Let Servitize Together! Collaborative Servitization and Ecosystem Management: The Process Framework

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Abstract

Manufacturing firms as ecosystem actors are struggling to strengthen their ecosystem management to facilitate collaborative servitization and match the pace of ongoing Industry 4.0 trends. This research aims to examine the ecosystem management-related services, challenges, and required capabilities. We conducted multiple case study across four Italian manufacturing firms conducting a total of 20 interviews. First, our findings, rooted in a process framework, emphasize three ecosystem management services: advanced services, integrated services, and collaborative services. Second, these services bring complexities require ecosystem management capabilities: ecosystem advances for future interfaces, ecosystem actors and technology integration, and ecosystem institutionalization. Third, each ecosystem actors need to understand the ecosystem typologies and their involvement to successfully capitalize on servitization. This research makes a significant contribution to servitization literature on ecosystem management in a dynamic setting by demonstrating how development of different services and capabilities support ecosystem management.

Keywords: Collaborative servitization, ecosystem management, B2B, Multiple Case Study, Ecosystem capabilities.

1. INTRODUCTION:

Servitization ~~is transforming our society in several ways, bringing~~ generated new opportunities and challenges for the manufacturing firms. In particular, firms nowadays operate in ecosystem settings (Leminen et al., 2022) that revolutionize the ways value is created in the industrial value chain. As this transformation is characterized by equifinality (Forkmann et al., 2017), it encompasses reconfigurations and adaptations (Barrett, 2019), including workplace modification, role adaptations, and relationship formation. Servitization is far from a simple, futuristic prediction and linear transformation (Forkmann et al., 2017), but it is a part of the current aspect of the evolving business landscape. In this evolving era of servitization, manufacturing firms are becoming "anti-fragile" by using industry 4.0 technologies such as the Internet of things (IoT), big data analytics (BDA), artificial intelligence (AI), cloud computing (CC), additive manufacturing (3D printing), augmented reality (AR), virtual reality (VR), robotics, and automation (Ambrogio et al., 2022; Ramezani & Camarinha-Matos, 2019). Such technologies allow the firm to offer value-added services (Kohtamäki et al., 2019). Nevertheless, a comprehensive understanding of servitization in this evolving era extends beyond the scope of these technologies and impacts operational functions at the ecosystem level, both internally and externally.

Jacobides et al. (2018) define ecosystems as a group of manufacturing firms that exhibit varying degrees of non-generic and multilateral complementarities and are not fully hierarchically controlled. They are characterized by a more comprehensive heterogeneity of partners, greater openness, and ecosystem-level outputs that create, deliver, and capture value for customers (Kapoor, 2018). Ecosystem management is a necessary management approach to facilitate servitization. However, the independent and interdependent nature of ecosystem networks and value propositions make ecosystem management a distinct approach (Autio, 2022). Ecosystem management involves purposeful and deliberate actions to support the integration of actors' knowledge, resources, and capabilities to explore new opportunities (Giudici et al., 2018). This process is challenging as they adapt their routines, cultures, and strategies to compete or cooperate within ecosystems (Tsujimoto et al., 2018). Therefore, despite the significant potential for ecosystem management, in practice, most manufacturers involved in servitization struggle or even fail to fully reap the benefit (Asplund et al., 2021).

Currently, servitization is influencing ecosystem management, and further, there is a need for adaptations and reconfigurations for several reasons. First, servitization, through the support of ecosystem dynamics and evolving activities (Hao et al., 2021), can offer better technical quality in product design and manufacturing processes, influencing the direction of ecosystem management (Baines et al., 2017). Second, the emergence of new forms of relationship and collaboration (Kolagar, 2024) has enhanced the utilization of real-time data, opening up opportunities for knowledge and resource sharing facilitated by Industry 4.0 technologies (Chiarini, 2020) and providing a more comprehensive understanding of the market (Bustinza et al., 2015). Similar to servitization, ecosystem management extends beyond a single department to generate value across the entire firm (Chiarini, 2020). To understand the significance of servitization, Fu et al. (2022) found that around 21% of European manufacturing firms were implementing servitization in 2021, with an expected 58% increase in the next five years. Therefore, servitization necessitates the development of a diverse ecosystem, including a wide range of actors and a many-to-one structure, to participate in the servitization journey. Therefore, it is essential to know ecosystem management in the servitization journey. Since servitization can impact every aspect of ecosystem management, addressing ecosystem management as a whole in the servitization journey is essential.

Servitization has become a strategic priority for businesses, yet navigating this new phenomenon is rarely discussed in the literature in an ecosystem context. Besides servitization affecting business operations, all the ecosystem actors (manufacturing firms) will shape or be shaped by servitization. One consequence is that the ecosystem's operational functions may change (Dubruc, 2014), requiring a more holistic and systematic approach to create, capture, and deliver value. Therefore, it is essential to recognize and examine ecosystem actors need to understand, interpret, communicate, and share their capabilities, knowledge, and practices. When ecosystem actors with lots of expertise, resources, and market share are unfamiliar with the servitization procedure, it can lead to a knowledge gap known as servitization asymmetry (Pinto et al., 2023). Servitization asymmetry occurs when there is an unequal distribution of servitization knowledge across the business ecosystem. When actors in the business ecosystem do not align with each other, servitization asymmetry can potentially lead to failure (Momeni et al., 2023). Given its critical importance in facilitating the servitization strategy, ecosystem management is expected to be impacted by servitization, influencing their knowledge, skills, routines, processes, design, delivery, and engagement; thus, ecosystem management needs considerable attention.

Despite the plenty of research arguing for servitization, research on the effects and challenges of servitization on ecosystem management has been limited. Heirati et al. (2024) examined the need to reconfigure the organization architecture (internal product units, internal service units, and external service providers); each department requires specialized knowledge, coordination, and assets. The specificity of any of them can affect the quality of integrated and advanced service offerings (Chiu et al., 2023). Moreover, Grandinetti et al. (2020) explored that servitization affects the relationship quality in the ecosystem, emphasizing the importance of relational intimacy and informational openness, which leads the organization toward data-driven efficiency and effectiveness. Thomas et al. (2014) stated that ecosystem management can develop coordination and communication processes to assimilate, integrate, and share data and resources.

Moreover, ecosystem management can build long-term relationships to bundle, structure, leverage, and access required capabilities and co-create knowledge (Qi et al., 2020), crucial to servitization success. They emphasize that their research does not originate from an examination of the ecosystem perspective and advocate for more investigation to facilitate servitization processes. Thus, there is a need of understanding how servitization in an ecosystem context can lead to the development of more services or how ecosystem actors are involved in ecosystem management activities for successful servitization. Therefore, this research focuses on numerous ecosystem actors and ecosystem management role in the servitization journey to uncover the prospects and challenges. It drives the formulation of two research questions:

RQ1: What are the challenges for the ecosystem management actors in the servitization journey?

RQ2: In what ways are ecosystem management actors involved in servitization initiatives?

To address these research questions, we employed a multiple case study of four manufacturing firms engaged in ecosystem networks looking to infuse servitization in their practices. This research makes three contributions to servitization literature. First, we propose distinct ecosystem management services:

advanced, integrated, and collaborative. We also identified challenges associated with these services. Second, we propose ecosystem management capabilities to deal with the complexities. Moreover, we emphasized the identification of ecosystem typologies and involvement of ecosystem actors to recognize the areas of adaptation. We proposed the process framework to understand ecosystem management and servitization.

The structure of this research is as follows: the next section literature review defines servitization along with a concise summary of prior research on ecosystem management and servitization. We proposed a direction for analyzing how ecosystem management actors capitalize on servitization. The following section outlines our methodology and demonstrates the process of conducting a multiple case study and analysis. After that, we presented the findings from our research on the servitization journey of four Italian (B2B) ecosystem actors. The final section presents the discussions and conclusions of the research.

2. LITERATURE REVIEW

2.1 Servitization

Servitization is an unique and strategic approach, potentially necessitating ecosystem actors (manufacturing firms) to establish novel functions and routines to offer or deliver solutions associated with the ecosystem interface (Sjödin et al., 2024). It require broad range of knowledge and expertise to expands their network and form and sustain ecosystem which include suppliers, agents, distributors, retailers, and many more to offer ecosystem-related solutions. According to network theory, digital technologies offer the potential for interconnectedness and the opportunity to servitize by providing the infrastructure for the ecosystem to enable knowledge exchange, expertise, and processing (Wang et al., 2022; Kapoor et al., 2022; Ardolino et al., 2015). The servitization phenomenon refers to transforming such knowledge, processes, or routines into a servitized format, necessitating altering its capabilities, functionality, essence, or actors involved, thus reconfiguring the business model (Baines et al., 2009; Neely, 2008). However, when a change in the business model occurs (Kohtamäki et al., 2021), manufacturing firms encourage and inspire their partners in an ecosystem to follow the same path, this is referred to as collaborative servitization.

Various theoretical perspectives can approach the complex process of collaborative servitization (Zhang et al., 2024). Collaborative servitization has led to the proposal of various models and theoretical perspectives. For instance, network theory can shed light on the interplay between various actors, resources, processes, services, complexities, and capabilities (Håkansson & Snehota, 2017). Servitization may be essential in achieving ecosystem related solution where sufficient sales are generated by offering services (Sjödin et al., 2020).. Due to the ecosystem’s service complexities and resource constraints, each actor could acquire capabilities to create win-win collaborative networks, such as service, operational, and platform networks (Vuletic et al., 2017). Although ecosystem management is increasingly vital for the actors engaged in servitization, ambiguity still exists on how to approach servitization and manage an ecosystem as an enabler of a win-win collaborative network.

Servitization research mainly focused on concepts of competitive strategy, customer relationship, customer value, product service differentiation, and product service configurations, suggesting the need to explore the link between servitization and ecosystem management as future research direction (Baines & Lightfoot, 2013). Furthermore, research focusing on context, content, and process of servitization transformation from an organizational change perspective finds that the ecosystem process needs to be developed more. There needs to be a greater understanding of collaborative servitization (Baines et al., 2017). Raddats et al. (2019) argue that investigating the servitization process using a network perspective should be research to explore how ecosystem management leads to servitization success. Adopting servitization requires network transformation from scarcity to abundance, planning to discovery, and hierarchy to partnership (Tronvoll et al., 2020). Existing research reveals that servitization implementation evolves through different stages, requiring different capabilities and an understanding of ecosystem management. However, there needs to be more evidence of the capabilities of ecosystem management in the servitization journey. Thus, the literature argues for further exploration of the servitization process at the ecosystem level. Paying attention to the ecosystem level is essential. Because it shows us the complete picture and helps us understand the complex relationship between managerial and non-managerial elements, this approach is also vital for competitive advantages, sustainable development, and checking the progress of the servitization journey. In addition, the ecosystem servitization concept helps understand the benefits each actor receives from offering different services, which is directly linked to firm profitability. Ecosystem-level research guides the formulation of institutional policies and regulations. Thus, paying attention to the ecosystem level enhances scientific understanding. Whereas, Paschou et al. (2020) call for more research on the impact of servitization on ecosystem management. Practically, this will allow managers to understand the firm cooperation and competition within the servitization ecosystem (Bigdeli et al., 2017). Theoretically, it will provide a holistic understanding of the dynamic interplay between resources, actors, and activities (Dahmani et al., 2016). By exploring these topics, researchers and managers will gain an in-depth understanding of market dynamics that influence customer experiences (Lipkin & Heinonen, 2022).

