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Understanding collaboration in servitization literature: A meta-synthesis of qualitative research

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ABSTRACT

This study investigates how multi-actor collaboration unfolds over time in servitization, where manufacturers increasingly rely on networks of customers, suppliers, and technology partners. Although significant research has examined collaboration in the context of servitization, we still know little about how multi-actor collaboration evolves in this context. Through a qualitative meta-synthesis study of 57 qualitative case studies, our analysis identifies preconditions and three phases – initiation, routinization, and learning and adaptation – each shaped by shifting structural, relational, and cognitive mechanisms. The study contributes by developing a process model of multi-actor collaboration in servitization, showing how mechanisms generate consequences that reshape collaboration over time. It further advances a temporal view of collaboration governance by explaining how structural, relational, and cognitive mechanisms are repeatedly recombined as actor roles, dependencies, and value logics change. For managers, the findings suggest the need to clarify roles, value-sharing agreements, data access, and governance arrangements as servitization networks expand and mature.

1. Introduction

Servitization refers to the strategic transition from product-centric to service-oriented business models, where value is delivered through integrated product-service offerings (Baines et al., 2009; Vandermerwe & Rada, 1988). Recently, digital technologies such as the Internet of Things (IoT), artificial intelligence (AI) (Sjödin, Parida, & Kohtamäki, 2023), cloud computing, and predictive analytics have emerged as key enablers of servitization (Lenka, Parida, & Wincent, 2017), increasing the potential of servitization and driving significant changes in manufacturers' strategies, operations, value chains, and business models (Rabetino, Kohtamäki, Brax, & Sihvonen, 2021). Often referred to as digital servitization (Kohtamäki, Rabetino, Parida, Sjödin, & Henneberg, 2022), this shift requires reconfiguring collaborations since value-creating activities are embedded in a broader constellation of actors.

This paper focuses specifically on inter-organizational collaboration, i.e., collaboration between two or more external organizations that work jointly to achieve shared objectives (Roehrich, Kalra, Squire, & Davies, 2023). For example, manufacturers may collaborate with service partners and customers to ensure responsive, high-quality service (Raja & Frandsen, 2017). At the same time, they collaborate with technology providers to co-create digital service innovations, such as predictive maintenance (Momeni, Raddats, & Martinsuo, 2023). Moreover, some manufacturers are also exploring platform-based solutions in collaboration with other manufacturers, suppliers, and platform providers to expand services and develop new forms of value (Kapoor et al., 2021).

Collaboration in servitization differs from other inter-organizational settings because value is created through ongoing service provision, close integration into customers' operational processes, and increasing reliance on digital and data-based resources and capabilities (Warraich, Huikkola, Kohtamäki, Kraus, & Talaoui, 2026). First, servitization involves shifting and overlapping roles. For example, manufacturers play multiple roles simultaneously, including equipment provider, service provider, data integrator, and intermediary (Kamalaldin, Linde, Sjödin, & Parida, 2020). The same may apply to the customer; while they are equipment users, they may take the role of co-creator, data producer, etc. (Raja & Frandsen, 2017). These shifting roles may change the power structures and dependencies between actors. Second, digital technologies change the relationships as they may create new dependencies, tensions, and power dynamics (Sklyar, Kowalkowski, Tronvoll, & Sörhammar, 2019). Third, these collaborative arrangements are shaped by diverse goals, ranging from innovation and customization to

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operational efficiency and long-term support.

