for the ARA framework to be adopted in the investigation of complex business phenomena, such as DS.

**Keywords** Digital Servitization · Business network · ARA framework · Case study · Complexity

---

✉ Elisa Carloni  
elisa.carloni@unibs.it

Serena Galvani  
serena.galvani@uniurb.it

<sup>1</sup> Department of Economics and Management (DEM), University of Brescia, Contrada S. Chiara 50, Brescia 25122, Italy

<sup>2</sup> Department of Economics, Society, Politics (DESP), University of Urbino Carlo Bo, Via Saffi, 42, Urbino 61029, Italy

## 1 Introduction

The growing digitalization of industrial contexts and the increasingly important role played by services in the B2B arena have recently emerged as disruptive trends (Gebauer et al., 2021; Chen et al., 2021). This strong link between digitalization and servitization is transforming servitization itself into Digital Servitization (DS).

DS represents, thus, an emerging research stream, which is catching the attention of both researchers and managers internationally and which is giving rise to a flourishing debate involving different disciplines and perspectives. Such debate is characterized by theoretical fragmentation, as the complexity of DS is pushing towards the adoption and integration of multiple theoretical lenses, such as the industrial organization theory, the resource-based view, the organizational identity, the service ecosystem perspective, or the transaction cost approach (Kohtamäki et al., 2019).

The complexity of the DS process requires understanding changes occurring over time and impacting relationships and network dynamics; in this sense, the need to look at DS from a networking perspective and by investigating micro-interaction processes has recently been acknowledged (Zhang et al., 2021; Galvani et al., 2022). So far, most studies have mainly adopted an ecosystem view, relying on a firm-centric and macro approach (Raddats et al., 2019). At the same time, the shift of manufacturers from product- to service-oriented firms has been the main point of attention in recent years (Tronvoll et al., 2020; Bustinza et al., 2018; Paschou et al., 2020), which requires a processual approach to understand DS implications over time (Chen et al., 2021; Galvani et al., 2022).

Existing studies on DS have highlighted the key role of coordination among multiple actors (i.e., customers, dealers, technology providers) and governance of their relationships (Tronvoll et al., 2020; Raddats et al., 2019), which in turn implies co-shared activities to access and reconfigure resources (Windahl et al., 2004; Tian et al., 2021). Starting from these studies, we posit that the Actors-Resources-Activities (ARA) framework (Håkansson & Snehota, 1995) - one of the major interpretative tools developed within the IMP (Industrial Marketing and Purchasing) approach - presents the prerequisites to be the right lens to capture all the elements of complexity generated by the DS process at the three layers of actors, resources, and activities and how interdependencies among the three layers affect such process. In fact, the inherent complexity of the DS process requires an understanding of the dynamics of change longitudinally, which can be better captured by an approach that emphasizes - by its nature - interconnection and interaction, such as the IMP one. Within IMP, which relies on a network perspective, technological and digital innovation has been traditionally explored and interpreted via the empirical investigation of industrial cases (e.g., Håkansson & Waluszewski, 2007). Thus, we build on existing studies on the analysis of the changes provoked by digitalization (Pagani & Pardo, 2017), with the aim to explore the contribution of the business network approach, compared to other existing frameworks, in the analysis of complex digital phenomena. Notably, the Research Questions (RQs) to be addressed are the following:

*RQ1. How does the DS process unfold in terms of Actors, Resources, and Activities?*

## RQ2. Does the interaction among them affect the DS process?

We answer these RQs by undertaking a single case study concerning *Gamma*, an Italian manufacturer which is experiencing a DS process, based on an IIoT-based platform. In particular, we set the context of our investigation in the DS process that the company has developed. The empirical qualitative analysis is guided by the three dimensions of the ARA framework, developed within the IMP approach.

The paper is structured as follows. Section 2 is devoted to the analysis and review of the main approaches adopted in DS studies and to the introduction of a business network approach to investigate technological development. In Sect. 3, we present the adopted methodology and the case study under investigation. Section 4 presents a critical discussion of the empirical findings. The last section highlights the main theoretical contribution and outlines the main implications of the study.

## 2 Picturing DS within a business network approach

### 2.1 Digital Servitization: characterization and main theoretical focuses

Servitization encompasses a transformation of the offering system of manufacturers, which overcomes the idea of traditional services supplied for free (i.e., warranty, phone assistance, ...) and includes innovative services sold at a cost. In particular, various forms of servitization exist, which move along a product-service continuum with different balances, “*ranging from products with services as an ‘add-on,’ to services with tangible goods as an ‘add-on’*” (Baines et al., 2009:556). Integrating services into a well-established manufacturing tradition represents a great challenge that - in the attempt to smoothen it - requires companies to build a digital service knowledge capital, rely on a technologically advanced network, and reinforce the relational exchange with customers (Paiola et al., 2022a). Nevertheless, manufacturing firms are seriously investing in servitization both in high-technological sectors, as in the case of Rolls-Royce and ABB, and in more traditional ones (see, for example, the case of Kone or John Deere).

The spread of servitization is being triggered by digitalization, leading to the concept of DS. The advent of Industry 4.0 (I4.0) technologies is redesigning how services are conceived and distributed (Hahn, 2020; Paiola & Gebauer, 2020). The most adopted technology within the B2B context is the Industrial Internet of Things (IIoT), which makes it possible to design and implement advanced product-services. The status of connection conferred to physical products allows the supply of services such as remote repair, diagnostics, and maintenance, which are becoming essential for customers (Biehl et al., 2004; Hasselblatt et al., 2018). Therefore, IIoT constitutes the main leveraging I4.0 technology to adopt DS (Paschou et al., 2020). It stands for a pre-condition to advanced services implementation, thanks to data collection and transmission and the possibility of remote monitoring of products and systems (Paschou et al., 2020; Ardolino et al., 2018; Porter & Heppelmann, 2014).

The complexity of DS can be observed from multiple angles. First, it requires coordination among different actors, both internal and external to the manufactur-

ing firm, that contribute to the realization of a service-oriented ecosystem (Sklyar et al., 2019). Indeed, manufacturers are called to access a complex infrastructural network for services, manage connections among different partners, coordinate actors to achieve value co-creation, and design new front-end and back-end roles (Pirola et al., 2020; Cenamor et al., 2017). Transformations are expected in the way in which relationships with customers, suppliers, dealers, and other stakeholders are conceived and managed (Tronvoll et al., 2020; Raddats et al., 2019). As Kohtamäki et al. (2019:381) noticed, “*Smart solutions must be designed to operate and interact with the solutions offered by many other manufacturers, used by customers, delivered by distributors, maintained by different service partners, and operated by third parties. Therefore, the integration of smart solutions across firm boundaries is crucial*”.

Second, DS brings to a re-evaluation and empowerment of existing resources as well as the acquisition of new ones to guarantee the ability to face such a long and complex transition effectively. DS calls for an extended set of both resources and competences (Cimini et al., 2021). Particularly relevant are intangible resources, such as the managerial approach or internal organizational structure, given the intangible nature of services (Bustinzá et al., 2018). Also, being digitalization and servitization processes that require time and an adaptation flow to be implemented, they stimulate changes in the human resource management process to obtain a digital service-oriented mindset, as well as digital and service capabilities (Favoretto et al., 2022; Lenka et al., 2017).

Third, consistent changes in terms of the type, number, and difficulty of the activities managed by manufacturers happen by means of DS (Manser Payne et al., 2021). On the one hand, DS calls for the integration of new activities related to customization and operational efficiency (Cenamor et al., 2017; Eloranta & Turunen, 2015). Kamalaldin et al. (2020) underline how key activities to implement in DS are digitally-enabled knowledge-sharing routines and a partnership governance. On the other hand, such activities need a new governance, which often implies coordination and cooperation with other actors; DS encourages co-shared activities, especially data-driven ones, with actors involved in the service transition (Tian et al., 2021; Shen et al., 2023).

The available literature on DS still misses a comprehensive view of this phenomenon, which is able to incorporate all the complexity angles it embraces. Not only, DS literature is currently based on a growing number of works adopting a variety of approaches. Indeed, when looking at DS research, it is possible to notice the existence of a high fragmentation in terms of adopted theoretical lenses, disciplines, and outlets (Paschou et al., 2020). Table 1 provides an overview of the main theoretical approaches adopted in DS studies.