2.2 Ecosystem management and servitization

The literature on ecosystem management and servitization can be categorized into three main topics: servitization enablers, servitization challenges and processes, and the effect of servitization on ecosystem management.

First, from the literature, we identified several enablers of servitization. At the organizational level, researchers identified Industry 4.0 technologies, such as information and communication technologies (ICT) and remote monitoring technologies (RMT) that explain servitization initiatives (Grubic, 2014; Ruff & Woschank, 2022). For instance, the literature addresses the failure to embrace servitization, sheds light on how Industry 4.0 has changed the industries, and illustrates how different ecosystem actors deal with different kinds of challenges and uncertainty (Martín-Peña et al., 2019; Minaya et al., 2023; Zhou et al., 2020). Moreover, moving from the single organization level to the ecosystem level to produce collaborative servitization, previous research emphasizes the manager role in servitization initiatives as they are known as people knowledgeable about the changes prompted by industry 4.0 technologies and market dynamics. Davies et al., (2023) identified a prominent role of managers to treat servitization as a change in their capabilities and practices at the intra-organizational level (e.g., chains, dyads, and networks). They further said that transitioning from product selling to manager selling could lead to success in servitization (Davies et al., 2023). Therefore, the manager role is crucial in ecosystem management to build new relationships and capabilities. We argue that an ecosystem network always has an orchestrating manager to lead and guide all ecosystem actors. Such a characteristic of a manager is known as agile leadership (Rialti & Filieri, 2024) and can be considered a potential servitization enabler. Another thematic enabler explained in literature for ecosystem actors is motivational behavior and capabilities embracing the different service types (Baik et al., 2019; Saccani et al., 2014). In line with this, Visnjic et al. (2016) explore the distinct competencies needed for ecosystem management, where the competencies from the orchestrating firm are translated and coordinated into the final services. They suggested viewing the ecosystem as an "extended enterprise."

Second, the literature focuses on the servitization prospects and challenges and provides practical examples of how to implement servitization (Baines et al., 2024; Kohtamäki et al., 2022). Research in this stream has a starting point indicating that access to industry 4.0 technologies is essential, but more important is the extent to which ecosystem actors can effectively and innovatively utilize it. Studying servitization initiatives beyond the industry 4.0 technologies mainly focus on external and internal ecosystems. Starting internally, there is a need to understand the internal ecosystem and to make it more explicit within a servitization context (Baik et al., 2019), which requires internal capabilities such as upstream and downstream capabilities as well as interdependencies (Jovanovic et al., 2019). Few firms such as Nokia and IBM offers collaborative services by developing "strong interdependencies connection" to mediate between product and service segments by forming competent "upstream operation function" for handling collaborative services and "downstream operation function" for reshaping their product line (Foote et al., 2001). To this end, the ways upstream and downstream capabilities are developed and the interdependencies are essential for servitization. Moreover, the researchers emphasize partner selection, automated assembly lines, integrated manufacturing processes, and

BDA for improving the internal ecosystem (E. Ferrari et al., 2018; Veile et al., 2022). With partner cooperation, strong connections can be developed using industry 4.0 technologies in which integrated communication is undertaken through new digital ways that improve ecosystem management. Moreover, it is essential to complement the external ecosystem assessment as it provides market knowledge on the ecosystem orchestrator and ecosystem actor's readiness towards servitization (Parida et al., 2019). Servitization becomes more challenging in a complex environment, as coordinating heterogeneous knowledge in the external ecosystem requires a greater internal scope of servitization re-combinations. Due to information processing challenges, division and coordination must combine diverse knowledge sets (Baik et al., 2019). They emphasized a high-performance work system to facilitate interactions across multiple levels. Organizations thus can invest in external relationships using high-work performance systems to improve ecosystem infrastructure (Baik et al., 2019) Existing literature has prioritized the attention on aligning the external ecosystem (Gomes et al., 2022). Therefore, aligning the external ecosystem with the internal ecosystem provides a pathway of ecosystem management to ensure the objectives and goals are in order and work together effectively to create a collaborative servitization pathway. Such an ecosystem poses a set of routines, practices, and capabilities that foster the relationship and develop capabilities to experiment with different initiatives. This line is consistent with Sjödin et al. (2024), who found that managing ecosystems mediates interactions between internal and external ecosystems.

Third, referring to Sklyar et al. (2019) and Baik et al. (2019), the studied literature needs to provide evidence of measurable and synergistic consequences of servitization and ecosystem management. Scarce research found that complexity in the ecosystem can lead to complexity in servitization and vice versa (Kolagar et al., 2022a; Zhang et al., 2023), requiring extended service networks, self-driving operation networks, related capabilities, and industry 4.0 technologies. The Servitization journey has been studied from various angles to conclude the literature. Many papers provide examples of how to work with servitization (Crowley et al., 2018; Fliess & Lexutt, 2019; Lenka et al., 2018; Polova & Thomas, 2020); however, not focusing on the ecosystem management can lead to servitization asymmetry. We conclude the literature on servitization and ecosystem streams and identify primary sources that established the connection between these streams (Table 1).

Table 1: Overview of key references within the ecosystem management and servitization research

Authors	Stream	Methodology	Findings	Research gaps
Adrodegari and Saccani (2020)	Servitization	Literature based approach	Developing a servitization maturity model for assessing and positioning	In contrast to large international firms, small firms trying to servitize should be more studied in

			companies in the servitization journey.	empirical evidence.
Benitez et al. (2020)	Ecosystem	Single case study	The ecosystem evolved from the traditional approach to collaboratively innovative developing solutions for Industry 4.0 and, subsequently, smart business.	Promoting innovation as a means for manufacturing firms to systematically co-create Industry 4.0 solutions is an ecosystem context where much remains unknown. More literature on technology providers, also known as the supply side, is needed. In contrast, previous research has mainly concentrated on technology adopters or the demand side.
Humbeck et al. (2020)	Ecosystem	Design research method (workshops)	New business models are compelling mechanical and plant engineering companies to create creative end-to-end solutions, often known as product-service systems. This can only be accomplished with the incorporation of novel competencies and resources.	Business ecosystems are a new organizational and economic activity involving dynamic and cross-company systems. The importance of controlling, coordinating, and managing business ecosystems is becoming more apparent.
Kowalkowski et al. (2013)	Servitization and ecosystem	Multiple case study	It investigated how manufacturing firms build value constellations that facilitate service-based value generation.	How manufacturing firms successfully incorporate service into their business has yet to be the subject of any particular research.
Sjödin et al. 2024	Servitization and ecosystem	Single case study	Their research shows that established manufacturers undergo significant technological changes due to digitization, artificial intelligence, and	Research on the relationship between ecosystem management competencies and company and ecosystem performance metrics, including innovation results and financial

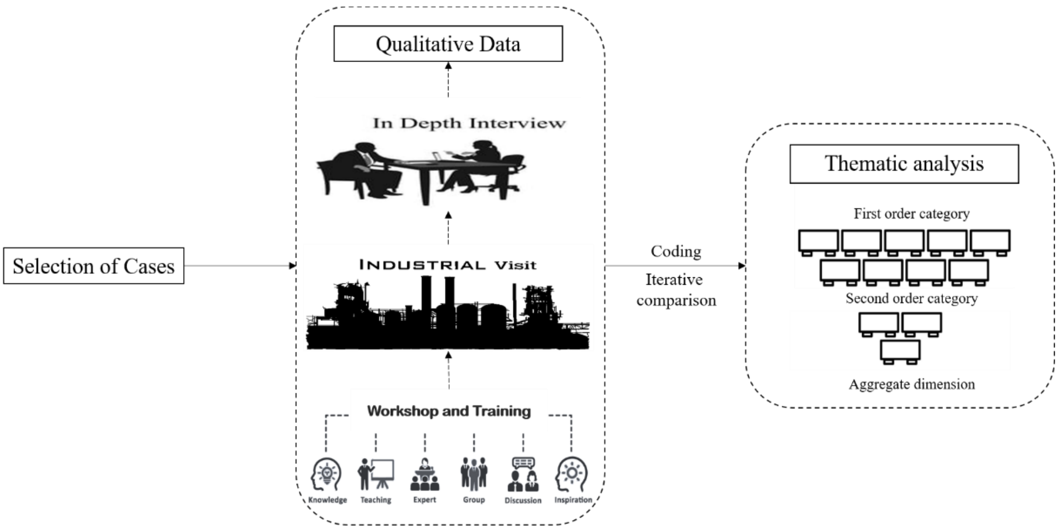
	electrification. At the same time, businesses are also shifting towards more sustainable models and servitization, called the twin transition (ecosystem transition).	success, must be included.

3. RESEARCH METHODOLOGY

We employed multiple case study (Yin, 2008) to explore the complexity of ecosystem management and its adaptation process. With multiple case study (Schlesinger et al., 2015), we were able to capture the complex ecosystem phenomena to develop a comprehensive understanding of ecosystems and servitization. A multiple case study is considered a superior approach over a single case study due to its ability to deliver more robust and compelling findings (Herriott & Firestone, 1983).

Therefore, we applied a multiple case study approach based on the triangulation concept, which includes studying the subject from multiple sources (Stavros & Westberg, 2009). It allows us to triangulate multiple sources, such as industrial site visits, in-depth interviews, and workshops, essential for proposing novel insights into phenomena (Pan et al., 2007). We targeted four ecosystem actors for data collection. It enables a deeper understanding of the contextual richness of functional and collaborative dynamics within the internal and external ecosystems. Figure 1 illustrates the methodological process.

Figure 1: Methodological process



Source: Author's elaboration

3.1 Case selection

We adhered to the methodology of Gunasekaran et al. (2017), selecting cases from similar industries, product categories, and ecosystem actors to demonstrate how ecosystem management can contribute to servitization success. The industry is the Italian fashion accessories manufacturing sector, and firms exhibit similar patterns of innovative activities, indicating that technology shapes specific sector patterns of innovation (Cefis & Orsenigo, 2001).

3.2 Research context

Italy is renowned as a country with highly successful fashion brands associated with favorable attributes such as innovation, aesthetics, excellence, and meticulousness. Italy is known for “knowing how to make things well” and “made in Italy,” which is an added attribute to the quality (Gregori, 2016). The Italian fashion industry is highly competitive and subject to rapid market demand and technological changes. Thus, they faced challenges in maintaining traceability and quality and navigating production and complex firm performances. Thus, reinforcing innovation and evolving market dynamics affect Italian craftsmanship, innovation, aesthetics, excellence, meticulousness, and cultural heritage (García, 2018), providing evidence of the need for ecosystem management to predict and mitigate the upcoming challenge due to the evolving market.