Although significant research has been conducted on collaboration in the context of servitization, previous studies still predominantly adopt a single-actor design. Some servitization scholars have recently acknowledged the importance of multi-actor collaboration, which is gaining prominence in the servitization literature (Dalenogare, Le Dain, Ayala, Pezzotta, & Frank, 2023). Studies examine collaboration among various actor relationships, such as those involving suppliers (Löfberg, Witell, & Gustafsson, 2015), customers (Kamalaldin et al., 2020), and technology providers (Dalenogare et al., 2023). These studies have also addressed specific mechanisms, such as managing challenges and tensions (Reim, Andersson, & Eckerwall, 2023; Stegehuis, Von Raesfeld, & Nieuwenhuis, 2023), knowledge sharing (Hakanen, 2014), or partner alignment (Raja & Frandsen, 2017). Previous studies have also identified emerging challenges, such as collaboration fatigue, tensions in data transparency, and uneven capability development across partners (Reim et al., 2023; Tóth et al., 2022). Differences in incentives, expertise, governance structures, and trust create challenges that affect the success of servitization (Smania, Osiro, Ayala, Coreynen, & Mendes, 2024).

To understand multi-actor collaboration in servitization, scholars have adopted various theoretical perspectives, including supply chain management (Finne & Holmström, 2013), business networks (Jaakkola & Hakanen, 2013), service ecosystems (Kolagar, Reim, Parida, & Sjödin, 2022), governance (Kamalaldin et al., 2020), and strategic alliances (Xing, Liu, Tarba, & Cooper, 2017), resulting in varied definitions and focal points. However, we still know little about how multi-actor collaboration dynamics work in the servitization context; in particular, 'how' collaboration evolves and 'why' collaboration shifts and develops over time. Answering these questions requires taking the process perspective (Langley, Smallman, Tsoukas, & Van De Ven, 2013). While the value of adopting a process theory approach to study the dynamic challenges in various phases of servitization has been acknowledged in the previous research (Kohtamäki, Rabetino, Einola, Parida, & Patel, 2021; Sun & Oliva, 2025), the collaboration in servitization has often been studied as a cross-sectional study and through a typology approach (Dalenogare et al., 2023; Kamalaldin, Sjödin, Hullova, & Parida, 2021). Moreover, existing servitization research has mainly adopted a mechanism-based or practice-based view of collaboration, examining mechanisms such as co-creation (Sjödin, Parida, Kohtamäki, & Wincent, 2020), joint learning (Huikkola, Ylimäki, & Kohtamäki, 2013), or capability development (Momeni, Raddats, & Martinsuo, 2023) in relative isolation. Applying a process perspective allows us to reframe collaboration mechanisms as interconnected elements whose interactions change over time.

This study aims to address this gap by understanding *how multi-actor collaboration unfolds over time in servitization*. In doing so, we employ a meta-synthesis approach to examine qualitative studies within the servitization literature systematically (Hoon, 2013), seeking to identify, compare, and integrate key insights into the conceptualization and execution of collaboration in this field, and to uncover emergent patterns and avenues for further research. Servitization research is characterized mainly by in-depth single- or multiple-case studies (Rabetino, Harmsen, Kohtamäki, & Sihvonen, 2018). Although the rich context provided by qualitative studies is a strength of the field, there remains a need for synthesis to build a more coherent understanding of collaboration and to consolidate the growing body of servitization research (Rabetino et al., 2021). In contrast to meta-analyses, which typically deductively evaluate hypotheses based on correlation coefficients in a set of quantitative articles (Wang, Lai, & Shou, 2018), a qualitative-based meta-synthesis enables the interpretive integration of empirical evidence, preserving the depth and contextual details of the original studies (Lazazzara, Tims, & De Gennaro, 2020).

The contributions of this study to the literature on servitization and inter-organizational collaboration are threefold. First, it develops a process model of multi-actor collaboration in servitization. Prior research has provided valuable insights into collaboration practices, such as co-creation, joint learning, partner alignment, knowledge sharing, and capability development (Huikkola et al., 2013; Sjödin et al., 2020; Story, Raddats, Burton, Zolkiewski, & Baines, 2017). However, these insights remain fragmented because they are often examined as separate mechanisms or as a static view linking antecedents to outcomes (Wang, Zhang, Lin, & Feng, 2023). This study synthesizes these findings into a process framework that links collaboration preconditions, mechanisms, and consequences over time (Habersang & Reihlen, 2025). In doing so, the study identifies key mechanisms and explains how their interactions shape later phases of collaboration.