Among the above-described approaches, a widely used lens in DS studies is the one of resources and capabilities, which poses attention to the process of building digitally-related knowledge and exploiting it in a shifting organizational context. The works of Bustinzá et al. (2018), Coreynen et al. (2020), Coreynen et al. (2017), Mosch et al. (2021), or Marcon et al. (2022) underline how the digital component of servitizing strategies leads to a necessary redesign of resources and capabilities at the organizational level. Beyond triggering innovative services, digital capabilities

**Table 1** Main theoretical focuses adopted in DS literature

Main focus	Focus description	References
Resources/ Capabilities	Digitalization, though triggering servitization processes, requires a strict redesign of organizational resources and capabilities, which are described in detail in these studies. They look at how digital capabilities need to be integrated and transformed to successfully innovate services.	Bustinza et al., 2018; Coreynen et al., 2020; Coreynen et al., 2017; Mosch et al., 2021; Marcon et al., 2022
Business Model Innovation/ Adaptation	By adopting a Business Model Innovation approach, these studies describe the transformational process of industrial firms toward DS. They trace how the digital component of servitizing strategies highly influences the entire process and leads to new organizational configurations.	Frank et al., 2019; Paiola & Gebauer, 2020; Chen et al., 2021; Paiola et al., 2022b; Tian et al., 2022
Paradox/Tensions/ Conflicts	Both from an intra- and inter-organizational perspective, studies underline how DS results in a series of paradoxes (or tensions), which are evaluated in terms of efficacy of DS, its complexity, and related coping strategies.	Tóth et al., 2022; Eggert et al., 2022; Galvani & Bocconcelli, 2022; Gölgeci et al., 2022; Korkeamäki et al., 2022
Ecosystems/Actors	Embracing the ecosystem approach to study DS is functional within these studies to explore the relational changes brought by it. Works depict the increasing complexity and transformation of DS between actors with different digital experiences.	Kohtamäki et al., 2019; Sjödin et al., 2020; Kohtamäki et al., 2021; Sklyar et al., 2019
Relational view	The relational view perceives DS as a net of interdependencies and relationships. Following this approach, the studies untangle how to manage buyer-supplier relationships and exchanges along the entire supply chain network, highlighting the key role of collaboration and identity.	Kamalaldin et al., 2020; Grandinetti et al., 2020; Vendrell-Herrero et al., 2017; Tronvoll et al., 2020; Korkeamäki et al., 2022
Networks	The adoption of a network approach support authors in the attempt to achieve a holistic and wide perspective on DS. They rely on the investigation of networking dynamics and buyer-supplier interfaces to describe DS complexity and reduce the related risks.	Galvani et al., 2022; Zhang et al., 2021; Ferreira & Lind, 2023

are required to internally reinforce companies' know-how and smoothen a service-oriented transition.

Other authors inquire about the impacts of DS via a business model innovation approach (Paiola & Gebauer, 2020; Chen et al., 2021; Tian et al., 2022; Paiola et al., 2022b). Such a lens is convenient to describe the transition of firms toward DS through a processual approach and to describe the new organizational configurations emerging from it. It also contributes to unveiling the key internal developments firms should achieve to succeed in DS. This is the case of Frank et al. (2019), which demonstrate how firms need to achieve convergence between the digital and the service innovation trajectories to succeed in DS and improve the firm's processes, such as reduced time to markets or production management. The adoption of such lens proves useful for the analysis of organizational and strategic aspects arising from DS as well as of the adaptation capabilities required; yet, they provide only one side of the story

as they look at intra-organizational impacts, disregarding how key external factors, including actors and resources, are impacted and impact in turn the DS process.

Some recent contributions elaborate on the paradox theory (Eggert et al., 2022; Tóth et al., 2022; Galvani & Bocconcelli, 2022; Golgeci et al., 2022; Korkeamäki et al., 2022) to describe the DS phenomenon. Untangling the paradoxes, tensions, and/or conflicts inherent in DS reveals useful to illustrate DS complexity at the intra- and inter-organizational levels. It also contributes to the identification of some of the reasons behind DS failures and therefore illustrates coping strategies.

Furthermore, one of the most widespread approaches in DS related to inter-organizational implications is the Service Dominant Logic (SDL) approach proposed by Vargo and Lusch (2011) or, more in general, an approach based on the observation of ecosystems and actors. This perspective focuses on the role of actors as key elements disentangling the dynamic actions happening in the ecosystem itself, through the increasing development of competences (Möller & Halinen, 2017). It attempts at achieving a wider point of observation in DS, especially since it relies on the ability of all actors, internal and external, to actively participate in it (Kohtamäki et al., 2019, 2021; Sjödin et al., 2020; Sklyar et al., 2019). Nevertheless, the focus on actors typical of the service ecosystems approach poses scant attention on other key elements in the process, as resources or activities. Given the current need to explore DS via a networking lens and through a fine-grained approach that takes into consideration micro-processes, the SDL logic appears limiting. Also, SDL-based studies are often theoretical in nature and avoid profound empirical investigations, which appear crucial to comprehensively interpret the articulation of the phenomenon.

Vendrell-Herrero et al. (2017), Kamalaldin et al. (2020), Tronvoll et al. (2020), and Grandinetti et al. (2020), instead, rely on a relational view to describe DS dynamics in terms of transformations happening along relationships. They contribute to underlining the paramount role of actors such as customers, suppliers, or intermediaries in determining the success of DS. By building on buyer-supplier relationship quality and supply chain management, they highlight the key role of collaboration and networking for a beneficial DS journey. Korkeamäki et al. (2022), though via a paradox theory framework, explore DS from a relational point of view, highlighting how DS complexity calls for relational coping practices, such as commitment, openness, partnership, and extrication between the digital services provider and its customers.

Finally, additional recent contributions are based on a networking approach to understand DS dynamics (Galvani et al., 2022; Zhang et al., 2021; Ferreira & Lind, 2023). Such a perspective is adopted in the attempt to achieve a holistic description of DS from a wider angle. Contributions are related to the deep investigation of networking evolutions and relational dynamics to reduce the risk of a 'service paradox' (Gebauer et al., 2005). A networking approach to explore DS seems promising since it allows to consider interrelation among actors in terms of all the elements inherent in - and exchanged within - business relationships, including resources and activities. However, DS research adopting a networking lens is still limited; thus, constituting an emerging research stream.

The fragmentation of DS literature points out the need to adopt an original perspective to observe this phenomenon that, according to the above-mentioned considerations, should rely on two key aspects. The first one concerns the idea that DS

needs a networking perspective to be fully investigated and understood (Kohtamäki et al., 2019). Second, DS should be conceived as a process since its actualization cannot disregard the concept of time (Kowalkowski et al., 2012). Indeed, DS implies a deep transformation of the organizational structure of the manufacturing firm, of the network in which it operates, and of the infrastructures it accesses. Therefore, it encompasses a deep cultural change, which requires time before being completely accepted and realized (Tronvoll et al., 2020). Authors as Chen et al. (2021) underline the need to adopt a processual approach in the analysis of DS with the aim of catching an overall view of the evolution of relationships involved in DS that considers the environmental factors active along this process. Similarly, Tronvoll et al. (2020:303) point out that research is needed “*from additional actors over an extended period to track network evolution during DS*”. For this reason, this study adopts a Business Network perspective (Håkansson & Ford, 2002) to investigate DS as a process; such an approach is explored in more detail in the following paragraph.

## 2.2 A business network approach on technological development

Given the complex, holistic, and difficult-to-manage processual development of DS (Sklyar et al., 2019), the need to move forward from a macro-level analysis - as the one proposed by SDL-based studies - to a broader understanding of the micro-processes behind DS is emerging (Kohtamäki et al., 2021). In this regard, this research attempts at applying a business network approach (Håkansson et al., 2009) to DS with the aim of including a processual and fine-grained micro-level analysis of relational networks (Quintens & Matthyssens, 2010), which has been so far under-investigated in favor of a more firm-centric or macro perspective. Indeed, despite the acknowledged complexity of DS, due to its multi-level implications, existing approaches have so far failed in recognizing the relevance of ongoing relationships and their potential leverage effect, the importance of resource interaction available through the established network relationships, and the set of value-creating activities carried out. The role played by networks and micro-interaction processes has started to emerge only in recent times, with the studies of Zhang et al. (2021), showing the importance of external networks and of the relational aspects of the DS phenomenon and, thus, moving toward a broader business network perspective. Later, a study by Galvani et al. (2022) combined a processual and longitudinal view of the DS phenomenon, with a relational micro-level network approach. Ferreira and Lind (2023) rely on an industrial network approach to explore interaction interfaces between manufacturing firms and IoT suppliers.

It is in this context that the core concepts of the IMP approach can prove valid in bringing added value to the analysis of DS. The IMP phenomenon-driven approach is based on an interactive view of the business world, made of interconnected relationships among interdependent actors (Håkansson et al., 2009; Håkansson & Snehota, 2017). The idea of interaction (Ford & Håkansson, 2006) lies at the core of the business landscape and shapes actors, activities, and resources (Ford et al., 2010). IMP covers the context-specific features and content of business exchanges, that is, its technological, social, and organizational aspects and consequences for businesses, networks, and society (Håkansson & Waluszewski, 2020). Within IMP, there

has been a research stream systematically focusing on innovation and technological development, starting with the early works of Håkansson (1982), Håkansson and Waluszewski (2002), Baraldi (2003) Strömsten and Håkansson (2007), and Håkansson and Waluszewski (2013), which have underpinned the idea that specific technological characteristics influence and are influenced by business interaction and can dominate its content.

One of the most relevant frameworks for investigating the DS process and the interaction outcomes is the Actors-Resources-Activities (ARA) framework (Håkansson & Snehota, 1995), suggesting that the content of a business relationship can be described in terms of three interrelated layers: actor bonds, resource ties, and activity links. The model can capture the “*complex connections between activity coordination and resource combining and the subsequent impact on the actor structure*” (Mattsson, 2002:169).

The first layer relates to the interpersonal and inter-organizational links developed through interaction. It is important to characterize actors by accounting for their economic, technological, organizational, and social aspects and to draw attention to the fact that actors engage in common problem-solving processes despite their different interests and aims. Companies are thus interconnected through actors’ bonds that form a web of actors at the network level. Actors’ bonds are an important means to mobilize others’ resources. The second layer relates to the extent of tangible and intangible resource adaptation and ties through interaction. Resources are heterogeneous, and interaction patterns influence their development, use, and combination. The last layer relates to activities, understood as a “*sequence of acts directed towards a purpose*” (Håkansson & Snehota, 1995:52), concerning technical, administrative, commercial, or other activities, and as being sustained by resources. The activity layer looks at the links between the activities of having substantial economic effects on the actors. Activities are linked across company borders and are dependent on each other (Håkansson et al., 2009; Håkansson & Waluszewski, 2020).