We selected firms based in the Toscana region of Italy. Previous literature (Arzubiaga et al., 2022; Fiorini et al., 2023; Gebauer et al., 2021; Intraligi et al., 2024) has studied the significance of the Toscana region. First, their manufacturing sector plays a crucial role in contributing to the country GDP. For example, in 2022, the Toscana region contributed 6.7% to the national GDP (Trading Economics, 2024), whereas in 2023, their contribution to the GDP declined by 0.4% (Agenzia Nova, 2024). Such decline can be attributed to several challenges, such as export dynamics (Ferraresi & Ghezzi, 2024), the impact of technologies, and industrial challenges (G. Ferrari et al., 2024). Second, Toscana regions, especially Firenze and Arezzo, are known for their manufacturing expertise, which specializes in the high-quality manufacturing of luxury goods, leather products, and textiles. They are highly regarded globally for their quality and craftsmanship. The diversity allows them to find suitable partners across different sectors. Engaging with B2B platforms provides access to manufacturing networks and increases the opportunity to collaborate to enhance competitive advantages (Vitulano, 2023), indicating the importance of ecosystem management. For instance, Rabino et al. (2008) investigated the importance of the Arezzo market in terms of its economic influence and the fascinating interactions and relationships among companies. Milanesi et al. (2020) have examined the Firenze Leather District, highlighting its significant number of business networks. Furthermore, Ricciardi (2013) shows meaningful examples of cooperation amongst firms in Santa Croce districts, emphasizing the importance of training, while Gaiardelli and Songini (2020) stressed the effectiveness and efficiency in this district.

Thus, we selected four firms that belong to a single ecosystem group, each of which is partnered with another and belongs to a similar industry. We selected one focal firm that we regarded as an orchestrating actor—"The Firm A.". The key selection of this firm is based on its motivation for change, creating a win-win scenario for all, for which they partnered with a business consultant and service firm, "Consultant A," to provide workshops and training to their employees, improve efficiency, reduce cost, adapt to the changing market demand, and change employees' mind-set toward innovation.

We focused on four ecosystem actors based on convenience and accessibility. All these firms are located in the Toscana region, Italy. The selection of these firms is based on a long-term relationship with orchestrating firms, which means that these firms are highly inspired by orchestrating leadership, decision-making, and organizational functions. The pace of changes adopted by orchestrating firms significantly influences them, impacting every actor in the ecosystem. The selection of these firms provides rich data and a deep understanding of how to fill this gap. The following section (Table 3) illustrates the key characteristics of the ecosystem actors.

3.3 Qualitative data collection

We used a triangulation approach to collect data, breaking it down into three steps: i) workshops and training, ii) industry site visits, and iii) in-depth semi-structured interviews.

3.3.1 Workshops and training

To evaluate and bring about changes in the ecosystem, "Consultant A" provides workshops to the employees of "Firm A," which include several rounds of training and group discussions with individuals—the discussion centers on their job responsibilities and the resolution of daily routine problems. This discussion aimed to analyze production, procurement, planning, quality control, technology, and business analytics. We attended each workshop and recorded and transcribed the discussions. Moreover, they also visited "Firm B," "Firm C," and "Firm D."

The first round of discussion began on 19th January 2023. The complete descriptions of each workshop are shown below (Table 2).

Table 2: Description of workshops

Agenda	**Date**
Analysis, scheduling and production planning	19/01/2023

Analysis of activities, purchase planning and procurement logics	02/02/2023
Analysis of warehouse management, packaging and internal and external logistics (material and intangible flows between warehouses)	16/02/2023
Analysis of raw material traceability procedures and definition of quality control checkpoints	02/03/2023
Analysis of the scheduling of production operations, technological analysis of the machines of the production plant	16/03/2023
Analysis related to the management of administration and control activities	30/03/2023
Analysis related to the management of maintenance activities and functional analysis of all the information systems used	13/04/2023
Business analysis.	27/04/2023

3.3.2 Industrial site visits

The second step involves the author visiting an industrial site, accompanied by the manager of each firm. We selected five actors in the ecosystem for industrial site visits. We selected industry visits primarily due to their similar practical environments, accessibility, and the potential to facilitate cross-site analysis. This step provides experience and practical insights into operation functions. Industrial site visits are an effective method for collecting in-depth qualitative data based on experience and observations.

All the sites are located in the Toscana region, Italy. They exhibit similar products, share a similar manufacturing nature, and utilize similar technologies and routines. We selected all cases because they were actively seeking improvements to leverage the benefits of innovation effectively. Table 3 provides a complete description of the industrial site visit.

Table 3: Description of industrial site visit and in-depth interviews

Actors	Categories	Firm Size	Firm Age	In-depth Interview	Industrial Site Visit
Firm A	Retail Apparels and Fashion	51-200	50	12	July, 2022
Firm B	Retail Apparels and Fashion	01-50	05	3	December, 2022
Firm C	Metal Treatments	01-50	50	3	March, 2023
Firm D	Metal Working	01-50	10	2	March, 2023
Firm E	Fashion Accessories Manufacturing	201-500	50	-	January, 2022

3.3.3 Semi structured interviews

The third step included individual in-depth, semi-structured interviews. We collected the data both inductively and retrospectively. In a retrospective case study (Berg & Madsen, 2020), we not only compare firms practices but also compare the prior ecosystem management activities with the new ecosystem management activities required for servitization.

We select the respondents from each firm using snowball sampling (Seidman, 2005), where managers recommend each respondent based on their expertise and knowledge of operation functions at inter- and intra-organizational levels, enhancing our understanding of ecosystem management. This diverse range of respondents with various experiences and extensive data helped us develop a holistic understanding of emerging ecosystem management concepts for servitization. The key demographics of each respondent and the interview data are provided in Appendix A.

We continuously updated and refined the format of the interviews and the structure of the questions to capture interesting themes that emerged during previous questions and interviews (Grönlund et al., 2010). We encouraged respondents to respond to these questions and address the problem by considering current practices and their experience, knowledge, and thoughts on the need for servitization adaptations. This facilitates us in comparing diverse perspectives. The interviews ranged from 15 minutes (min) to 87 minutes (max), with 46 minutes of average duration. The total interview duration was 12 hours, 04 minutes, 16 seconds (724 minutes, 16 seconds). We conducted 20 interviews from 4 firms in total (see Appendix A). We conducted the interviews from 23rd November 2023 to 19th December 2023.

To mitigate the influence of respondent bias on cause-effect relationships and prevent confusion (Leonard-Barton, 1990), we triangulated the data by verifying the responses through workshops and training, industrial site visits, and in-depth interviews. We recorded each workshop, training, and in-depth interview to increase reliability. We transcribe each recording using the MAXQDA (Kamalaldin et al., 2020). To maintain data accuracy, the transcripts were carefully examined by subject matter experts.

3.4 Empirical analysis

The thematic analysis explored relevant themes and patterns (Table 4). We followed Gioia methodology to explore the themes from the large data set (Gioia et al., 2013). Using this methodology, we could effectively and accurately identify the relationship between analytical themes. We followed the steps outlined by Ben-Menahem et al. (2016).

First, we transcribed that data and began with an in-depth transcript analysis. After several rounds of reading the transcripts, listening to the interviews, and marking the phrases and passages that align with the objective of this research, this step provides us with the first-order category codes, which directly represent the participants' opinions on the subject. MAXQDA and Microsoft Excel facilitate this step.

The second step involves an iterative approach that aids in developing second-order themes and identifies patterns and links within first-order categories that represent theoretically distinct concepts. Based on a higher level of abstraction from first-order themes, we identified nine second-order themes. New information from previous literature, archival sources, consultancy reports, and industrial visits allowed further refinement of the topics.

The final steps include generating aggregate dimensions with a higher abstraction level in the coding. The output aggregate dimensions provide a theoretically and practically sound classification based on first-order categories and second-order themes. Therefore, our findings revolve around the foundation for three aggregate dimensions (Table 4).

In the final step, we develop theories, connections, and rationalities across the first-order categories, second-order categories, and aggregate dimensions. Our objective was to propose a grounded framework, drawing from findings on how ecosystem management unfolds and how ecosystem actors manage the servitization process.

Table 4: Data structure and coding process

1st Order category *(Based on respondents insights)*	2nd Order Category	Aggregate Dimension
Personalized services, extended services, product attributes, product features, digital tools, quality management, capacity management, process complexity, advanced management	Advanced Services	Ecosystem management services
Intelligent technologies, agile managers, operational agility, integration complexity, actors coordination	Integrated services	
Extended services ecosystem, self-driving operational networks, self-driving service networks, industry 4.0 technologies, dynamic network relationship	Collaborative services	
Big data analytics (BDA), market evaluation, relationship evaluation, artificial intelligence (AI)	Ecosystem advances for future interface (EAFI)	Ecosystem management capabilities
Automated operations, integrated operations, innovation culture, process integration	Ecosystem actors and technology integration (AETI)	
Digital documentation, Restructuring, ecosystem training, open communication platform	Ecosystem Institutionalization (EI)	
Digital platform, service platform, Global Positioning System (GPS), Enterprise resource planning (ERP)	Service Ecosystem	Ecosystem management typologies

Decision making, Virtual reality (VR), deep learning, Augmented reality (AR)	Operation ecosystem
Transparency, cloud computing (CC), predictive analysis, Internet of things (IoT)	Platform ecosystem

Source: Author's elaboration

4. EMPIRICAL FINDINGS

First, this research provides insights into servitization strategies involving ecosystem management services, ecosystem management capabilities, and ecosystem management typologies. The findings are described below following the order of the aggregate themes in the coding structure.

Based on our findings, we observe that ecosystem actors, to capitalize on servitization, must undergo an ecosystem management process that requires them to develop capabilities and understand their service offerings according to market dynamics and their involvement in ecosystem management typologies. We found a need to develop a process framework on how ecosystem actors can drive servitization (Figure 2). Sjödin et al. (2020) highlighted the need for a process framework for servitization due to its nature of path-based strategy. Our research reveals that each ecosystem actor does not follow the same direction in their servitization journey, as there is no optimal path to servitization (Kolagar et al., 2022b). Instead, selecting an ecosystem path for servitization depends on ecosystem actors' capability development in their ecosystem management process or reconfiguring their routine, methods, and practices.

"Each actor in an ecosystem depends on the services of others. For Example, a customer of Firm A decided to outsource 95% of its production to them. Due to a lack of capacities, they are more reluctant to use the services of Firm B. We perceived that each actor in an ecosystem context is a B2B customer looking for value delivery. Failure in delivery by any actors in an ecosystem can result in ecosystem complexities, resulting in servitization failure. (Observation during industrial site visit)"

4.1 Ecosystem management services

The process framework (figure 2) illustrates ecosystem management service offerings in their business model to realize the potential of servitization. Although effective ecosystem management is essential for servitization, the literature suggests they are implemented to a limited extent (Bastl et al., 2012). In this research, we proposed three types of services that can be delivered as a lens to analyze ecosystem management. The motivation behind this is that different ecosystem actors offer different services or combinations of different services that may influence ecosystem management. A similar approach was proposed by Saccani et al. (2014), who proposed three service types (product support service, customer support service, and process support service) as a lens to explore the buyer-supplier relationship. Therefore, we organize the discussion around the three distinct service types included in the process framework in the ecosystem context: advanced services, integrated services, and collaborative services. The agenda behind classifying services is to ensure product functionality and ecosystem actors' satisfaction. Depending on their market requirements, ecosystem actors can develop and offer any consequent services.