Second, the study advances a temporal view of collaboration governance in servitization (Langley et al., 2013). Existing research frequently frames governance as a choice between structural and relational mechanisms or as a gradual shift from contractual arrangements to trust-based collaboration (Kamalaldin et al., 2020; Sjödin, Parida, & Kohtamäki, 2019). In contrast, this research demonstrates that collaboration in servitization requires ongoing reconfiguration. As actors progress from initiation through routinization and learning and adaptation, they renegotiate roles, power dynamics, data-sharing agreements, and relational commitments (Datta, 2020; Raja & Frandsen, 2017; Robinson, Chan, & Lau, 2016).

Third, the study extends broader theories of inter-organizational collaboration and governance by showing how collaborative arrangements develop when actors must share resources they also seek to protect (Krystallis, Kalra, & Locatelli, 2025; Roehrich, Selviaridis, Kalra, Van Der Valk, & Fang, 2020). Servitization requires firms to share data, capabilities, service knowledge, and customer access, yet these same resources shape power, control, and value capture (Dalenogare et al., 2023; Smania, Osiro, et al., 2024). This context, therefore, reveals collaboration tensions that are less visible in more stable collaboration settings; for example, openness may enable value creation while increasing dependence, trust may support coordination while weakening safeguards, and joint value creation may coexist with conflict over value capture (Rantala, Ukko, Nasiri, & Saunila, 2023; Tóth et al., 2022). By explaining how actors reconfigure collaboration over time, the study offers a new path for examining collaboration as an ongoing balancing of openness, control, and trust.

2. Theoretical background

2.1. Multi-actor collaboration in servitization

Servitization refers to the transition from creating value through products to generating value through services (Baines & Lightfoot, 2013). This shift often requires the close integration of physical products with service processes and customer outcomes (Ulaga & Reinartz, 2011). These changes challenge traditional firm boundaries and require new types of collaboration between organizations (Kohtamäki, Parida, Oghazi, Gebauer, & Baines, 2019). Service development increasingly necessitates collaboration between firms and external partners, such as customers and downstream intermediaries, to co-create, customize, and innovate service offerings (Sjödin et al., 2020). On the other hand, service delivery relies on continuous coordination among various stakeholders to guarantee quality, responsiveness, and customer value-in-use (Story et al., 2017).

Servitization research has generally focused on manufacturer-customer dyads. These dyadic relationships have emphasized long-term relationships, value co-creation, and contractual arrangements (Grandinetti, Ciasullo, Paiola, & Schiavone, 2020). Triadic structures have received growing attention, particularly in studies exploring how manufacturers coordinate with customers and intermediaries, such as external service providers (Finne & Holmström, 2013; Momeni, Vaittinen, Jähi, & Martinsuo, 2023). The emergence of digital technologies, such as IoT, Artificial Intelligence (AI), and cloud platforms, has created new forms of interdependence, necessitating collaboration with a diverse range of actors (Sklyar et al., 2019). These developments

reflect a broader shift from linear supply chains to networked and ecosystem-based value-creation models, in which collaboration spans organizational boundaries (Kohtamäki et al., 2022). In particular, manufacturers have become increasingly dependent on the digital capabilities of technology providers, such as software companies and data analytics firms, to develop innovative digital services, including predictive maintenance and automation solutions (Momeni, Raddats, & Martinsuo, 2023). This collaboration requires real-time data sharing and interoperability, raising concerns about trust, transparency, and infrastructure compatibility among firms (Galvani & Bocconcelli, 2022). These digital interdependencies and concerns frequently give rise to tensions related to data ownership, control, and value capture (Smania, Ayala, Coreynen, & Mendes, 2024). Thus, these collaborations are not only about asset sharing but more about aligning intangible infrastructures, mindsets, business logics, and innovation pathways (Sgambaro, Chiaroni, & Urbinati, 2024; Töytäri et al., 2018; Wang et al., 2023). The dyadic, triadic, and more complex network models reflect different logics of collaboration, highlighting the complexity of mapping the collaboration process. This consideration includes differences in governance modes, coordination intensity, and mutual dependencies across these configurations.