Interconnectedness among the three dimensions occurs as activities are performed by actors, who use resources, and what occurs in a specific relationship impacts not only the individual organization but also its relationships and the wider network. Based on the three layers, B2B relationships can be described as companies being connected by activity links, sustained by resource ties, and interconnected by actor bonds (Håkansson & Snehota, 1995).

Existing studies (Dóra et al., 2023; Pagani & Pardo, 2017) have shown how technological developments can have effects in terms of alterations of the supply and demand criteria of actors, change to the applied technology, and different resource interfaces connected to it, network expansions, or restrictions causing changes in relationships. Activities can be transformed by making changes to the technology that modify business performance and help seize opportunities that have arisen because of such changes.

Building on both early and more recent studies and adopting the IMP as the theoretical and analytical lens on DS can allow us to understand technological development as a process and look simultaneously at the coordination among multiple actors contributing to DS realization, at the reconfiguration of existing resources and the acquisition of new ones, and at the consistent changes at the activity layer managed by



manufacturers. Foremost, the underlying concepts and inherent characteristics of this approach allows to understand how interdependence among the three layers emerges throughout the process. Indeed, we posit that the IMP approach and particularly the interpretative ARA framework represent an important and comprehensive tool for the development of a more holistic analysis and understanding of complex technological advancements, such as the DS process. The ARA framework highlights the deepening of relationships and network evolutions, and it is thus helpful for a more in-depth examination of the variety of actors in the development of a technological trajectory (i.e., DS) and to analyze the type of activities required by the variety and complexity of technological adoption and development. In addition, the change brought by DS can be examined in relation to the resources that are combined in the interface among actors who relate to each other through organized and coordinated activities.

To sum up, the adoption of the empirically-based IMP approach can bring added value to the analysis of DS as a process. Looking at the nature of a business company and the network in which it is embedded could provide wide-ranging results, and interesting theoretical and managerial implications, compared to more mainstream approaches. In this context, the ARA model can represent a valid tool to describe the comprehensive process of DS, explaining the changes in the flow of resources internally and toward the external environment and interlinking the various elements through a single framework.

### 3 Case study

#### 3.1 Research design

##### 3.1.1 A longitudinal single case study

The main aim of this research is to observe and trace the actors, resources, and activities involved in DS, and understand how their (eventual) interconnectedness affects DS as a process. To reach this aim, this study applies a qualitative methodology, based on a longitudinal, in-depth single case study approach. The qualitative processual case study methodology (Yin, 2003; Halinen & Törnroos, 2005) appears as the most suitable one in light of the “how” nature of the RQs outlined.

The study is designed with an abductive approach to code information and elaborate results (Dubois & Gadde, 2002). Building on the three dimensions of the ARA framework (Håkansson & Snehota, 1995) we propose to analyze one case firm, *Gamma*. *Gamma* is a mechatronic manufacturer operating in the B2B context and located in central Italy. It is a family-run business, though it expanded consistently across the years, and it currently operates worldwide with more than 4.000 employees and a yearly turnover of around 750 million euros.

Specific criteria allowed for the choice of *Gamma* as a case study firm. First, *Gamma* is a manufacturing firm that demonstrated interest in a servitization path. Indeed, in 2016 the company started collecting information and doing market research to consider the introduction of services within its business model.

Second, it implemented new technologies that the company was not already familiar with. In 2017, *Gamma* confirmed the initiation of a DS-related project by implementing a Product-Service System based on the Industrial Internet of Things (IIoT) technology. The project, named IotBomb, consists of the realization of a website and mobile application for *Gamma* customers upon payment. Basically, via the application of sensors to the realized machineries, IotBomb customers can benefit from continuous and real-time monitoring of machineries and access a series of customized services, such as KPI and data reporting, remote and video assistance, and preventive and predictive maintenance notifications.

Third, the IotBomb project had an expected duration sufficiently long to allow for a longitudinal investigation. The business plan for IotBomb was validated in 2016 and the overall official project planning lasted from January 2017 until December 2021. Furthermore, additional developments on the project happened even after the planned timeline, with new releases in 2022–2023.

The research has been designed following different steps. First, we collected data by means of semi-structured interviews, active participant observation, and secondary sources. In the second step, data has been coded following the three dimensions of the ARA model, focusing on relevant actors, resources, and activities at the organizational level, investigating the set of actors that are involved, and the relevant resource collection and activity structure in connection with technological change. Finally, data have been analyzed and compared with existing literature.

### 3.1.2 History of the IotBomb project

*Gamma* considered the idea to invest in a DS process in 2016. Thanks to working trips undertaken by the firms' top management around Europe and cross-sectorial market analyses, *Gamma* recognized how innovative sectors such as the automotive were focusing their attention on digital services. In the same year, informal meetings with the consultancy agency *DigiConsulta* put further attention on the topic of DS, which finally led *Gamma* to invest in it.

In 2017, a formal business plan for the DS-related project IotBomb was created and validated. IotBomb was officially the IIoT-based DS application for the digital services of *Gamma* and *DigiConsulta* (in co-partnership). In the same year, the pilot session started with the support of *SoftProviderC* providing the route-engine system and the cloud for data storage. November 2017 saw the official launch of IotBomb globally.

2018 was the year with greater developments of IotBomb: new contract packages based on the IIoT sensors were created and sold, a great internal and external marketing campaign was distributed through all the firm's communication channels, adjustments were made in contracts' form and content for adaptation to local needs, new IotBomb-related data and workflows were integrated into the available systems of *Gamma*. During this year, IotBomb experienced faltering sales, mainly due to cultural resistances on the customers' side.

In the following year, the company managed the first cycle of IotBomb contract renewals. To this aim, it created a new salesmen team specialized in selling service

contracts. The collaboration with local universities led to co-financed PhD projects on IotBomb in the production/technology and data analysis areas.

In 2020, *Gamma* developed a deep market analysis of their customers' service purchasing behavior, which revealed how to redesign the service selling strategy and reinforce the selling team. During this year, IotBomb sales increased, demonstrating how some of the resistances previously encountered by customers were reducing.

2021 was the year of a deep change in IotBomb contracts: a new contract package was designed for customers without connected machineries. In this way, *Gamma* expanded its DS project beyond the IIoT technology and toward the entire customer portfolio. At the end of the year, the forecasted business plan for IotBomb ended, as well as the official collaboration with *DigiConsulta*. Nevertheless, *Gamma* chose to continue investing in DS and in the IotBomb project. At the end of the year, a rebranding of *Gamma* and IotBomb was deployed with the support of *MarkConsultB*.

During 2022, the initial conceptualization of IotBomb drastically changed and expanded. Indeed, a service data analysis team was created to monitor IotBomb performance and develop ad-hoc studies on it. In accordance with a local university, a research fellow was introduced in *Gamma* to support research processes within this team. By cooperating with the *SoftProviderC - Division 1* team, a new software for service data analysis was integrated. Together with *DigiConsultD*, an algorithm to identify customers with the highest service-selling potential was implemented as a key supporting tool for the service sales team.

Nowadays, thanks to the success of IotBomb and the visionary approach of the top management, *Gamma* is working on its transition toward a service platform, which represents the evolution of IotBomb from a website/mobile application to a unified platform. The new platform, designed with the help of *DigiConsultE*, allows product and service selling, online service access, service contact center, and technical support to converge and it is thought to be accessible to both actual and potential customers.

### 3.2 Data collection

Data collection consists of a combination of primary and secondary data sources. Primary sources include participant observation and interviews, while internal financial and economic reports, official documents on the DS-related project, website articles, intranet documental repository, and Customer Relationship Management database constitute secondary data sources.

Participant observation was conducted by one of the co-authors, who participated in *Gamma*'s activities and took part in several meetings within *Gamma* across four years (from January 2019 until July 2023). The following criteria were applied to select meetings: (i) meetings should directly involve the service function, (ii) they should involve both top/middle managerial level and operational level, (iii) they should allow to observe intra- and inter-functional dynamics, and (iv) they should include external actors (as suppliers or customers). Such criteria were functional to observe the evolution of DS in *Gamma* maintaining a wide perspective, which includes the point of view of the firm and its service-related network. Participant observation resulted in 419 h of observation (161 meetings) of about 10 different

topics, ranging from the IotBomb project to the digital services implementation and evolution (see Table 2 for details). The opportunity to observe in real time what happened in *Gamma* across years allowed to achieve great knowledge of the DS path of the company and its intra- and inter-organizational implications. Observations happened without a formal protocol since they were causal in nature (Yin, 2009); yet a series of field notes were collected during each meeting, shared with all co-authors, and constantly confronted with interviews' transcriptions.