4.1.1 Advanced services

Ecosystem actors recognized servitization as a strategy for growth focusing on advanced services, including "personalized and extended services" related to the products. Advanced services include personalization and knowledge exchange, with a visual traceability of quality (Dahmani et al., 2016). It will open an opportunity for knowledge and resource sharing related to the market, allowing them to personalize their offerings by developing "digital tools," including customized functions to upload the products for customizing the "attributes and features" to deliver advanced services. Using digital tools allows actors to calculate the prices using the different available customization options. We suggest including videos, pictures, 3D drawings, comments, and remarks to enhance product value. In this way, ecosystem actors can directly offer advanced services.

The selected case reveals that offering advanced services brings complexities associated with advanced service provision. Complexities are related to "process, quality, capacity, and cost management." Selected cases highlight the challenges of offering advanced services related to commercializing it and to measure the value and convince the ecosystem actors; hence, inconsistencies and uncertainty can hinder actors' servitization journey and increase the risk of servitization failure. Furthermore, selected cases acknowledged that their process and capacity could be improved for advanced service offerings, mitigating the implementation servitization challenges (Wasserbaur et al., 2024). Moreover, offering advanced services includes a high cost of services, which affects the firm profitability and leads to a shortage of service experts, ultimately leading to high service costs that influence the firm performance. Therefore, the firm must understand how to deal with such complexities.

4.1.2 Integrated services

In some areas of the ecosystem, integration can only generate the value. Their final offerings depend on the services of ecosystem partners. For Example, for Firm A prior the delivery of the final products depend on manual craftsmanship from Firm B and require Firm E to dye and polish the articles before final treatment. Therefore, this segment of services is considered integrated services (the offerings that cannot be fulfilled without ecosystem integration). The integrated services are characterized by the outcomes achieved by services and knowledge bundles. For instance, selected cases have launched integrated intelligent technologies that provide services for removing dust from the products of ecosystem actors.

Moreover, they have launched integrated intelligent dying technologies to ensure weight and quality. Such technologies ensure integrated services for ecosystem actors. These services are managed within the single organization/management for ecosystem actors without their concern, focusing more on a centralized approach.

Similar to advanced services, we found three complexities associated with integrated services: "integration complexity, actors' coordination, and operational agility." To manage integration, the role of the agile manager becomes prominent in quickly identifying the digital solution for integration, which is highly complex. Moreover, ensuring the reliability and consistency of such integration is challenging. As the C.E.O of "Firm D" responded that:

"We already have big machines, we do not think of integrating or upgrading any features of it (we are happy as of now) because it can affect the reliability and stability and its maintenance cost is very high (R16), but we love to listen to novel ideas (R17)."

For smooth integration, ecosystem actors need to negotiate with upstream and downstream personnel, as stated by the respondent:

"In this internet era, we expect a quick response; the chain structure and working mechanism are ineffective since the downstream is usually slow to react to variations in demand from the ecosystem – all communication is done by personnel visits (R15)."

Ecosystem actors' needs are dynamic and very hard to predict, requiring operational agility. Therefore, ecosystem actors need to adopt digital solutions, implement data-driven decision-making, offer end-to-end service delivery, and adjust their relationships. Data-driven operational management can help ecosystem actors rapidly respond to diverse demands. The role of the orchestrating manager is obvious.

4.1.3 Collaborative services

Ecosystem actors can combine advanced services and integrated services to open the opportunity to develop collaborated services facilitated by bundles of industry 4.0 technologies. As respondent said

"With the achievement of 5G technologies and other advanced technologies, we are promoting smart workplace (R02, R11, and R14)."

Further, the manager of Firm A responded:

"We have a robot now; in the future, we are trying to install a robotized plant (R11)."

Based on our industrial site visit of Firm E:

"The robot-based plants are enormous integrated and advanced (collaborative) plants representing the largest production capacity within the fashion and luxury accessories industries. It is completely automated and advanced, controlled by robots, and has a dedicated digital system dedicated to production. It demands absolute qualitative performance and total reliability while respecting manufacturing and delivery schedules (Group Discussion with the manager of Firm A and E during Industrial site visit)."

Moreover, the responses revealed complexities associated with collaborative servitization: "extended ecosystem network, self-driving operational and service network, and industry 4.0 implementation."

"We have a different philosophy of services and manufacturing (R18, R19, and R20)."

Collaborative servitization is dominated by dynamic network relationships, which require brilliant collaboration and reconfiguring technological capabilities and practices. Smart collaborative servitization will help ecosystem actors improve their advanced and integrated services. Orchestrating ecosystem actors expects everyone to be involved in collaborative servitization in a self-manner, but motivating each ecosystem actor is an enormous challenge.

"We expected something from them, but it is an investment of our time and training cost (R05)."

We witnessed the complexity of implementing and adopting industry 4.0 technologies. Complexity emerges when performing industry 4.0 technologies, data-driven services, monitoring, autonomy, and optimization involving diverse ecosystems.

Thus, to address the abovementioned complexities for ecosystem management actors in the servitization journey, each actor must develop ecosystem management capabilities to participate effectively in servitization.

4.2 Ecosystem management capabilities

The main purpose of ecosystem management is to foster collaborative servitization by providing "integrated advanced services" to each ecosystem actor in a

B2B context. Servitization requires new capabilities in ecosystem management. This slow process is characterized by several ways (capabilities) of managing the ecosystem and addressing its complexities. Our findings found three ways of ecosystem management: ecosystem advances for future interface (EAFI), ecosystem actors and technology integration (EATI), and ecosystem institutionalization (EI).

4.2.1 Ecosystem advances for future interface (EAFI)

The first way to manage the ecosystem is EAFI, defined as the ecosystem ability to predict future developments to drive collaborative servitization. The analysis provides a clear picture that actors often initiate their journey of change in response to external environment headlines, evolving market knowledge, and competitive spying information shared by ecosystem actors, emphasizing the importance of data sharing and trusts in relationships. Regardless of the availability of resources, knowledge, and technologies, ecosystem actors have not reached the level of forecasting future uncertainty, explaining the need to develop "BDA" capabilities. Ecosystem actors must invest in industry 4.0 technologies to enable collaborative servitization and offerings to gain a competitive advantage in the market. Furthermore, ecosystem actors are advised to explore the pros and cons of "building relationships with new actors." Ideally, an ecosystem actor needs to identify joint future goals to open the opportunity to develop a long-term relationship. We noted that the ecosystem actor prioritizes a win-win approach, emphasizing the preferences to align with their operations and adaptations. Thus, EAFI includes the capability of exploring promising potential new partners, and selection is a key capability that ecosystem actors must acquire. Respondent acknowledged the potential of the relationship:

"Partnering with additional companies allows us to expand operations (R13) and ensure stability and continuity of business (R10)."

This underscores the importance of fostering active interactions and cultivating connections to nurture relationships. Thereby, we emphasize selection capabilities to include more actors in the ecosystem, which brings the opportunity for knowledge and data integration for the decision-making process via industry 4.0 technologies (Brodeur, 2022). Respondents have mentioned using "BDA and AI" for decision-making regarding their collaboration, operations, and service offerings. Thus, The Industry 4.0 technologies facilitate the "EAFI capabilities" and create more organized ecosystem management. Respondents emphasized the investments in industry 4.0 technologies and stated that:

"We need to invest in Industry 4.0 technologies (R3); we need to upgrade internal software to enable the sharing of relevant product information with clients, such as materials, measurements, and stock levels, while protecting sensitive data (R14), resulting in efficiency and accessibility of records (R9)."

4.2.2 Ecosystem actor and technology integration (EATI)

The Win-Win approach in the relationship required EATI, where advanced services, operations, processes, and routines are reconfigured to create value in the ecosystem. EATI is a crucial source for ecosystem actors to improve knowledge, gain resources, and develop capabilities, ultimately boasting competitive advantages. From the analysis, we found that EATI can provide the possibility of "integrating and automating the operation and processes" and propel the actors to reduce the number of organizational processes (in a particular area) in which they are less competent to be supported by its competent ecosystem partners. Moreover, the success of EATI depends on empowering the orchestrating managers (agile) who should be in charge of taking responsibility for the relationship formation process, and their role is seen as particularly important when dealing with the servitization process. EATI facilitates the servitization process by creating numerous additional services but can also introduce added complexity due to increasing numbers of ecosystem actors (Sjödin et al., 2024). Therefore, firms should prioritize quality over quantity of ecosystem networks. It was clear that companies can optimize their processes and operations and create new collaborative services. Respondents acknowledged the importance of the EATI and suggested that:

"It is high time to assess the advantages of performing with machines and AI technologies to enhance production efficiency and maintain consistent product quality throughout the lifecycle (R1, R4, R13); we are happy that our partnered firm has invested a lot in machinery and automated solutions to not only optimize the production capacity and efficiency, but to keep the pace of coopetition motivate us to introduce new strategies (R2), as you can see, we have initiated the change getting inspiration from our partners, the process is slow, but we are happy that we have healthy relations which will not affect our daily operations (R18, R19, R20).

A coherent and solid development plan is the key to introducing new technologies to a new need. It requires a culture of innovation, thereby:

"Including younger talent and implementing advanced tracking and key performance indicators (KPI) systems for improved automation and integration (R11)".

4.2.3 Ecosystem Institutionalization (EI)

After understanding EAFI and EATI, ecosystem actors must develop capabilities to manage the evolving ecosystem and ensure the reconfiguration of the collaboration process (Sjödin et al., 2024). Too many ecosystem actors result in complexity in managing cooperation, requiring "digital documentation" to manage the complex and diverse ecosystem portfolio and the integration of diverse services portfolio. Wang et al. (2022) acknowledged that such complexity leads to servitization failure. Moreover, it requires "restructuring" roles, responsibilities, and functions. This process harnesses the diverse capabilities of ecosystem actors and supports the evolution of the ecosystem (Sjödin et al., 2024). Respondents emphasized the need for "digital documentation for restructuring":

"There is a need for a structured approach to job responsibilities and specifications through comprehensive documentation (R12). "Non sappiamo chi è chi, cos'è cosa, dov'è dove e come è come" – I am un-aware internally (R1)" illustrate the challenges of unorganized structure."

Further, the respondent said:

"There is a need to differentiate between technical and quality control workers (R12)."

This statement illustrates that there is a need to provide training to understand different and diverse functions in the ecosystem. Servitization is like an ocean in which any type of fish (service) from anywhere can surprise and shock you at the same time. It means that services can be demanded from anywhere, anyhow, and in any form, so the ecosystem actor must acquire skills for this. Therefore, we acknowledged the importance of developing EI capabilities by offering training.

Firm A and Firm E are offering training activities:

"We have introduced courses in collaboration with universities and consultants to train new minds with new managerial skills for fashion and luxury industries. This training is unique in Italy, and provides the competencies necessary to analyze the market scenarios, render respected production processes more efficient, and enhance final products regarding sustainability and innovation (Discussion with the firm A and E manager during industrial site visit)".