2.2. Overview of multi-actor collaboration theoretical background

In this study, collaboration refers to purposive inter-organizational relationships aimed at completing tasks effectively and achieving jointly determined goals (Roehrich et al., 2023). The servitization literature reflects on collaboration through multiple conceptual perspectives, including supply chain management (Finne & Holmström, 2013), business networks (Jaakkola & Hakanen, 2013), service ecosystems (Kolagar et al., 2022), governance (Kamalaldin et al., 2020), and strategic alliances (Xing et al., 2017), resulting in varied definitions and focal points. Considering this complexity, studying collaboration in servitization requires integrating multiple theoretical perspectives. Drawing on multi-actor collaboration studies in the servitization literature, this study draws on the following dominant theories as an interpretive background for the qualitative meta-synthesis: transaction-cost economics, network theory/social network theory, social exchange theory, and sensemaking (see Table 1).

From a *transaction cost economics* perspective, multi-actor collaboration is a governance structure chosen to reduce transaction costs arising from uncertainty, asset specificity, and opportunism (Williamson, 1985). Collaboration occurs when markets or hierarchies fail to provide efficient coordination among interconnected actors (Kohtamäki et al., 2019). It is conceptualized as a hybrid governance form that blends elements of contractual control and relational adaptation to address exchange challenges (Powell, 1990). From a *network* perspective, multi-actor collaboration is shaped by the structure and quality of relationships among actors (Uzzi, 1997). A central concept in this perspective is embeddedness. Embeddedness in the supply chain context refers to the extent to which an actor depends on and is influenced by other actors within the network (Kim, 2014). Structural embeddedness refers to the formal and informal network structures that shape collaboration, emphasizing actors' network positions, governance structures, contractual agreements, and role allocation (Kim, 2014). Relational embeddedness, on the other hand, emphasizes the quality and depth of social ties between actors, encompassing trust, mutual understanding, and reciprocity (Feng, Zheng, & Shen, 2024).

From a *social exchange* perspective, multi-actor collaboration relies on reciprocal, trust-based relationships rather than formal authority or complete contracts (McEvily & Zaheer, 2006). Cooperation continues when actors see exchanges as fair, beneficial, and socially reinforced over time (Ring & Van De Ven, 1994). From a *sensemaking* perspective, multi-actor collaboration relies on actors' ability to develop shared understandings of problems, goals, and roles amid ambiguity (Einola et al., 2017). Collaboration is driven not by fixed preferences, but by processes of meaning creation. Coordination appears through narrative, framing, and interaction (Weick, Sutcliffe, & Obstfeld, 2005).

Table 1 and the central themes serve as a guiding framework for the data analysis (Habersang, Küberling-Jost, Reihlen, & Seckler, 2019).

Table 1
Overview of the multi-actor collaboration theoretical background.

Theoretical background	Central themes	Exemplary multi-actor collaboration studies	Exemplary servitization studies
Transaction-cost economics	• Contract design and safeguards • Opportunism and behavioral uncertainty • Stability and renegotiation of collaborative arrangements	Gulati (1995); Reuer and Ariño (2007)	Kohtamäki, Partanen, and Möller (2013)
Network theory/social network theory	• Structural and relational embeddedness • Trust, reciprocity, and tie strength • Information flow • Informal coordination and control	Rowley, Behrens, and Krackhardt (2000); Swierczek (2019)	Chen, Zhang, and Tong (2019)
Social exchange theory	• Reciprocity and mutual benefit • Trust development • Commitment and obligation • Relational stability and breakdown	Ellis, Henke, and Kull (2012); Yang, Li, Cui, and Qiao (2023)	Dalenogare et al. (2023)
Sensemaking	• Framing and problem definition • Alignment of interpretations	Henneberg, Naudé, and Mouzas (2010); Möller (2010)	Einola, Kohtamäki, Parida, and Wincent (2017)

3. Review method

This review study employs meta-synthesis to synthesize primary qualitative case studies and contribute to the research domain of the original studies, moving beyond their individual findings (Karhu & Ritala, 2021). Meta-synthesis enables researchers to interpret and combine qualitative case studies in a manner that preserves their contextual richness while generating new theoretical insights (Habersang & Reihlen, 2025). The servitization field of research is particularly conducive to this technique, given the overrepresentation of qualitative research, especially case studies (Rabetino et al., 2018, 2021).