**Table 2** Participant observation details

Main topic of meetings	Topic description	Managerial level	Number of meetings	Total of hours
IotBomb development and progress	Cyclical updates between Service and Innovation dept.s and <i>DigiConsulta</i> to verify the status of the IIoT project, check the level of achievement in the established goals, and arrange next developments	Operations	9	21,5
Service selling strategy	Internal meetings between Sales and Service dept.s to design and monitor the market approach and the selling strategies for IIoT services	Middle management	15	37,5
Service ICT architecture	Meetings between <i>SoftProviderC</i> , <i>SoftProviderF</i> and Service dept. aimed at implementing new ERP and CRM software sections dedicated to Services (including employees training)	Top management	6	11
Service contracts design	Cyclical internal meetings within Service dept. to design new service packages and/or innovate the service offering	Top and middle management	12	27,5
Service marketing analysis	Meetings between Service and IT dept.s and <i>DigiConsulta</i> aimed at interpreting market data, defining clusters of customers with similar service needs, and adjusting commercial strategies accordingly	Middle management and operations	23	53,5
Service Data Analysis unit	Kick-off meetings to launch and integrate a Service Data Analysis unit within <i>Gamma</i> organization	Operations	31	73
Service international performances	Internal meetings to monitor <i>Gamma</i> service performances worldwide (both on IIoT and non-IIoT services)	Middle management	14	33
Software implementation for Service analytics	Kick-off meetings between Service and IT dept.s and <i>DigiConsultD</i> to launch and industrialise a new software for service analytics	Operations	9	29,5
IotBomb platform design	Internal cross-functional meetings (Service, IT, Sales, Finance, ...) to evaluate future developments of the IotBomb project and the realization of a digital platform for services	Top and middle management	4	9,5
Service reporting strategy	Internal meetings led by the Service Data Analysis Unit with other dept.s (IT, Sales, Finance, ...) to define and operationalize data reporting activities on service	Operations	38	123
<b>Total</b>			<b>161</b>	<b>419</b>

Information collected via participant observation was integrated through interviews. The authors conducted twelve semi-structured interviews in the timespan 2019–2022. Interviews untangled the perspective of *Gamma*, which is the focal firm investigated in this research. Therefore, nine interviews involved professional figures belonging to the company. However, the point of view of two different actors, one customer and one supplier, were integrated via three additional interviews. A perceptual triangulation approach (Farquhar et al., 2020) was useful to provide further information and reinforce the interpretation of data collected internally by framing it within the perception of more actors (Bonoma, 1985). Interviewees are relevant figures in the DS path of *Gamma*; they have experience in the service field and could observe the transition toward a product-and-service offering within time. They were selected starting from participant observations and then following a snowballing technique (Bott & Tourish, 2016). All interviews were face-to-face, conducted in Italian, recorded, and transcribed verbatim. Further details are provided in Table 3.

Since each interview had the aim to acquire punctual and different information, no unique interview protocol was elaborated. To address the conversation toward relevant information and differentiate questions, a short protocol based on ‘prompts’ was elaborated for each interview, following the suggestions of Jiménez and Orozco (2021). Prompts, i.e., short highlights on relevant topics, were preferred to direct

**Table 3** Interviews details

Time (M-Y)	Firm	Professional role	Topic	Duration (min)
10-2019	<i>Gamma</i>	Service Director	Decisional process in IotBomb project and main consequences (internally and in the network)	45'
11-2019	<i>Gamma</i>	CEO Assistant	Innovation trajectories in services and impacts of IIoT technology	50'
11-2019	<i>Gamma</i>	IotBomb Salesman	Internal response to IotBomb project and market reaction	40'
11-2019	<i>Gamma</i>	IotBomb Project Manager	Barriers and facilitators in IotBomb project development	55'
11-2019	<i>DigiConsulta</i>	Senior Consultant	Relational history with <i>Gamma</i> and steps in finalizing collaboration decision	50'
12-2019	<i>Gamma</i>	Digital Marketing Manager	Changes in the communication strategies and digitalization process	45'
08-2020	Customer	Production Manager	Decision to adopt IIoT services and relational dynamics with <i>Gamma</i>	35'
09-2020	<i>Gamma</i>	Service Controller	Impact of IotBomb project in economic and organizational terms	40'
11-2020	<i>DigiConsulta</i>	Junior Consultant	Evolution in the relationship with <i>Gamma</i> and future steps	45'
07-2021	<i>Gamma</i>	CEO Assistant	Main issues in the DS path and evolution of the supply chain	40'
09-2022	<i>Gamma</i>	IIoT & Digital Service Manager	Inter-functional implications of DS	45'
10-2022	<i>Gamma</i>	IIoT & Digital Service Manager	Projects for the evolution from IotBomb to a digital service platform	65'

questions with the aim of guiding the interview toward relevant issues while leaving the interviewer a certain level of freedom. In this way, it was possible to collect precise information, aligned with the experience and knowledge of each interviewer and coherent with the information needs of the authors.

### 3.3 Data analysis

Given the exploratory nature of the RQs and the tight link with the considered literature, empirical findings were analyzed by means of a systematic combining approach (Dubois & Gadde, 2002). It is a consolidated approach within IMP studies, since it supports the elaboration of theoretical insights based on empirical evidence, and it is particularly suitable to explore new phenomena taking into consideration existing theory (La Rocca et al., 2017). Data analysis followed an iterative approach, whereby the authors have interrelated and interpreted data coming from primary sources with data from secondary sources.

Given the processual perspective adopted in this study, the DS path has been traced by chronologically identifying and mapping events which unfolded throughout the process, adopting a tabular display (Eisenhardt, 1989). Thus, events represented chronological nodes functional to the processual narrative. The events were inserted in a spreadsheet shared among the authors, and for each event data have been coded adopting the ARA model, thus, identifying and observing the three inherent layers of business interaction (Håkansson & Snehota, 1995). The ARA model allows hidden network processes to surface (Ingemansson Havendid et al., 2016) and can thus help better clarify the relational dynamics unfolded in DS and, foremost, the interdependencies arising among actors, resources, and activities throughout the events characterizing the process. A continuous interplay among authors facilitated the process of data triangulation (Denzin, 1978) and ensured a univocal and unambiguous interpretation of the empirical material.

For example, one of the events identified for the year 2018–2019 has been coded as “Design of the first service packages related to IotBomb and IotBomb internationalization (incremental expansion to subsidiaries and dealers)”. A brief description of the event was provided in the spreadsheet together with an indication of the main actors involved (in this case *Gamma*, *DigiConsulta*, *SoftProviderC*), resources enacted (physical and organizational such as the service packages, Beta’s new technical staff, IotBomb ambassadors, the training provided by the headquarter to subsidiaries and dealers, among others) and activities implemented (as for example the design of service packages, the release of IotBomb internationally, the design of new workflow for service from an administrative, financial, and commercial point of view, etc.). Finally, the main implications deriving from the event and from the interplay among the three layers were outlined, which can be exemplified in this particular example by the emergence of technical issues in big data analytics as well as internal reluctance, resistance, and skepticism among the production departments emerging from the top-down leadership adopted in the management of IotBomb and of the limited financial resources given to the IT department for supporting the process.

## 4 Critically observing the lotBomb case

This paragraph presents the empirical results of our investigation, first, by filtering them through the three layers of the ARA framework. Thus, we analyze separately the actors involved in and contributing to DS realization, the resources - both existing and new ones - that the company needs to acquire or reconfigure, and the activities implemented. In the second part of this section, we take the discussion a step further by discussing the interrelation and interdependence among the three layers throughout the unfolding of DS.

### 4.1 Observing DS through the lens of the ARA framework

#### 4.1.1 Actors

Starting from the actor layer of the ARA framework, the analysis shows that the adoption and evolution of DS are characterized by a reconfiguration of internal actors and their roles and an evolving collaboration with external ones. The role of *Gamma* leadership and management was paramount in the embryonic phase and in the recognition of the need for service innovation. From an intra-organizational perspective, the DS actualization entailed the gradual, incremental involvement of the different *Gamma* departments and teams and required the recruitment and/or readdressing of professional figures and the expansion of existing teams. A change in leadership, which occurred during the lotBomb project implementation led to a reorganization of the entire structure, to rethinking the roles and responsibilities of the *Gamma* departments, and to the creation and transfer of professional figures.

This development and change, however, did not come without friction within *Gamma* teams, which emerged due to information asymmetries and a lack of effective communication, especially in the first stages of the process. This resulted in internal resistance to change, and a lack of commitment from the staff to modify their established working routines and acquire new knowledge. For example, the process was characterized by the reluctance of the salesmen that became in charge of selling services, skepticism from the production department, and a limited scope of action of the IT department in supporting the IIoT-based project due to constraints in resources.

A striking feature of DS implementation is the importance played by external partners throughout the development of the lotBomb project (Sklyar et al., 2019; Chen et al., 2021). A closer look at the key actors that have been involved starting from the conception of the DS idea shows that DS is a transformation that highly relies on the external context, information exchange, and acquisition of new competencies and resources, which cannot be developed in isolation (Kohtamäki et al., 2019). In this sense, *Gamma* created new business relationships and reactivated old ones with a technology provider and a business consultancy.

Yet, the complexity of the DS process, both from a technological and managerial perspective, requires a continuous reconfiguration of existing partnerships. *Gamma* made a major effort in involving new partners throughout the implementation of the DS. This is the case of (i) local universities (Tronvoll et al., 2020; Galvani et al., 2022), from which *Gamma* hired a data analyst and a technology expert, and, later

on, a research collaborator; (ii) new consultancy agencies, which provided support in terms of business, technical, and marketing strategic activities; (iii) technology providers to add new tools to the software base of *Gamma*; and (iv) clients and dealers, as external interactions also took the form of customers' and competitors' responses to the project and suppliers' interests (Ciasullo et al., 2021).

The actor layer of the ARA framework shows the importance played by the ability of the company to take advantage and effectively manage the already established network of relationships and to involve new external partners when specific needs related to the DS implementation are to be addressed (Sklyar et al., 2019; Chen et al., 2021). Also, the complexity of DS entails organizational changes and internal adaptation to established roles, responsibilities, and relationships (Kohtamäki et al., 2021).