The EI supports the change in the ecosystem and harnesses the diverse capabilities. There is a need to adapt to role changes and establish new "open communication channels." To enhance such capabilities:

"Training for new technologies and specialized skills is required (R3); implementing a performance-based reward system and offering targeted training will foster growth and innovation (R10). Additionally, job rotation programs can help cross-train staff, promoting flexibility within the workforce (R11)."

4.3 Ecosystem management typologies

Ecosystem management helps manufacturing firms grow rapidly, even in a rapidly evolving market. Ecosystem management consists of interconnected organization networks that are rapidly evolving and require resilience and adaptation as necessary management requirements. Our findings reveal that ecosystem management in the context of services can be categorized into three types: service ecosystem, operational ecosystem, and platform ecosystem. We argue that each ecosystem actor is involved in any type of ecosystem, depending on the nature of their service offerings and business model.

4.3.1 Service ecosystem

We address the need to develop service platforms in different departments to promote collaborative servitization. We found that not necessarily infusing servitization in each department is required. However, a few departments, such as R&D, the information technology (IT) department, and the logistics and procurement department, need to be platformed initially. Disrupting servitization in all departments will create turbulence affecting the performance – let it spread slowly and gradually – once people are aware of that and can understand what it is, go for it. Making servitization a distinct entity can speed up the adoption and implementation of servitization.

Ecosystem actors need to capitalize on the service ecosystem, which connects each functional department through which any issues can be solved via crowdsourcing and crowd innovation. For instance,

"I recognized the need for such a platform where I can report any technical issues related to article design, quality, or functionality and receive the response from the person responsible for handling that job (R1)."

Such a platform can quickly offer services in real-time, thus creating value in the ecosystem. We acknowledged that the service ecosystem can improve the transparency, visibility, and efficiency of services offered by several functional departments. Such service ecosystems include "enterprise resource planning (ERP) and office automation," which can digitalize procurement, production, and supply chain management. The service ecosystem has several benefits, such as order management, automatic processing, and delivery tasks that can be managed in real-time by "GPS tracking" (Fu et al., 2022). Furthermore, mobile applications can provide actors with the "comfortability and feasibility" of performing the task.

We found that embedding Industry 4.0 technologies in a service ecosystem facilitates effective ecosystem management. We further recognized that bundles of service offerings can be increased by aggregating each ecosystem actor service capabilities. In this way, service scalability and capacity can be enhanced. Involvements in the service ecosystems allow the ecosystem actors to reconfigure their services to create, deliver, and capture value in the ecosystem.

4.3.2 Operational ecosystem

Operational ecosystems provide a link and network structure of all operational functions, enabling ecosystem actors to collectively contribute to the development and management of integrated services. Moreover, actors can propose their ideas, opinions, and feedback on products and services and contribute to "decision-making" related to new value-added services. On this platform, anyone can submit their solution. This platform can provide tools to develop virtual and real product prototypes and incorporate service features, functionality, and attributes to promote lean services.

Therefore, the operational ecosystem is designed to coordinate various operational functions in the ecosystem. It also embeds a business intelligence system to manage and integrate information systems. In addition, by using immersive technologies (augmented reality and virtual reality) and optimizing technologies (AI and deep learning), firms can acquire the data, analyze the product quality, forecast demand based on consumer behavior data, and facilitate co-development, resulting in the construction of advanced integrated services. The manager of "Firm A" emphasized digital platforms to get access to data to determine production schedules and optimize the service offerings effectively.

Thus, the operational ecosystem can enable point-to-point visibility of all operational functions and integrate the operational transactions, improving responsiveness. For instance, ecosystem actors can consult with such interactive design platforms to learn about evolving market requirements and communicate with the related personnel to solve problems and innovate. It is essential to develop established processes that protect the insensitive and intellectual data – which will encourage ecosystem actors to communicate openly and co-develop collaborative servitization.

4.3.3 Platform ecosystem

Almost all the ecosystem actors have more or less everyday business routines and processes, which implies that they can have typical platform architecture for creating ecosystem value. Therefore, we recognize the importance of platform ecosystem for ecosystem management. It can potentially develop interconnectedness with ecosystem actors internally and externally (across different industries also).

The platform ecosystem connects the operational and service ecosystems with several actors and enables a strong connection. In a platform ecosystem, ecosystem actors can automate, integrate, coordinate, and communicate different routines, processes, and operations to enhance "transparency." Furthermore, we argue that the operational ecosystem promotes the centralization of the procurement process and logistic integration to understand the evolving markets; the platform ecosystem provides an opportunity to expand its services in different markets by adopting CC, IoT, and BDA.

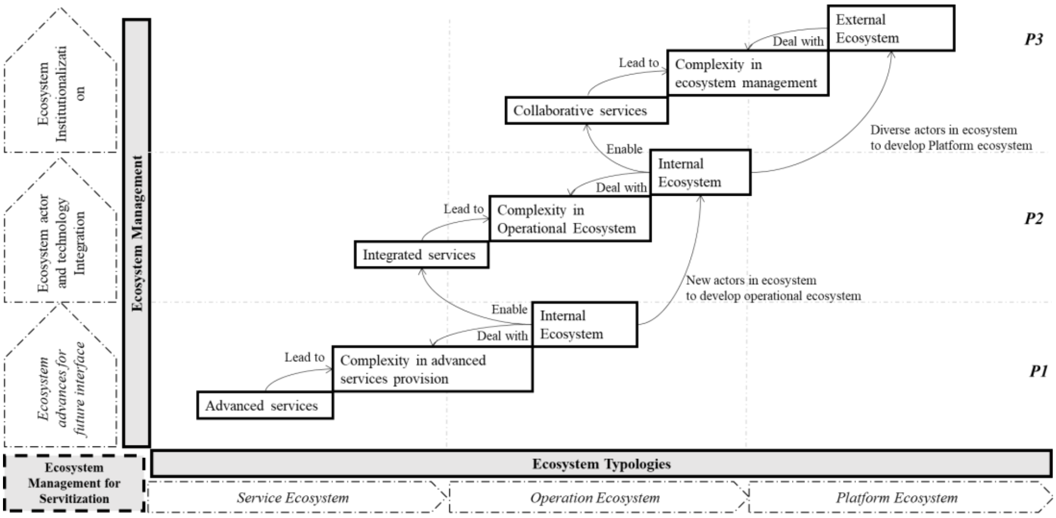
Therefore, the platform ecosystem provides mechanisms and infrastructure for ecosystem actors to strengthen and explain their continuous collaboration. For example, in our case, “Firm C” can easily acquire knowledge and resources from downstream and upstream of their operational departments, internal ecosystem, external ecosystem, and other actors in the ecosystem. Such knowledge can help establish new relationships for servitization and enhance long-term ecosystem engagement. For instance, “Firm A” has supported “Firm D” in extending its operation to an advanced level and choosing the resources for building a new facility (Fu et al., 2022). Thus, the platform ecosystem enables ecosystem actors to build a dynamic operation ecosystem by reconfiguring relationships and structure effectively and efficiently. Thus, we can say that the platform ecosystem promotes collaborative servitization by collaborating with ecosystem actors from different industries – we call it bundles of ecosystem networks.

5. CONCLUDING DISCUSSION

5.1 Discussion

Based on the empirical results of our study, we argue that ecosystem actors, in order to increase their firm performance, build long-term customer relations, and achieve a competitive advantage, go through a collaborative servitization process that requires them to develop ecosystem management capabilities and understand their ecosystem management typologies, which allow them to reconfigure their ecosystem management activities by understanding the importance of each ecosystem management dynamics. We propose a process framework on how ecosystem actors can drive servitization in an ecosystem context (see Figure 2). Our findings reveal that ecosystem actors advance differently regarding ecosystem management capabilities and ecosystem management typologies and do not follow the same path in their servitization process. However, there are many pathways to succeed with servitization. Instead, the selection of a suitable servitization pathway is dependent upon the ecosystem management capabilities or ecosystem management typologies.

Figure 2: The process framework



Source: Author's elaboration ***(P=Pathway)***

The process framework represents three different servitization paths: advanced, integrated, and collaborative. Because the path that an ecosystem actor chooses depends on its ecosystem management capabilities and ecosystem typologies involvement, ecosystem actors can use this process framework to identify their current situation and determine the path ahead to servitization. The logic of the different servitization pathways is explained below.

The first servitization path is the "developing and offering advanced services," where an ecosystem actor needs to develop and strengthen their ecosystem management capabilities. We argue that ecosystem actors can offer advanced services by developing all ecosystem management capabilities (EAFI, EATI, and EI) during the servitization journey. If ecosystem actors only exhibit EAFI capabilities, deploying advanced services in an ecosystem might be enough. However, a unique feature of this advanced service is that when any ecosystem actors succeed in developing ecosystem management capabilities, they propel the other actors to be involved in their service ecosystem.

The second servitization path is "integrated services." Similar to the advanced services, the integrated services prioritize the involvement of internal ecosystem actors and operational functions. Accessing their knowledge, skills, and market penetration of the internal ecosystem is essential. For example, they can obtain the skills of the operations in which they are less competent. Ecosystem actors can utilize the support to create a synergy of ecosystem knowledge by gathering knowledge related to the operations, assessing and selecting potential partners, and exploring knowledge complementarities with other ecosystem actors. In this context, an operational ecosystem requires formal collaboration with experienced actors to integrate and jointly exploit digital technologies in the ecosystem.

Finally, the third servitization path is collaborative servitization, a complex and resource-intensive path requiring the involvement in a platform ecosystem. This means that ecosystem actors must strengthen their ecosystem management capabilities and improve their service and operational ecosystem to reap the benefits of collaborative servitization. Ecosystem actors simultaneously need to rapidly build the capacity to carry out service and operational ecosystem activities and become somewhat flexible. It is a high-risk, high-reward strategy. All ecosystem actors do not need to adopt, as we argue that ecosystem actors need to choose their path according to their requirements and markets.

Organizations must decide about their priorities in servitization. We have discussed three types of servitization paths that can assist them in succeeding in servitization. Each path has different characteristics.

Pathway 1: To gain a competitive edge in the market, firms may develop and offer advanced services prioritizing customer-centricity. Advanced services can lead to complexities in the service delivery process, necessitating the efficiency of the internal ecosystem to handle them, which requires ecosystem management capabilities.

Pathway 2: To gain efficiency in their operations, firms may choose to develop and offer integrated services that prioritize streamlining service delivery. Similar to advanced services, integrated services can lead to complexities in the operational ecosystem, necessitating new actors in the internal ecosystem to deal with them, which requires ecosystem management capabilities.

Pathway 3: For co-creating opportunities, firms could prioritize their choice in understanding the importance of collaborative services for fully realizing the potential of servitization. It comes up with the challenges in ecosystem management; require platform ecosystem, external ecosystem, and more diverse actors which bring the opportunity of developing and offering collaborative services – thus enabling collaborative servitization.

Ecosystem actors can involve themselves in the required ecosystem typologies by understanding these three servitization pathways and process frameworks. Furthermore, we found several challenges for ecosystem management actors in the servitization journey. The challenges are process management, quality management, capacity management, cost management, integration management, actors' coordination, operational agility, data-driven services, monitoring, autonomy, and optimization involving diverse ecosystems. We found that addressing these complexities can be well organized in the platform ecosystem, facilitating its deployment and allowing it to evolve.