The steps in the meta-synthesis process are as follows (Habersang & Reihlen, 2025; Hoon, 2013). First, we framed the research objective to explore how multi-actor collaboration unfolds over time in servitization. Second, we identified relevant research through a comprehensive Scopus search using keywords related to servitization and collaboration. Scopus is widely recognized for its comprehensive coverage of peer-reviewed journals and support for transparent and reproducible systematic reviews (Rabetino et al., 2021). As meta-synthesis needs qualitative case studies that mainly discuss the specific topic of the research, we limited the query to titles and abstracts. We experimented with keywords informed by different theoretical perspectives and refined the search strings accordingly to ensure sufficient case diversity (Habersang & Reihlen, 2025). We then verified the results by reviewing the reference lists of the retrieved items (snowballing). The search was limited to English-language journal articles, resulting in an initial list of 255 studies as of September 2025. The search query is presented in Table 2.

Third, we further refined the list of articles by setting inclusion/exclusion criteria. We selected studies that focused on servitization,

Table 2
List of keywords and search strings.

A- Servitization	B- Collaboration
serviti*ation OR "product-service system*" OR "integrated solution*" OR "smart service*" OR "service transformation" OR "service infusion" OR "advanced service" OR "service transition" OR "digital serviti*ation" OR "digital PSS" OR "smart product-service system*" OR "smart PSS" OR "smart serviti*ation" OR "smart solution"	"business ecosystem" OR "innovation ecosystem" OR "service ecosystem" OR multi-actor OR multi-stakeholder OR "service network" OR "solution network" OR"service supply chain" OR "collaborative network" OR "business network" OR "value network" OR "value constellation" OR "value system" OR "partnership" OR "key account relationships" OR "customer relationships" OR "relational" OR "dyads" OR "triads" OR "service triads" OR "distribution channels" OR "buyer-supplier relationships" OR "inter-organizational" OR "collaborat*" OR "coordinat*" OR "cooperat*" OR "coopetition"

involved manufacturers collaborating with external actors, and detailed the nature of collaboration through empirical qualitative case studies. Studies were excluded if they involved purely internal collaboration within a single company, were theoretical or quantitative, or lacked empirical case studies. This process resulted in a final selection of 57 qualitative studies. We extracted metadata from each study, including the authors, year, research setting, and involved actors (Appendix C, Supporting material).

Fourth, the analysis followed an exploratory qualitative meta-synthesis logic, in which the findings of original studies were treated as interpretative findings that were re-examined and reconfigured into higher-order conceptual insights (Habersang & Reihlen, 2025). We did descriptive within-case analysis as suggested by Habersang and Reihlen (2025). Descriptive analysis involved writing summaries of the findings from each case, using the authors' original language to remain sensitive to the studies' original meanings and contexts. Table 1 served as a guiding framework for highlighting relevant evidence in the case studies. We gathered illustrative quotes and narrative descriptions of collaboration from the findings/results sections. As a result, first-order codes were developed directly from the empirical material (e.g., documenting processes, providing training, adjusting contracts). Appendix A presents the first-order codes and illustrative quotes for each code. Through comparing codes across cases, we grouped them into second-order themes (e.g., aligning value logics, defining implementation routines, mobilizing network resources). These two steps resulted in 60 first-order codes, grouped into 28 s-order themes and further aggregated into 13 dimensions that reflect key collaboration mechanisms and their consequences. In this study, mechanisms are recurrent practices, activities, or arrangements through which actors shape collaboration over time. This understanding aligns with a process-theory view, in which mechanisms are examined as temporally situated actions and interactions rather than as static variables (Langley, 1999; Langley et al., 2013). Examples of mechanisms in our study include establishing the network, implementing information-sharing routines, revising the shared vision, and cultivating partnerships. Appendix B presents a process view of collaboration in servitization and the data structure. The coding process was iterative, enabled by regular memo-writing and constant comparison across studies, as well as by the refinement of themes through back-and-forth to the multi-actor collaboration theoretical background (Table 1). The authors discussed codes and themes throughout the analysis process to resolve disagreements and clarify their meanings and boundaries. A summary of the within-case analysis for each reviewed paper is provided in Table D1 in the Supporting material.