A main contribution provided by the adoption of the interpretative ARA framework is that the way actors relate to each other by establishing actor bonds is the point of departure for accessing, adapting, and combining resources, and linking different typologies of activities together (Håkansson et al., 2009). Furthermore, this lens provides an additional contribution as it allows for understanding the impact of changes in the network structure on internal actors' configurations and roles.

Thus, the actor dimension of the ARA framework adds to the strong emphasis that previous studies have put on the high degree of interaction of solutions required by DS (Marcon et al., 2022; Galvani et al., 2022; Sklyar et al., 2019) and on the intra-organizational adjustments in terms of roles and capabilities of manufacturers pursuing DS (Tóth et al., 2022).

#### 4.1.2 Resources

The DS process undertaken by *Gamma* is characterized by an increasing complexity which triggered a path of research, acquisition, and accumulation of new resources and/or adaptation of existing ones (Galvani et al., 2022). Adopting a resource dimension perspective, the case highlights three main insights.

The first one relates to the resource nature: the successful implementation of DS requires the development, use, and combination of both physical and organizational resources (Håkansson & Waluszewski, 2002). On the one hand, data shows the development and deployment of physical resources, including technological ones, such as IIoT sensors, the IotBomb software, a newly developed algorithm, digital contracts, a digitally integrated ERP, a route engine, licenses, and the data cloud system. Physical resources also encompass facilities at customers' sites to test the technology, redesigned spaces to host service-related activities, and service packages, as well as financial resources, such as an ad hoc budget for the Service Data Analysis business unit and for the communication strategy. On the other hand, internally the DS process has required *Gamma* to develop new organizational resources over time. This has manifested in the creation of a new IotBomb team, made of both new staff and readressed one. New figures have been introduced to deal with the requirements of advanced digital solutions, such as a dedicated Project Manager for the IotBomb team, IotBomb Ambassadors, and Service Area Managers. Existing figures' competencies, roles, and skills have been upgraded and rethought throughout the process.



Second, it emerges how the two resource types, organizational and physical/technological, are closely related to each other. The interdependence of physical and organizational resources is apparent as the new technological/physical tools require the development and unfolding of organizational ones in the form of training and new knowledge. Other than technology providers, the establishment of relationships with local universities allowed the development of resources such as new knowledge and competencies to be deployed in the DS process (Pirola et al., 2020). This is the case of a Ph.D. student in the service department, who has later been involved as a research collaborator on the topic of service. In most cases, furthermore, the development of physical resources has been triggered by organizational ones, such as the exploitation of existing relationships with partners and clients, and newly formed ones needed to realize advanced digital solutions (Sklyar et al., 2019). Indeed, the exploitation of the relationship with *SoftProviderC* and its expansion to one of its units has proved key in generating important physical resources, such as the cloud system used to store data and the packages' licenses.

Finally, and inherently to the previous points, looking at resources in terms of their acquisition and development process, it is possible to notice how DS has required an increasing number of resources to be displayed over time, which *Gamma* found at the intra- and inter-organizational levels. While the resources available internally, including existing knowledge and already established relationships, unfolded at the beginning of the DS path, these proved insufficient in the next stages and required *Gamma* to procure external resources to face such complexity. Thus, the search for new resources and the use of existing ones allowed the company to exploit the availability of numerous resources, wholly rethink its service structure, and internalize key resources needed for the project's evolution and completion towards a service platform.

Insights from the resource dimensions of the ARA framework are, on the one hand, in line with previous studies within the broad DS literature and, on the other hand, enrich the existing literature by adding in-depth insights on the resource development processes in place. Indeed, DS requires the collection of different types of resources, which are tied to a set of resource providers; while some resources may be available or developed internally, others can only be acquired through external relationships with providers (Håkansson & Snehota, 1995; Sklyar et al., 2019). The relationships highlighted throughout our analysis reveal crucial in securing access and transferring existing resources, but also in developing new ones and using them in the context of technological development. Additionally, a key insight emerging from the adoption of the ARA framework is that relationships themselves emerge as relevant resources (Håkansson & Snehota, 1995).

### 4.1.3 Activities

At the activity layer, the ARA analysis allows to introduce some considerations on the development of DS. In general, it can be noted how, over time, DS requires an increasing number of activities, leading to greater complexity. Mainly, DS complexity derives from two activities-related macro aspects.

The first one is the adoption of an iterative process over time and the implementation of new activities aimed at trying to solve issues that emerged from previous ones (Galvani & Bocconcelli, 2022). After the first year of IotBomb development, activities became more and more related to a smart decisional process, highlighting the impact of decision-making in DS success (Tóth et al., 2022; Bustinza et al., 2018). Within the first year of IotBomb actualization, the first activities included a market analysis, informal participation in events and meetings, operational management of the pilot project, decoding of technical problems related to the data communicated by machineries, and so on. After the launch of IotBomb, new activities were introduced, mainly to solve internal and external cultural resistances, adapt to local needs, or reinforce the firm's capabilities (Bustinza et al., 2018; Hasselblatt et al., 2018). Among them, the efforts of alignment and training with foreign branches and dealers, hiring and/or reskilling (therefore the optimized management) of human resources, and the design of ad hoc contracts based on in-depth market analyses, just to name a few.

The second macro aspect concerns the creation of an intra- and inter-organizational continuum where activities are settled and completed with the involvement of external actors, some already known and others completely new (Marcon et al., 2022; Galvani & Bocconcelli, 2022). This is visible, for instance, looking at the IotBomb project initialization and assessment. When IotBomb was launched, the two key players involved in most of the activities were *DigiConsulta*, for technical and business support, and *SoftProviderC*, to access the physical software and cloud storage service flanking the IIoT technology. As the project advanced, new activities were introduced, such as deep market analyses, the creation and sale of new service packages, the process of internationalization, and the design of a unique and global service platform. New players were directly involved in planning and deploying such activities. Local universities supported market analyses, *DigiConsultD* provided a sophisticated algorithm to improve the service sales strategy, or *DigiConsultE* supervised the platform creation idea.

Furthermore, it can be noted how both the digital and the service components within DS have a direct and decisive impact on the activities load related to it. Particularly, the digital dimension of the servitizing path facilitates the decision to adopt DS, since it allows for the generation of unprecedented service innovation (Pirola et al., 2020; Iansiti & Lakhani, 2014). At the same time, though, it complicates the process along its development (Hasselblatt et al., 2018; Matthyssens, 2019; Bustinza et al., 2018). Observing the case of *Gamma* in terms of the digital dimension of its servitization journey, various activities emerged as necessary to allow the functioning of the adopted IIoT technology. Among them, the management of the pilot project, the decoding of information coming from machineries and the resolution of technical bugs, the integration of new contracts within operational and administrative flows and inside the software already in use, the construction and continuous updating of the IotBomb app and website. Simultaneously, however, the service-related component of DS had a significant impact on the total activities, contributing to the overall project complexity. For example, service activities undertaken by *Gamma* include the creation and management of new contracts, the definition and maintenance of ad hoc commercial strategies for services, the internal training of personnel to guarantee a

cultural shift toward a service-oriented mindset, or the adaptation of service contracts to the necessities of various countries around the world.

It is noteworthy to underline that, to the authors' knowledge, a deep investigation of the activities involved in a DS journey has not been deployed yet. While it is possible to find research works addressing the investigation of resources in DS (e.g., Bustinza et al., 2018; Coreynen et al., 2018) as well as actors (e.g., Kohtamäki et al., 2019; Sjödin et al., 2020), the role of activities has been so far neglected. Nevertheless, the case of *Gamma* sheds light on the existing link between the number and articulation of activities related to the implementation of digital services on the one side, and the level of complexity deriving from the overall DS journey on the other. Not only, in the attempt of firms to face and overcome such complexity, launching new and/or corrective activities becomes the quickest and most impactful way to improve the strategic lead of the DS process. DS activities unfolding at the intra- and inter-organizational layer also facilitate the connection with external actors, whose involvement and support are paramount and somehow unavoidable.

#### 4.2 DS and the IMP approach: an effective combo?

The exploratory case of *Gamma* was adopted within this research to, on the one side, test the validity of the business network approach in general, and particularly of the ARA framework for the analysis of advanced technological developments, such as DS. On the other side, the case contributed to investigating the typology and nature of actors, resources, and activities involved in DS and the effects of their interrelation. Empirical findings allow to build some considerations on this.

A business network approach revealed particularly efficient in highlighting and understanding the implications of DS within and outside the manufacturing firm's boundaries. What *Gamma* experienced, indeed, is a continuous interrelation between the internal and external contexts in terms of both activities, resources, and actors, therefore endorsing the thesis that DS is a multi-dimensional phenomenon (Struyf et al., 2021). In such a context, the ARA framework within the business network approach brings added value. Indeed, besides facilitating the observation of internal and external relationships (Mattsson, 2002) – crucial in a process unfolding within a network and never in isolation such as DS (Kohtamäki et al., 2019), the original conformation of the framework in three layers allows the natural exploration of interaction and interrelatedness existing among them. In fact, through this analytical framework, interrelation among layers became evident in the case of *Gamma*, which is synthesized in Fig. 1.