Our findings underscore that ecosystem management propelled each other towards servitization. Ecosystem actors can stay competitive with diverse industry 4.0 technologies (Kolagar, 2024; Smania et al., 2024). It requires the development of new capabilities and practices for managing the evolving ecosystem. This research identified the routines and practices that will go under alteration under each platform well documented above. Furthermore, this research sought to uncover the composition and nature of ecosystem management capabilities. It explored the underlying capabilities, routines, and practices of ecosystem management actors in servitization initiatives: EAFI, EATI, and EI. We detailed 03 thematic routines (2nd-order categories) and their 09 subcategories (1st-order categories), underlying these routines and capabilities from personalized services to big data analytics. Figure 11 illustrate the overall findings in ecosystem management, underscoring the reconfiguration and role of capabilities and practices in managing the collaborated servitization.

5.2 Theoretical and managerial implication

We extend servitization literature at the meso-level, focusing on the ecosystem perspective. We examine the underlying mechanism that shows how ecosystem management actors can adapt and reconfigure their capabilities, routines, and practices to capitalize on servitization successfully. The contribution of this research is three fold.

First, our research encompasses three primary servitization pathways: advanced services, integrated services, and collaborative services. We have emphasized that collaborative services encompass other two service types and are more effective. The challenges related to each service type are well documented; addressing them is essential for servitization success.

Second, addressing the challenge in the servitization journey includes adaptation of three ecosystem capabilities: EAFI, EATI, and EI. These capabilities are crucial for adequately providing ecosystem services, particularly in advancing ecosystem management. Our research indicated that ecosystem actors must concentrate on targeted initiatives owing to their constrained internal resources. The advancement of these capabilities can facilitate the successful resolution of challenges and strengthen collaborations within the ecosystem.

Third, we have identified three distinct types of ecosystem management: service ecosystems, operational ecosystems, and platform ecosystems. These categories illustrate each actor involvement in ecosystem management varies according to the requirement of services. The process framework we established has explained the interrelationships among these types, the servitization paths, and their capabilities to facilitate ecosystem management. Consequently, our research presents significant theoretical advancements to the current ecosystem management and servitization literature.

This research serves as a novel managerial contribution by providing managers with guidelines on capitalizing on servitization using the proposed process framework. Orchestrating managers must advance their ecosystem management capabilities for mutual servitization success (Alghisi & Saccani, 2014). Managers and leaders in ecosystem management can adopt this new perspective to understand better how firms can adapt, survive, and thrive in a rapidly evolving market. In this regard, the managerial implication of this research is twofold. First, ecosystem actors can use the process framework to analyze their ecosystem management capabilities and ecosystem management typologies. They need to identify their current positioning concerning the services they are delivering to each other.

Moreover, ecosystem actors can also learn the importance of each ecosystem typologies for delivering different services. Indeed, ecosystem managers and leaders (orchestrating) must constantly evaluate their requirements, needs, and opportunities in an evolving market. With this framework in mind, they will be able to conceptualize their strategy for promoting their servitization pathways and better understand how ecosystem actors influence them. Second, we offered guidance to ecosystem management actors, emphasizing that there is no one-size-fits-all path for successful servitization. For example, ecosystem actors that depend on others should identify their common goals by analyzing the proposed ecosystem typologies, service types, and capabilities requirements to realize the potential of servitization.

5.3 Future research and limitations

This research is not without limitations. We focused on single ecosystem management (B2B manufacturing firms) to build novel insights into the ecosystem management and servitization stream. However, a larger data set (diverse ecosystem) is needed to avoid the generalizability of our findings.

We propose the possibility of future research. First, future research could focus on how documented ecosystem management capabilities influence ecosystem servitization performances through a quantitative method. Furthermore, a longitudinal study is advised to detail the adaptation and reconfiguration of routines and practices in ecosystem management for servitization. To extend our findings, the interesting investigation is to analyse how documented ecosystem management capabilities vary at different ecosystem typologies and services. Lastly, we found aggregate dimensions essential for servitization success in an ecosystem context; future research could combine these themes to study the stepwise progression model of servitization.

REFERENCES

Adrodegari, F., & Saccani, N. (2020). A maturity model for the servitization of product-centric companies. *Journal of Manufacturing Technology Management*, *31*(4), 775–797. Scopus. https://doi.org/10.1108/JMTM-07-2019-0255

Agenzia Nova. (2024). *In 2023 the South is growing more than the North, the Center is stagnating: Svimez data—Agenzia Nova*. https://www.agenzianova.com/en/news/nel-2023-il-sud-cresce-piu-del-nord-in-stagnazione-il-centro-i-dati-della-svimez/

Alghisi, A., & Saccani, N. (2014). *Development of a Knowledge Management framework to support installed base information management practices in a servitized context*. 28.

Ambrogio, G., Filice, L., Longo, F., & Padovano, A. (2022). Workforce and supply chain disruption as a digital and technological innovation opportunity for resilient manufacturing systems in the COVID-19 pandemic. *Computers & Industrial Engineering*, *169*, 108158. https://doi.org/10.1016/j.cie.2022.108158

Ardolino, M., Saccani, N., & Perona, M. (2015, May). *The impact of digital technologies and ecosystems on the servitizazion of companies: A preliminary analysis*.

Arzubiaga, U., De, M. A., Kammerlander, N., & Hoy, F. (2022). Knowledge management in family firms: Opening the black box and suggestions for future research. *Journal of Knowledge Management*, *26*(2), 269–290. https://doi.org/10.1108/JKM-03-2022-924

Asplund, F., Björk, J., Magnusson, M., & Patrick, A. J. (2021). The genesis of public-private innovation ecosystems: Bias and challenges☆. *Technological Forecasting and Social Change*, *162*, 120378. https://doi.org/10.1016/j.techfore.2020.120378

Autio, E. (2022). Orchestrating ecosystems: A multi-layered framework. *Innovation*. https://www.tandfonline.com/doi/abs/10.1080/14479338.2021.1919120

Baik, K., Kim, K. Y., & Patel, P. C. (2019). The internal ecosystem of high performance work system and employee service-providing capability: A contingency approach for servitizing firms. *Journal of Business Research*, *104*, 402–410. https://doi.org/10.1016/j.jbusres.2019.02.028

Baines, T., & Lightfoot, H. (2013). *Made to Serve: How Manufacturers can Compete Through Servitization and Product Service Systems*. John Wiley & Sons.

Baines, T., Lightfoot, H., Peppard, J., Johnson, M., Tiwari, A., Shehab, E., & Swink, M. (2009). Towards an operations strategy for product-centric servitization. *International Journal of Operations & Production Management*, *29*(5), 494–519. https://doi.org/10.1108/01443570910953603

Baines, T., Ziaee Bigdeli, A., Bustinza, O. F., Shi, V. G., Baldwin, J., & Ridgway, K. (2017). Servitization: Revisiting the state-of-the-art and research priorities. *International Journal of Operations & Production Management*, *37*(2), 256–278. https://doi.org/10.1108/IJOPM-06-2015-0312

Baines, T., Ziaee Bigdeli, A., & Kapoor, K. (2024). *Servitization Strategy: Delivering Customer-Centric Outcomes Through Business Model Innovation*. Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-45426-4

Barrett, B. J. (2019). Equifinality in empirical studies of cultural transmission. *Behavioural Processes*, *161*, 129–138. https://doi.org/10.1016/j.beproc.2018.01.011

Bastl, M., Johnson, M., Lightfoot, H., & Evans, S. (2012). Buyer-supplier relationships in a servitized environment: An examination with Cannon and Perreault's framework. *International Journal of Operations and Production Management*, *32*(6), 650–675. Scopus. https://doi.org/10.1108/01443571211230916

Benitez, G. B., Ayala, N. F., & Frank, A. G. (2020). Industry 4.0 innovation ecosystems: An evolutionary perspective on value cocreation. *International Journal of Production Economics*, *228*, 107735. https://doi.org/10.1016/j.ijpe.2020.107735

Ben-Menahem, S. M., von Krogh, G., Erden, Z., & Schneider, A. (2016). Coordinating Knowledge Creation in Multidisciplinary Teams: Evidence from Early-Stage Drug Discovery. *Academy of Management Journal*, *59*(4), 1308–1338. https://doi.org/10.5465/amj.2013.1214

Berg, T., & Madsen, D. Ø. (2020). The evolution of a management control package: A retrospective case study. *Journal of Applied Accounting Research*, *21*(4), 763–781. https://doi.org/10.1108/JAAR-10-2019-0148

Brax, S. A., Calabrese, A., Levialdi Ghiron, N., Tiburzi, L., & Grönroos, C. (2021). Explaining the servitization paradox: A configurational theory and a performance measurement framework. *International Journal of Operations & Production Management*, *41*(5), 517–546. https://doi.org/10.1108/IJOPM-08-2020-0535

Brodeur, J. (2022). *Gestion de la transformation 4.0 au sein des PME manufacturières* [Phd, Polytechnique Montréal]. https://publications.polymtl.ca/10791/

Bustinza, O. F., Bigdeli, A. Z., Baines, T., & Elliot, C. (2015). Servitization and Competitive Advantage: The Importance of Organizational Structure and Value Chain Position. *Research-Technology Management*, *58*(5), 53–60. https://doi.org/10.5437/08956308X5805354

Cefis, E., & Orsenigo, L. (2001). The persistence of innovative activities: A cross-countries and cross-sectors comparative analysis. *Research Policy*, *30*(7), 1139–1158. https://doi.org/10.1016/S0048-7333(00)00139-6

Chiarini, A. (2020). Industry 4.0, quality management and TQM world. A systematic literature review and a proposed agenda for further research. *The TQM Journal*, *32*(4), 603–616. https://doi.org/10.1108/TQM-04-2020-0082

Chiu, W.-H., Dai, Z.-J., & Chi, H.-R. (2023). Mastering customer lock-in by servitization innovation strategies of asset specificity. *Journal of Business & Industrial Marketing*, *38*(13), 239–263. https://doi.org/10.1108/JBIM-02-2023-0121

Crowley, E., Burton, J., & Zolkiewski, J. (2018). Servitization intent as a factor in the servitization process. *Journal of Business & Industrial Marketing*, *33*(8), 1125–1140. https://doi.org/10.1108/JBIM-08-2016-0199

Dahmani, S., Boucher, X., Peillon, S., & Besombes, B. (2016). A reliability diagnosis to support servitization decision-making process. *Journal of Manufacturing Technology Management*, *27*(4), 502–534. https://doi.org/10.1108/JMTM-06-2015-0044

Davies, P., Liu, Y., Cooper, M., & Xing, Y. (2023). Supply chains and ecosystems for servitization: A systematic review and future research agenda. *International Marketing Review*, *40*(4), 667–692. Scopus. https://doi.org/10.1108/IMR-10-2021-0318

Dubruc, N. (2014). The Impact of Servitization on Corporate Culture. *Procedia CIRP*.