Looking at the first two years of *Gamma* DS represented in the figure, it is possible to note how its path toward digital services was triggered by the great interest manifested by two key actors: *Gamma* leadership and *DigiConsultA*. In particular, the relationship between the two stimulated the idea to invest in an IIoT-related project for innovative services. Successively, when actors became involved in the DS journey, they showed the need to move along a set of new activities (as the market analysis), functional to explore the possible approaches to face DS. To deploy such activities, then, a set of new (or renewed) resources needed to be involved, in this case financial, digital, and human resources required to invest in the IoT technology.

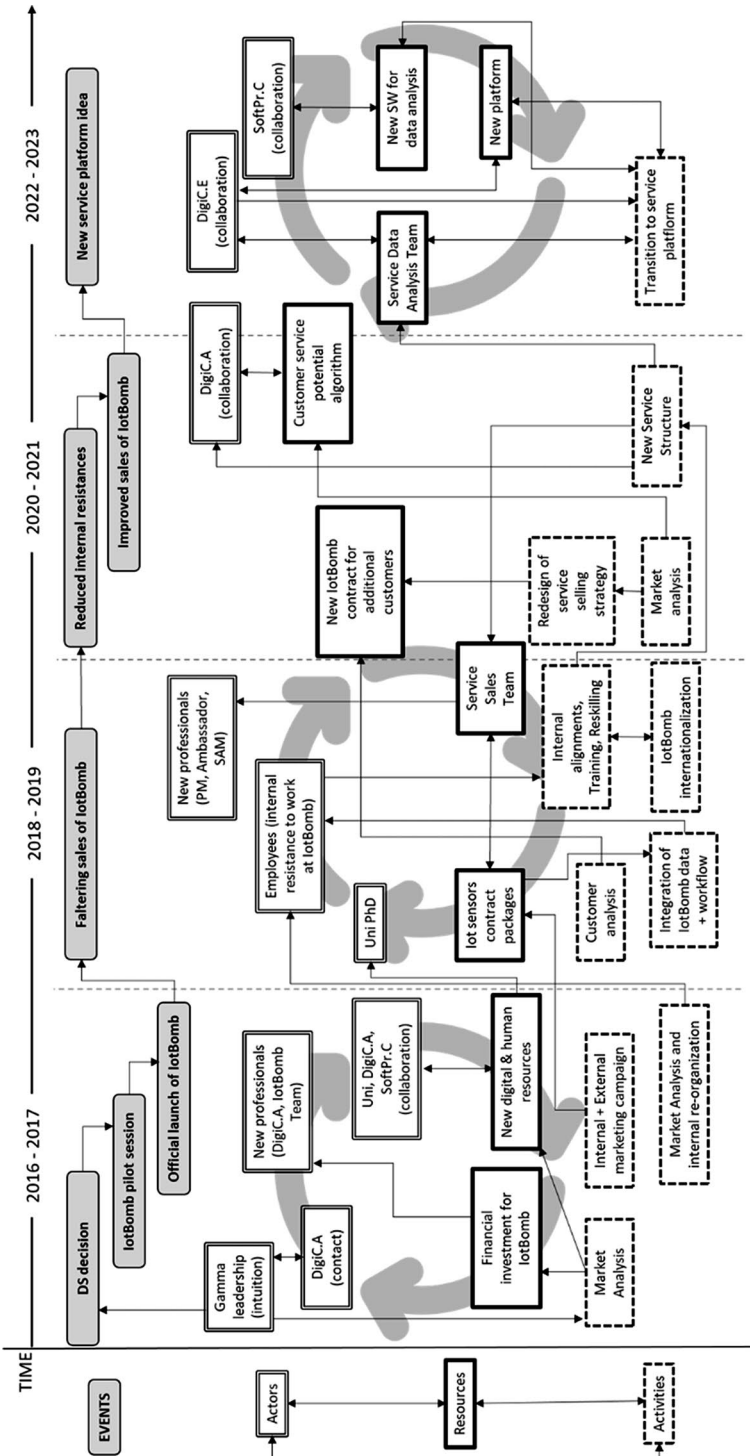


Fig. 1 Timeline of Gamma DS process from the ARA perspective

Some resources were available inside *Gamma* and needed to be readdressed; others should be acquired externally. In both cases, the activities triggered the emergence of new actors. On the one side, the IoTBomb Team was created and trained; on the other side, *Gamma* established a new relationship with a Ph.D. researcher with the aim of studying the service innovation process of manufacturers and internalizing highly specialized knowledge. To summarize, the interest of *Gamma* and *DigiConsultA* (actors) led to a market analysis (activity) calling for financial, digital, and human investments (resources) which finally led to new professional figures and collaborations (actors again).

Therefore, just by looking at the first two years in the DS path of *Gamma*, it is possible to observe a sort of ‘circularity’ in the way in which the three layers of the ARA framework interact: from actors to activities, from activities to resources, and from resources to actors again. By observing the overall figure, then, it looks like the cyclical interrelation among layers becomes a repeated pattern over time. Similarly, indeed, in 2018, the internal resistances of employees (actors) triggered internal alignments and the definition of a new service structure (activities) that required a new service sales team (resource) which finally led to identifying new professional figures in the sales environment (actors again). In 2022, the collaboration with *Digi-Consulte* (actor) allowed to deploy a transition toward a service platform (activity) which required a new platform and a related software (resources) calling for the collaboration with *SoftProviderC* (actor again).

The identification of such circularity allows to highlight two main features of DS as a process. First, actors, resources, and activities in DS are highly interrelated in relationships (Håkansson & Snehota, 1995). It is evident how activities and resources are tightly linked to each other. Indeed, the established relationships affect *Gamma*’s possibility to deploy new activities, which in turn require additional resources, implying an integrated management of both elements. Yet, business relationships do not only appear critical to accessing and transferring existing resources, but also for the focal company to develop new ones in use. Similarly, a link exists between actors and activities, since most of the activities are settled by actors, and the activity links developed within certain business relationships impact activities at the network level as well as adjustments in the structure of the company (i.e., adaptation and reallocation of activities and actors). In the same vein, also resources and actors experience a similar interdependence. Notwithstanding interrelation exists among all three layers, empirical evidence shows that a circular pattern is more likely to happen.

Second, and in relation to the first point, the circular interdependence among layers is a repeated pattern over time, which becomes leaner and simpler for the focal company to manage as the DS process unfolds. This result is not to be confused with the idea of DS becoming ‘easier’ over time. Indeed, the DS path includes many elements of complexity, which are for sure substantial when DS is launched for the first time, but that continue to exist as it evolves. For instance, the design, launch, and organizational management of new contract packages involve a high degree of complexity, as well as building a digital service platform (Eloranta et al., 2021). What becomes ‘easier’, instead, is dealing with the interrelatedness among layers. Building on an iterative, learning approach, *Gamma* recognized the existence of a cyclical interrelation among actors, resources, and activities and developed awareness of their

effects and dynamics and the necessary capabilities to deal with it. In this sense, both the key roles of time and of DS as a process, on the one hand, and of iterative learning in interaction, on the other, emerge. Namely, the interrelation among the layers is rooted in past interactions and the effects of interdependence manifest themselves over time (Håkansson & Snehota, 1995) and because the effective management of business relationships and of their content requires knowledge of business network dynamics.

## 5 Concluding remarks, contributions, and implications

This study aimed to investigate the appropriateness and potential contribution of the business network approach to observe and trace the actors, resources, and activities involved in DS, and understand how their interconnectedness affects DS as a process. To achieve this objective, this study has explored the DS process undertaken by *Gamma* through the application of an in-depth case study qualitative methodology.

The analysis, which has been conducted by looking at the three interrelated dimensions of the ARA framework, has provided key insights for each of the three layers. The actor layer has highlighted the need for internal reconfigurations and adaptations of actors and their roles throughout the implementation of DS and the frictions and internal resistances that may emerge. At the same time, it has provided insights concerning the importance of evolving collaboration and new partnerships that the company needs to establish with external actors. From a resource perspective, the analysis revealed the resource development process underlying DS, as the complexity of the process required an ever-increasing number of resources to be displayed over time and highlighted the nature of such resources. Indeed, DS requires the unfolding and interdependence of both physical and organizational resources. The activity dimension emerged as being so far under-investigated in previous studies. The analysis pointed at the iterative nature of activities and at the need of creating an intra- and inter-organizational continuum where activities are implemented. The two main DS components - the digital and service one - unfold in the different required activities and have an impact on them. Finally, while our findings provide insights that can be filtered through the three dimensions of the ARA framework, they also unveil a continuous interrelation between the internal and external context and interdependence among the three layers of actors, resources, and activities.

At the theoretical level, it is possible to identify three main contributions of this research. The first contribution is to the stream of literature dealing with DS. Our study contributes to enriching the existing literature on DS by unveiling its varied implications at multiple levels. Indeed, the deep investigation of DS via a longitudinal case study underlines the complexity of the process and its multidimensional nature (Favoretto et al., 2022). On the one hand, it further confirms previous literature asserting that DS implications are simultaneously intra- and inter-organizational (Galvani & Bocconcelli, 2022; Gölgeci et al., 2022) and displayed along a continuum that goes far beyond the firm's boundaries (Kohtamäki et al., 2019). On the other hand, the research identifies how DS as a process is often tangled by the high degree of interaction exerted by those actors, activities, and resources that the servitizing

firm unfolds to offer advanced digital services. A specific organizational setting and redesigned dynamics inside the company are insufficient on their own to support an effective transition toward digital services; empirical findings show how they need to be combined with a rethinking of networking relationships, well beyond mere internal adjustments.