Ferraresi, T., & Ghezzi, L. (2024, April 15). *Tuscany's exports. Balance 2023*. Irpet. https://www.irpet.it/en/tuscanys-exports-balance-2023/

Ferrari, E., Gamberi, M., Pilati, F., & Regattieri, A. (2018). Motion Analysis System for the digitalization and assessment of manual manufacturing and assembly processes. *IFAC-PapersOnLine*, *51*(11), 411–416. https://doi.org/10.1016/j.ifacol.2018.08.329

Ferrari, G., Zhao, Y., Jiménez, J. M., & Secondi, L. (2024). The economy of Tuscany in the post Covid-19 era: Struggling with energy crisis and inflation. What to do to resume the journey?[1]. *National Accounting Review*, *6*(1), 1–26. https://doi.org/10.3934/NAR.2024001

Fiorini, N., Pucci, T., Casprini, E., & Zanni, L. (2023). The actors' role in industrial districts facing the challenge of technologies 4.0 between absorption and dissemination. *European Planning Studies*, *31*(7), 1377–1396. https://doi.org/10.1080/09654313.2022.2161299

Fliess, S., & Lexutt, E. (2019). How to be successful with servitization – Guidelines for research and management. *Industrial Marketing Management*, *78*, 58–75. https://doi.org/10.1016/j.indmarman.2017.11.012

Foote, N. W., Galbraith, J., Hope, Q., & Miller, D. (2001). Making solutions the answer. *The McKinsey Quarterly*, *3*, 84.

Forkmann, S., Henneberg, S. C., Witell, L., & Kindström, D. (2017). Driver Configurations for Successful Service Infusion. *Journal of Service Research*, *20*(3), 275–291. https://doi.org/10.1177/1094670517706160

Friesenbichler, K. S., & Kügler, A. (2022). Servitization across countries and sectors: Evidence from world input-output data. *Economic Systems*, *46*(3), 101014. https://doi.org/10.1016/j.ecosys.2022.101014

Fu, W., Zhang, M., Zhao, X., & Jia, F. (2022). Interplay between servitization and platforms: A longitudinal case study. *International Journal of Operations & Production Management*, *42*(4), 471–499. https://doi.org/10.1108/IJOPM-02-2021-0067

Gaiardelli, P., & Songini, L. (2020). Successful business models for service centres: An empirical analysis. *International Journal of Productivity and Performance Management*, *70*(5), 1187–1212. https://doi.org/10.1108/IJPPM-05-2019-0230

García, L. N. (2018). Fashion: Cultural Heritage and the \textlessem\textgreaterMade in\textless/em\textgreater. *ZoneModa Journal*, *8*(1), 63–75. https://doi.org/10.6092/issn.2611-0563/8222

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

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, *16*(1), 15–31. https://doi.org/10.1177/1094428112452151

Giudici, A., Reinmoeller, P., & Ravasi, D. (2018). Open-System Orchestration as a Relational Source of Sensing Capabilities: Evidence from a Venture Association. *Academy of Management Journal*, *61*(4), 1369–1402. https://doi.org/10.5465/amj.2015.0573

Gomes, L. A. D. V., Facin, A. L. F., Leal, L. F., Zancul, E. D. S., Salerno, M. S., & Borini, F. M. (2022). The emergence of the ecosystem management function in B2B firms. *Industrial Marketing Management*, *102*, 465–487. https://doi.org/10.1016/j.indmarman.2021.12.015

Grandinetti, R., Ciasullo, M. V., Paiola, M., & Schiavone, F. (2020). Fourth industrial revolution, digital servitization and relationship quality in Italian B2B manufacturing firms. An exploratory study. *The TQM Journal*, *32*(4), 647–671. https://doi.org/10.1108/TQM-01-2020-0006

Gregori, G. L. (2016). *Made in Italy: Una lettura critica fra eredi virtuosi e dissipatori*. Società editrice il Mulino.

Grönlund, J., Sjödin, D. R., & Frishammar, J. (2010). Open Innovation and the Stage-Gate Process: A Revised Model for New Product Development. *California Management Review*, *52*(3), 106–131. https://doi.org/10.1525/cmr.2010.52.3.106

Grubic, T. (2014). Servitization and remote monitoring technology: A literature review and research agenda. *Journal of Manufacturing Technology Management*, *25*(1), 100–124. https://doi.org/10.1108/JMTM-05-2012-0056

Gunasekaran, A., Subramanian, N., & Rahman, S. (2017). Improving supply chain performance through management capabilities. *Production Planning & Control*, *28*(6–8), 473–477. https://doi.org/10.1080/09537287.2017.1309680

Hakanen, T., Helander, N., & Valkokari, K. (2017). Servitization in global business-to-business distribution: The central activities of manufacturers. *Industrial Marketing Management*, *63*, 167–178. https://doi.org/10.1016/j.indmarman.2016.10.011

Håkansson, H., & Snehota, I. (Eds.). (2017). *No Business is an Island: Making Sense of the Interactive Business World*. Emerald Publishing Limited. https://doi.org/10.1108/9781787145498

Hao, Z., Liu, C., & Goh, M. (2021). Determining the effects of lean production and servitization of manufacturing on sustainable performance. *Sustainable Production and Consumption*, *25*, 374–389. https://doi.org/10.1016/j.spc.2020.11.018

Heirati, N., Thornton, S. C., Leischnig, A., & Henneberg, S. C. (2024). Capability configurations for successful advanced servitization. *International Journal of Operations and Production Management*. Scopus. https://doi.org/10.1108/IJOPM-03-2023-0226

HERRIOTT, R. E., & FIRESTONE, W. A. (1983). Multisite Qualitative Policy Research: Optimizing Description and Generalizability. *Educational Researcher*, *12*(2), 14–19. https://doi.org/10.3102/0013189X012002014

Humbeck, P., Jaeckle, J. P., Duwe, J., & Bauernhansl, T. (2020). The Business Ecosystem Management Canvas. *2020 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, 249–254. https://doi.org/10.1109/IEEM45057.2020.9309731

Intraligi, V., Vittori, C., & Ricci, A. (2024). Job polarisation in Italy: Routinisation and structural change? *Spatial Economic Analysis*, 1–21. https://doi.org/10.1080/17421772.2023.2298965

Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal*, *39*(8), 2255–2276. https://doi.org/10.1002/smj.2904

Jovanovic, M., Raja, J. Z., Visnjic, I., & Wiengarten, F. (2019). Paths to service capability development for servitization: Examining an internal service ecosystem. *Journal of Business Research*, *104*, 472–485. https://doi.org/10.1016/j.jbusres.2019.05.015

Kamalaldin, A., Linde, L., Sjödin, D., & Parida, V. (2020). Transforming provider-customer relationships in digital servitization: A relational view on digitalization. *Industrial*

Marketing Management, *89*, 306–325. https://doi.org/10.1016/j.indmarman.2020.02.004

Kanatlı, M. A., & Karaer, Ö. (2022). Servitization as an alternative business model and its implications on product durability, profitability & environmental impact. *European Journal of Operational Research*, *301*(2), 546–560. https://doi.org/10.1016/j.ejor.2021.10.052

Kapoor, K., Bigdeli, A. Z., Schroeder, A., & Baines, T. (2022). A platform ecosystem view of servitization in manufacturing. *Technovation*, *118*, 102248. https://doi.org/10.1016/j.technovation.2021.102248

Kapoor, R. (2018). Ecosystems: Broadening the locus of value creation. *Journal of Organization Design*, *7*(1), 12. https://doi.org/10.1186/s41469-018-0035-4

Kindström, D., Kowalkowski, C., & Sandberg, E. (2013). Enabling service innovation: A dynamic capabilities approach. *Journal of Business Research*, *66*(8), 1063–1073. https://doi.org/10.1016/j.jbusres.2012.03.003

Kohtamäki, M., Parida, V., Oghazi, P., Gebauer, H., & Baines, T. (2019). Digital servitization business models in ecosystems: A theory of the firm. *Journal of Business Research*, *104*, 380–392. https://doi.org/10.1016/j.jbusres.2019.06.027

Kohtamäki, M., 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. https://doi.org/10.1016/j.jbusres.2021.08.027

Kohtamäki, M., Rabetino, R., Parida, V., Sjödin, D., & Henneberg, S. (2022). Managing digital servitization toward smart solutions: Framing the connections between technologies, business models, and ecosystems. *Industrial Marketing Management*, *105*, 253–267. https://doi.org/10.1016/j.indmarman.2022.06.010

Kolagar, M. (2024). Orchestrating the ecosystem for data-driven digital services and solutions: A multi-level framework for the realization of sustainable industry. *Business Strategy and the Environment*, *n/a*(n/a). https://doi.org/10.1002/bse.3855

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

Kolagar, M., Reim, W., Parida, V., & Sjödin, D. (2022). Digital servitization strategies for SME internationalization: The interplay between digital service maturity and ecosystem involvement. *Journal of Service Management*, *33*(1), 143–162. Scopus. https://doi.org/10.1108/JOSM-11-2020-0428

Kowalkowski, C., Witell, L., & Gustafsson, A. (2013). Any way goes: Identifying value constellations for service infusion in SMEs. *Industrial Marketing Management*, *42*(1), 18–30. https://doi.org/10.1016/j.indmarman.2012.11.004

Leminen, S., Rajahonka, M., Wendelin, R., Westerlund, M., & Nyström, A.-G. (2022). Autonomous vehicle solutions and their digital servitization business models. *Technological Forecasting and Social Change*, *185*, 122070. https://doi.org/10.1016/j.techfore.2022.122070

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

Leonard-Barton, D. (1990). A dual methodology for case studies: Synergistic use of a longitudinal single site with replicated multiple sites. *Organization Science*, *1*(3), 248–266.