Second, the research contributes to providing a unified theoretical approach for investigating DS. In a way, the business network approach contributes to solving the problem of theoretical fragmentation existing in DS studies (Paschou et al., 2020). In the investigated case, the adoption of the ARA framework allowed to look at the DS dynamics consistently and comprehensively, with an in-depth declination of events in the actors, resources, and activities layers. The result is the possibility to achieve a complete overview of the phenomenon without any further combination with other theoretical approaches. This appears to be in contrast with previous DS studies that required the integration of multiple theoretical lenses, such as the industrial organization theory, the resource-based view, the organizational identity, the service ecosystem perspective, and the transaction cost approach (Kohtamäki et al., 2019). Thus, the main contribution of this study is that it provides empirical evidence for the effectiveness of the business network approach in observing the DS process thanks to analytical completeness. As it emerged along the exploration of the *Gamma* case, the ARA framework helped in untangling DS complexity with a micro perspective that provides a complete description of the phenomenon. Differently from other approaches, the business network one pays attention not only to actors and/or resources, as it happens for instance with the Service Dominant Logic approach (Vargo & Lusch, 2011; Vargo et al., 2017) or approaches based on the exploration of resources and capabilities (Coreynen et al., 2017, 2020; Marcon et al., 2022), but also to activities. The activity layer, though so far mainly under-investigated, further helps in the deep comprehension of DS complexity. Indeed, the case of *Gamma* highlights the importance of decision making-related activities when implementing DS, of activities concerning the optimization of human resources management as well as of technology-related activities.

Finally, this study paves the way for the business network approach and for the ARA framework to be adopted in investigating a complex business phenomenon as DS. Notwithstanding the expressed need to further explore the potential applications of the business network approach, especially in the digital field (Pagani & Pardo, 2017), only a few works elaborate on it addressing the issue indirectly (Paiola et al., 2021; Ferreira & Lind, 2023). In this sense, it could be argued that the research contributes to the 'broadening' of the interpretative ARA model, by demonstrating how it works as a valid tool to unravel the implications of adopting advanced digital services in the B2B context via a fine-grained and micro-processual point of view.

The empirical analysis provided in this research also helps recognizing some implications at the managerial level. First, by adopting a multi-layered perspective on DS, the analysis underlines the key role of business relationships to trigger opportunities in terms of advanced digital services. Not only the relationship between two actors, *Gamma* and *DigiConsultA*, triggers the entire DS path of the manufacturer. Also, *Gamma* shows increasing attention to the external environment and exploits a series of new (and renewed) business relationships in order to identify key partners

supporting the overall DS transition. The internal adjustments at the organizational level, then, support a DS journey that is triggered by, in the first place, external actors.

Second, and connected to the first point, DS calls for the involvement of new actors mainly as a response to a condition of missing resources. On the one hand, the consistent number of resources required by DS let the partnership with actors become a key value along this journey. On the other hand, though, practitioners are called to activate processes aimed at internalizing such resources not to lose the underlying value. Resources internalization requires time and iteration; nevertheless, the cyclical interrelationships of resources with activities and actors, together with the accumulation of digital- and service-related experience, smoothens the process over time.

Additionally, a strong interrelatedness is visible via the empirical case between activities and resources, which appear as tightly intertwined. It is true, indeed, that new activities to deploy DS mostly require specific resources. For this reason, the design, management, and implementation of new activities should go hand in hand with resource planning. To this aim, practitioners could benefit from the managerial support of a human resource department, being able to guarantee activities transfer, strategic integration, and a key influence on the line managers (Teo & Rodwell, 2007).

Finally, another aspect to consider is the role of top and middle management in leading the DS process. Indeed, the interrelatedness between the three layers of the ARA framework (actors, resources, and activities) calls for adjustments in the managerial responsibilities accounted for by both top directions and middle managers. Middle managers are usually involved in a limited part of the DS process, and therefore their DS knowledge mainly relates to the specific set of actors, activities, and resources they deal with. Based on the interconnections among ARA layers, middle managers should make the effort of expanding their knowledge of DS by monitoring actors, resources, and activities exploited by other managers within the DS context. This is particularly helpful to achieve a more effective decision-making process. At the same time, though, the effort of middle managers should be facilitated by top directors in charge of spreading DS-related information down the line to middle managers and providing them with an overall perspective of the firm's journey toward digital services.

This study, although representing a first exploratory investigation of DS using an established approach as the ARA framework, entails limitations related to its generalizability. Furthermore, while the ARA framework has been employed bringing to the front interrelations among its layers, future studies could further enhance the use of this framework by adopting network vectors (i.e., dual connections) as analytical tools (Gadde & Håkansson, 2023) for understanding changing dynamics within networks characterized by the implementation of complex technological solutions.

**Funding** Open access funding provided by Università degli Studi di Brescia within the CRUI-CARE Agreement.



## Declarations

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- 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.
- Baines, T. S., Lightfoot, H. W., Benedettini, O., & Kay, J. M. (2009). The servitization of manufacturing: A review of literature and reflection on future challenges. *Journal of Manufacturing Technology Management*, *20*(5), 547–567.
- Baraldi, E. (2003). *When information technology faces resource interaction. Using IT tools to handle products at IKEA and Edsbyn (Sweden)*. PhD Thesis, Department of Business Studies, Uppsala University, Uppsala.
- Biehl, M., Prater, E., & McIntyre, J. R. (2004). Remote repair, diagnostics, and maintenance. *Communications of the ACM*, *47*(11), 100–106.
- Bonoma, T. (1985). Case research in marketing: Opportunities, problems, and a process. *Journal of Marketing Research*, *2*, 199–208.
- Bott, G., & Tourish, D. (2016). The critical incident technique reappraised. *Qualitative Research in Organizations and Management*, *11*(4), 276–300.
- Bustinza, O. F., Gomes, E., Vendrell-Herrero, F., & Tarba, S. Y. (2018). An organizational change framework for digital servitization: Evidence from the Veneto region. *Strategic Change*, *27*(2), 111–119.
- Cenamor, J., Sjödin, D. R., & Parida, V. (2017). Adopting a platform approach in servitization: Leveraging the value of digitalization. *International Journal of Production Economics*, *192*, 54–65.
- Chen, Y., Visnjic, I., Parida, V., & Zhang, Z. (2021). On the road to digital servitization—the (dis) continuous interplay between business model and digital technology. *International Journal of Operations & Production Management*, *41*, 694–772.
- Ciasullo, M. V., Polese, F., Montera, R., & Carrubbo, L. (2021). A digital servitization framework for viable manufacturing companies. *Journal of Business & Industrial Marketing*, *36*(13), 142–160.
- Cimini, C., Adrodegari, F., Paschou, T., Rondini, A., & Pezzotta, G. (2021). Digital servitization and competence development: A case-study research. *CIRP Journal of Manufacturing Science and Technology*, *32*, 447–460.
- 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.
- 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.
- 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.

- Denzin, N. K. (1978). *The Research Act: A theoretical introduction to sociological methods* (Second Edition). McGraw Hill.
- Dóra, T. B., Mátó, Á. R., Szalkai, Z., & Vilmányi, M. (2023). The role of information in relation to interaction affected by technology change—the case of a telemedicine pilot project. *Journal of Business & Industrial Marketing*, *38*(8), 1639–1655.
- Dubois, A., & Gadde, L. E. (2002). Systematic combining: An abductive approach to case research. *Journal of Business Research*, *55*(7), 553–560.
- Eggert, C. G., Winkler, C., Volkman, A., Schumann, J. H., & Wunderlich, N. V. (2022). Understanding intra-and interorganizational paradoxes inhibiting data access in digital servitization. *Industrial Marketing Management*, *105*, 404–421.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550.
- Eloranta, V., & Turunen, T. (2015). Seeking competitive advantage with service infusion: A systematic literature review. *Journal of Service Management*, *26*(3), 394–425.
- Eloranta, V., Ardolino, M., & Saccani, N. (2021). A complexity management approach to servitization: The role of digital platforms. *International Journal of Operations & Production Management*, *41*(5), 622–644.
- Farquhar, J., Michels, N., & Robson, J. (2020). Triangulation in industrial qualitative case study research: Widening the scope. *Industrial Marketing Management*, *87*, 160–170.
- Favoretto, C., Mendes, G. H., 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.
- Ferreira, C. C., & Lind, F. (2023). Supplier interfaces in digital transformation: An exploratory case study of a manufacturing firm and IoT suppliers. *Journal of Business & Industrial Marketing*, *38*(6), 1332–1344.
- Ford, D., & Håkansson, H. (2006). The idea of interaction. *The IMP Journal*, *1*(1), 4–27.
- Ford, D., Gadde, L. E., Håkansson, H., Snehota, I., & Waluszewski, A. (2010). Analysing business interaction. *The IMP Journal*, *4*(1), 82–103.
- 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.
- Gadde, L. E., & Håkansson, H. (2023). Network dynamics and action space. *Journal of Business & Industrial Marketing*, *38*(13), 166–179.
- Galvani, S., & Bocconcelli, R. (2022). Intra-and inter-organizational tensions of a digital servitization strategy. Evidence from the mechatronic sector in Italy. *Journal of Business & Industrial Marketing*, *37*(13), 1–18.
- Galvani, S., Carloni, E., Bocconcelli, R., & Pagano, A. (2022). From after-sales to Advanced Services: A Network Analysis on the impacts of Digital Servitization Evolution. *Sustainability*, *14*(14), 8308.
- Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the service paradox in manufacturing companies. *European Management Journal*, *23*, 14–26.
- Gebauer, H., Paiola, M., Saccani, N., & Rapaccini, M. (2021). Digital servitization: Crossing the perspectives of digitization and servitization. *Industrial Marketing Management*, *93*, 382–388.
- Gölgeci, I., Lacka, E., Kuivalainen, O., & Story, V. (2022). Intra and inter-organizational paradoxes in product-service systems: Current insights and future research directions. *Industrial Marketing Management*, *107*, A25–A31.
- Grandinetti, R., Ciasullo, M. V., Paiola, M., & Schiavone, F. (2020). Fourth industrial revolution, digital servitization and relationship quality in Italian BtoB manufacturing firms. An exploratory study. *The TQM Journal*, *32*(4), 647–671.
- Hahn, G. J. (2020). Industry 4.0: A supply chain innovation perspective. *International Journal of Production Research*, *58*(5), 1425–1441.
- Håkansson, H., & Ford, D. (2002). How should companies interact in business networks? *Journal of Business Research*, *55*(2), 133–139.
- Håkansson, H., & Snehota, I. (1995). *Developing relationships in Business networks*. Routledge.
- Håkansson, H., & Snehota, I. (2017). *No business is an island: Making sense of the Interactive Business Landscape*. Emerald Publishing Limited.
- Håkansson, H., & Waluszewski, A. (2002). *Managing Technological Development*. Routledge.
- Håkansson, H., & Waluszewski, A. (2007). *Knowledge and innovation in business and industry: The importance of using others*. Routledge.