Li, H., Lu, L. bing, & Yang, S. (2024). Servitization level, digital transformation, and enterprise performance of sporting goods manufacturing enterprises in China. *Heliyon*, *10*(13), e33520. https://doi.org/10.1016/j.heliyon.2024.e33520

Lipkin, M., & Heinonen, K. (2022). Customer ecosystems: Exploring how ecosystem actors shape customer experience. *Journal of Services Marketing*, *36*(9), 1–17. https://doi.org/10.1108/JSM-03-2021-0080

Liu, D., Wang, H., Zhong, B., & Ding, L. (2022). Servitization in Construction and its Transformation Pathway: A Value-Adding Perspective. *Engineering*, *19*, 166–179. https://doi.org/10.1016/j.eng.2021.09.013

Martín-Peña, M.-L., Sánchez-López, J.-M., & Díaz-Garrido, E. (2019). Servitization and digitalization in manufacturing: The influence on firm performance. *Journal of Business & Industrial Marketing*, *35*(3), 564–574. https://doi.org/10.1108/JBIM-12-2018-0400

Milanesi, M., Guercini, S., & Tunisini, A. (2020). Exploring SMEs' qualitative growth and networking through formalization. *Competitiveness Review: An International Business Journal*, *30*(4), 397–415. https://doi.org/10.1108/CR-10-2019-0103

Minaya, P. E., Avella, L., & Trespalacios, J. A. (2023). The effects of digital servitization on business competitiveness: A case study of Spanish manufacturers. *Journal of International Entrepreneurship*, *21*(2), 180–213. https://doi.org/10.1007/s10843-023-00333-6

Momeni, K., Vaittinen, E., Jähi, M., & Martinsuo, M. (2023). Introducing smart services: Requirements and interconnections in multi-actor cooperation. *Journal of Business & Industrial Marketing*, *38*(13), 105–121. https://doi.org/10.1108/JBIM-03-2022-0144

Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing. *Operations Management Research*, *1*(2), 103–118. Scopus. https://doi.org/10.1007/s12063-009-0015-5

Pan, S. L., Pan, G., Chen, A. J. W., & Hsieh, M. H. (2007). The Dynamics of Implementing and Managing Modularity of Organizational Routines During Capability Development: Insights From a Process Model. *IEEE Transactions on Engineering Management*, *54*(4), 800–813. https://doi.org/10.1109/TEM.2007.906854

Parida, V., Burström, T., Visnjic, I., & Wincent, J. (2019). Orchestrating industrial ecosystem in circular economy: A two-stage transformation model for large manufacturing companies. *Journal of Business Research*, *101*, 715–725. https://doi.org/10.1016/j.jbusres.2019.01.006

Paschou, T., Rapaccini, M., Adrodegari, F., & Saccani, N. (2020). Digital servitization in manufacturing: A systematic literature review and research agenda. *Industrial Marketing Management*, *89*, 278–292. https://doi.org/10.1016/j.indmarman.2020.02.012

Pinto, H., Guerreiro, J. A., & Fernández-Esquinas, M. (2023). Sources of knowledge in the firm: A review on influential, internal and contextual factors in innovation dynamics. *SN Business & Economics*, *3*(2), 57. https://doi.org/10.1007/s43546-023-00430-7

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

Qi, Y., Mao, Z., Zhang, M., & Guo, H. (2020). Manufacturing practices and servitization: The role of mass customization and product innovation capabilities. *International Journal of Production Economics*, *228*, 107747. https://doi.org/10.1016/j.ijpe.2020.107747

Rabino, S., Simoni, C., & Zanni, L. (2008). Small & Medium Gold & Fashion Enterprises (SMEs) in Arezzo, Italy: Competitive Challenges and Strategic Implications. *Journal of Global Marketing*, *21*(2), 141–159. https://doi.org/10.1080/08911760802135525

Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J., & Gebauer, H. (2019). Servitization: A contemporary thematic review of four major research streams. *Industrial Marketing Management*, *83*, 207–223. https://doi.org/10.1016/j.indmarman.2019.03.015

Ramezani, J., & Camarinha-Matos, L. M. (2019). A collaborative approach to resilient and antifragile business ecosystems. *Procedia Computer Science*, *162*, 604–613. https://doi.org/10.1016/j.procs.2019.12.029

Rialti, R., & Filieri, R. (2024). Leaders, let's get agile! Observing agile leadership in successful digital transformation projects. *Business Horizons*, *67*(4), 439–452. https://doi.org/10.1016/j.bushor.2024.04.003

Ricciardi, A. (2013). I distretti industriali italiani: Recenti tendenze evolutive (Italian industrial districts: recent evolutionary trends). *Sinergie Italian Journal of Management*, *31*(May-Aug), Article May-Aug. https://doi.org/10.7433/s91.2013.03

Ruff, M., & Woschank, M. (2022). Industry 4.0 as an Enabler of Servitization in the Plant Engineering Business: Literature Review and Development of a Conceptual Research Model. *Procedia Computer Science*, *200*, 833–842. https://doi.org/10.1016/j.procs.2022.01.280

Saccani, N., Visintin, F., & Rapaccini, M. (2014). Investigating the linkages between service types and supplier relationships in servitized environments. *International Journal of Production Economics*, *149*, 226–238. Scopus. https://doi.org/10.1016/j.ijpe.2013.10.001

Schlesinger, T., Klenk, C., & Nagel, S. (2015). How do sport clubs recruit volunteers? Analyzing and developing a typology of decision-making processes on recruiting volunteers in sport clubs. *Sport Management Review*, *18*(2), 193–206. https://doi.org/10.1016/j.smr.2014.04.003

Seidman, I. (2005). *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences, 3rd Edition* (3rd edition). Teachers College Pr.

Sjödin, D., Liljeborg, A., & Mutter, S. (2024). Conceptualizing ecosystem management capabilities: Managing the ecosystem-organization interface. *Technological Forecasting and Social Change*, *200*, 123187. https://doi.org/10.1016/j.techfore.2023.123187

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

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

Smania, G. S., Ayala, N. F., Coreynen, W., & Mendes, G. H. S. (2024). Data-related tensions in digital servitization ecosystems: A systematic literature review. *Industrial Marketing Management*, *123*, 31–48. Scopus. https://doi.org/10.1016/j.indmarman.2024.09.002

Stavros, C., & Westberg, K. (2009). Using triangulation and multiple case studies to advance relationship marketing theory. *Qualitative Market Research: An International Journal*, *12*(3), 307–320. https://doi.org/10.1108/13522750910963827

Thomas, L. D. W., Autio, E., & Gann, D. M. (2014). Architectural Leverage: Putting Platforms in Context. *Academy of Management Perspectives*, *28*(2), 198–219.

Trading Economics. (2024). *Italy—Manufacturing, Value Added (% Of GDP)—2024 Data 2025 Forecast 1990-2023 Historical*. https://tradingeconomics.com/italy/manufacturing-value-added-percent-of-gdp-wb-data.html

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

Tsujimoto, M., Kajikawa, Y., Tomita, J., & Matsumoto, Y. (2018). A review of the ecosystem concept—Towards coherent ecosystem design. *Technological Forecasting and Social Change*, *136*, 49–58. https://doi.org/10.1016/j.techfore.2017.06.032

Vargo, S. L., Wieland, H., & Akaka, M. A. (2015). Innovation through institutionalization: A service ecosystems perspective. *Industrial Marketing Management*, *44*, 63–72. https://doi.org/10.1016/j.indmarman.2014.10.008

Veile, J. W., Schmidt, M.-C., & Voigt, K.-I. (2022). Toward a new era of cooperation: How industrial digital platforms transform business models in Industry 4.0. *Journal of Business Research*, *143*, 387–405. https://doi.org/10.1016/j.jbusres.2021.11.062

Visnjic, I., Wiengarten, F., & Neely, A. (2016). Only the Brave: Product Innovation, Service Business Model Innovation, and Their Impact on Performance. *Journal of Product Innovation Management*, *33*(1), 36–52. Scopus. https://doi.org/10.1111/jpim.12254

Vitulano, D. (2023, October 30). Italian Artisan: «Italian manufacturers and contractors from the fashion world». *Lampoon Magazine*. https://lampoonmagazine.com/article/2023/10/30/italian-artisan-the-first-made-in-italy-b2b-fashion-platform-collaborates-with-prototipo-studio/

Vuletic, T., Whitfield, R. I., Wang, W., Duffy, A., Gatchell, S., Prins, H., & Leer-Andersen, M. (2017). Improving the creation and management of collaborative networks within the European maritime sector. *Journal of Industrial Information Integration*, *8*, 22–37. https://doi.org/10.1016/j.jii.2017.05.002

Wang, J., Zhang, K., Lin, K.-Y., & Feng, L. (2022). A systematic review for organizing servitization by multi-actor collaborations: Lenses, factors and outcomes. *Journal of*

Business & Industrial Marketing, *38*(4), 828–851. https://doi.org/10.1108/JBIM-07-2021-0355

Wasserbaur, R., Schroeder, A., & Beltagui, A. (2024). Heat-as-a-Service (HaaS): A Complex Adaptive Systems perspective on servitization. *Production Planning & Control*. https://www.tandfonline.com/doi/abs/10.1080/09537287.2023.2189639

Yin, R. K. (2008). *Case Study Research: Design and Methods* (4th edition). SAGE Publications, Inc.

Zhang, K., Feng, L., Wang, J., Lin, K.-Y., & Li, Q. (2023). Servitization in business ecosystem: A systematic review and implications for business-to-business servitization research. *Technology Analysis & Strategic Management*, *35*(11), 1480–1496. https://doi.org/10.1080/09537325.2021.2010698

Zhang, X., Balaji, M. S., & Jiang, Y. (2024). Charting the future of digital servitization using CIMO framework. *International Studies of Management & Organization*. https://www.tandfonline.com/doi/abs/10.1080/00208825.2024.2372461

Zhou, D., Yan, T., Zhao, L., & Guo, J. (2020). Performance implications of servitization: Does a Manufacturer's service supply network matter? *International Journal of Production Economics*, *219*, 31–42. https://doi.org/10.1016/j.ijpe.2019.05.019

Ziaee Bigdeli, A., Baines, T., Bustinza, O. F., & Guang Shi, V. (2017). Organisational change towards servitization: A theoretical framework. *Competitiveness Review: An International Business Journal*, *27*(1), 12–39. https://doi.org/10.1108/CR-03-2015-0015

Zott, C., & Amit, R. (2013). The business model: A theoretically anchored robust construct for strategic analysis. *Strategic Organization*, *11*(4), 403–411. https://doi.org/10.1177/1476127013510466

Zott, C., Amit, R., & Massa, L. (2011). The Business Model: Recent Developments and Future Research. *Journal of Management*, *37*(4), 1019–1042. https://doi.org/10.1177/0149206311406265

Appendix

Appendix A: Response details

Response Code	Gender	Designation	Experience	Interview date	Interview duration
Firm A					
R15	Female	Senior product development and customer care	3	1/12/2023	15 Minutes, 31 seconds
R5	Female	Production development specialist	12	1/12/2023	38 Minutes, 49 Seconds
R6	Male	Head of production	43	1/12/2023	51 Minutes, 00 Seconds
R8	Male	Head of inventory	9	1/12/2023	37 Minutes, 03 Seconds
R7	Female	Quality control clerk	6	1/12/2023	24 Minutes, 19 Seconds
R11	Male	Production planning manager	1	7/12/2023	25 Minutes, 58 Seconds
R9	Female	Administration	10	7/12/2023	62 Minutes, 12 Seconds
R19	Female	Production clerk	5	7/12/2023	66 Minutes, 02 Seconds
R10	Female	Head of quality control	28	7/12/2023	56 Minutes, 19 Seconds
R13	Male	Production clerk	2	12/12/2023	40 minutes, 34 Seconds
R12	Male	Production clerk	20	12/12/2023	22 Minutes, 21 Seconds
R14	Male	Technical object and accessories production	1	12/12/2023	56 Minutes, 05 Seconds
Firm B					
R4	Female	Leather Goods Expert Consultant	5	23/11/2023	21 Minutes, 50 Seconds
R3	Female	Quality control Expert	3	23/11/2023	40 Minutes, 10 seconds
R2	Female	Supervisor	5	23/11/2023	54 Minutes, 53 Seconds
Firm C					
R18	Male	Customer Service and care	7	19/12/2023	
R19	Male	QHSE Coordinator	9	19/12/2023	87 Minutes, 22 Seconds
R20	Female	Operations	3	19/12/2023	

Firm D					
R16	Male	Ownner (C.E.O)	10	19/12/2023	23 Minutes, 47 Seconds
R17	Female	Co-owner (C.E.O)	10	19/12/2023	