- Håkansson, H., & Waluszewski, A. (2013). A never ending story – Interaction patterns and economic development. *Industrial Marketing Management*, 42(3), 443–454.
- Håkansson, H., & Waluszewski, A. (2020). Thick or thin? Policy and the different conceptualisations of business interaction patterns. *Journal of Business & Industrial Marketing*, 11(35), 1849–1859.
- Håkansson, H., Ford, D., Gadde, L. E., Snehota, I., & Waluszewski, A. (2009). *Business in networks*. Wiley.
- Halinen, A., & Törnroos, J. A. (2005). Using case methods in the study of contemporary business networks. *Journal of Business Research*, 58, 1285–1297.
- Hasselblatt, M., Huikkola, T., Kohtamäki, M., & Nickell, D. (2018). Modeling manufacturer's capabilities for the internet of things. *Journal of Business and Industrial Marketing*, 33(6), 822–836.
- Iansiti, M., & Lakhani, K. R. (2014). Digital ubiquity: How connections, sensors, and data are revolutionizing business. *Harvard Business Review*, 92(11), 90–99.
- Ingemansson Havenvid, M., Håkansson, H., & Linné, Å. (2016). Managing renewal in fragmented business networks. *IMP Journal*, 10(1), 364–389.
- Jiménez, T. R., & Orozco, M. (2021). Prompts, not questions: Four techniques for crafting better interview protocols. *Qualitative Sociology*, 44(4), 507–528.
- 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.
- 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.
- Kohtamäki, M., Rabetino, R., Einola, S., Parida, V., & Patel, P. (2021). Unfolding the digital servitization path from products to product-service-software systems: Practicing change through intentional narratives. *Journal of Business Research*, 137, 379–392.
- Korkeamäki, L., Sjödin, D., Kohtamäki, M., & Parida, V. (2022). Coping with the relational paradoxes of outcome-based services. *Industrial Marketing Management*, 104, 14–27.
- Kowalkowski, C., Kindström, D., Alejandro, B., Brege, T., S., & Biggemann, S. (2012). Service infusion as agile incrementalism in action. *Journal of Business Research*, 65(6), 765–772.
- La Rocca, A., Hoholm, T., & Mork, B. E. (2017). Practice theory and the study of interaction in business relationships: Some methodological implications. *Industrial Marketing Management*, 60, 187–195.
- Lenka, S., Parida, V., & Wincent, J. (2017). Digitalization capabilities as enablers of value co-creation in servitizing firms. *Psychology and Marketing*, 34(1), 92–100.
- Manser Payne, E. H., Dahl, A. J., & Peltier, J. (2021). Digital servitization value co-creation framework for AI services: A research agenda for digital transformation in financial service ecosystems. *Journal of Research in Interactive Marketing*, 15(2), 200–222.
- 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.
- Matthyssens, P. (2019). Reconceptualizing value innovation for industry 4.0 and the industrial internet of things. *Journal of Business & Industrial Marketing*, 34(6), 1203–1209.
- Mattsson, L. G. (2002). Dynamics of markets: How 'Actor-Network Theory' and 'Markets-as-Networks' can learn from each other. *Paper presented at the Nordic Workshop on Interorganizational Studies, Kolding, August 2002*
- Möller, K., & Halinen, A. (2017). Managing business and innovation networks - from strategic nets to business fields and ecosystems. *Industrial Marketing Management*, 67, 5–22.
- Mosch, P., Schweikl, S., & Obermaier, R. (2021). Trapped in the supply chain? Digital servitization strategies and power relations in the case of an industrial technology supplier. *International Journal of Production Economics*, 236, 108141.
- Pagani, M., & Pardo, C. (2017). The impact of digital technology on relationships in a business network. *Industrial Marketing Management*, 67, 185–192.
- 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.
- Paiola, M., Schiavone, F., Grandinetti, R., & Chen, J. (2021). Digital servitization and sustainability through networking: Some evidences from IoT-based business models. *Journal of Business Research*, 132, 507–516.
- Paiola, M., Khvatova, T., Schiavone, F., & Jabeen, F. (2022a). Paths toward advanced service-oriented business models: A configurational analysis of small- and medium-sized incumbent manufacturers. *Technological Forecasting and Social Change*, 182, 121774.

- Paiola, M., Agostini, L., Grandinetti, R., & Nosella, A. (2022b). The process of business model innovation driven by IoT: Exploring the case of incumbent SMEs. *Industrial Marketing Management*, *103*, 30–46.
- 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.
- Pirola, F., Boucher, X., Wiesner, S., & Pezzotta, G. (2020). Digital technologies in product-service systems: A literature review and research agenda. *Computers in Industries*, *123*, 103301.
- Porter, M. E., & Heppelmann, J. E. (2014). How smart, connected products are transforming competition. *Harvard Business Review*, *92*(11), 64–88.
- Quintens, L., & Matthyssens, P. (2010). Involving the process dimensions of time in case-based research. *Industrial Marketing Management*, *39*(1), 91–99.
- Raddats, C., Story, V., Burton, J., & Zolkiewski, J. (2019). Digital capabilities for advanced services: a multi-actor perspective. *Proceedings of the Spring Servitization Conference 2019*, Linköping, 21–27.
- Shen, L., Sun, W., & Parida, V. (2023). Consolidating digital servitization research: A systematic review, integrative framework, and future research directions. *Technological Forecasting and Social Change*, *191*, 122478.
- Sjödin, D. R., Parida, V., Kohtamäki, M., & Wincet, J. (2020). An agile co-creation process for digital servitization: A micro-service innovation approach. *Journal of Business Research*, *112*, 478–491.
- Sklyar, A., Kowalkowski, C., Sörhammar, D., & Tronvoll, B. (2019). Resource integration through digitalization: A service ecosystem perspective. *Journal of Marketing Management*, *35*(11/12), 974–991.
- Strömsten, T., & Håkansson, H. (2007). Resources in use: Embedded electricity. In H. Håkansson, & A. Waluszewski (Eds.), *Knowledge and innovation in business and industry* (pp. 39–65). Routledge.
- Struyf, B., Galvani, S., Matthyssens, P., & Bocconcelli, R. (2021). Toward a multilevel perspective on digital servitization. *International Journal of Operations & Production Management*, *41*(5), 668–693.
- Teo, S. T., & Rodwell, J. J. (2007). To be strategic in the new public sector, HR must remember its operational activities. *Human Resource Management*, *46*(2), 265–284.
- 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.
- Tian, M., Coreynen, W., Matthyssens, P., & Shen, L. (2022). Platform-based servitization and business model adaptation by established manufacturers. *Technovation*, 102222.
- 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.
- Tronvoll, B., Sklyar, A., Sörhammar, D., & Kowalkowski, C. (2020). Transformational shifts through digital servitization. *Industrial Marketing Management*, *89*, 293–305.
- Vargo, S. L., & Lusch, R. F. (2011). It's all B2B... and beyond: Toward a systems perspective of the market. *Industrial Marketing Management*, *40*(2), 181–187.
- Vargo, S. L., Lusch, R. F., Akaka, M. A., & He, Y. (2017). Service-dominant logic: A review and assessment. *Review of Marketing Research*, *6*, 125–167.
- Vendrell-Herreo, F., Bustinza, O. F., Parry, G., & Georgantzis, N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management*, *60*, 69–81.
- Windahl, C., Andersson, P., Berggren, C., & Nehler, C. (2004). Manufacturing firms and integrated solutions: Characteristics and implications. *European Journal of Innovation Management*, *7*(3), 218–228.
- Yin, R. K. (2003). *Case Study Research: Design and method* (3rd ed.). SAGE Publications.
- Yin, R. K. (2009). *Case Study research – design and methods* (4th ed.). SAGE Publications.
- Zhang, K., Feng, L., Wang, J., Lin, K. Y., & Li, Q. (2021). Servitization in business ecosystem: A systematic review and implications for business-to-business servitization research. *Technology Analysis & Strategic Management*, 1–17.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.