Fifth, we analyzed the identified codes and themes at the case-specific level. Within each case, for each quote, we focused on whether and how codes influence one another, whether they appear together or evolve sequentially (Küberling-Jost, 2021). This step results in the identification of key relationships between mechanisms and between mechanisms and consequences. Table D2 in the Supporting material provides a few examples of how we translated quotes to relationships (Sun & Oliva, 2025). In the sixth step, we moved to a cross-case level where the relationships in each case were mapped using the "linkage-exploring review matrix" approach (Hutzschenreuter & Kleindienst, 2006). This process revealed the key dynamics between mechanisms and consequences across cases (Table D3 in the Supporting material).

The purpose of the seventh step was to synthesize on an across-study level. Following a process theory approach (Langley, 1999), we visually mapped the codes as a process model. To do so, we returned to each case to identify the approximate place/timing of the mechanism, and used the relationships identified in the previous step to depict the model (Küberling-Jost, 2021). Then, we compared the cases to develop a more generalizable process. To better understand the servitization collaboration process, we divided it into three phases: initiation, routinization, and learning and adaptation. The purpose of this step was to divide the complex servitization collaboration process into distinct and manageable phases (Langley, 1999). These phases were defined based on shifts in dominant mechanisms, actor configurations, and the consequences of collaboration. One clear transition, for instance, occurred as collaboration shifted from initiation to routinization. Early interactions tended to revolve around exploratory sensemaking and often-tentative negotiations over roles, responsibilities, and agreements. Over time, this exploratory work gave way to more settled arrangements, with roles, interfaces, and recurring practices becoming formalized. Another transition became evident as collaboration shifted from routinization to learning and adaptation. This phase marked a shift from established practices to reflective evaluation and close partnership, in which participants evaluated previous routines and their consequences and adjusted existing arrangements as conditions changed. Because the analysis is based on a qualitative meta-synthesis, no single study necessarily followed the entire collaboration process from start to finish. Some papers focused on a single phase in isolation, while others addressed several. As a result, the phases should be understood as reconstructed segments of collaboration, assembled from patterns across multiple studies rather than as complete, self-contained sequences observed within any single case.

In qualitative meta-synthesis, the findings do not provide an aggregate of empirical findings; rather, they are a second-order interpretation (Habersang & Reihlen, 2025). The qualitative studies are themselves interpretative within specific contexts, where their findings represent the meanings constructed by the participants in those studies and the authors' analytical interpretations. Thus, the findings of this study provide a theoretically informed collaboration framework that guides further conceptual development and empirical investigation, instead of universal generalizability. Fig. 1 presents a process model of collaboration in servitization, depicting the temporal sequence of collaboration mechanisms across three phases.

4. Findings

This section provides a process model of collaboration in servitization (Fig. 1). The model is divided into preconditions and three phases. Collaboration in servitization occurs across different types of networks that include various actors, some of whom are existing partners with established collaboration histories, others are new actors, and the goals and roles in some relationships are more certain than others. These differences create unique preconditions for collaboration. While the literature often divides the conditions into structural and relational, the synthesis of the case studies also revealed a cognitive layer that addresses how actors perceive the benefits of servitization. The three phases include initiation, routinization, and learning and adaptation.

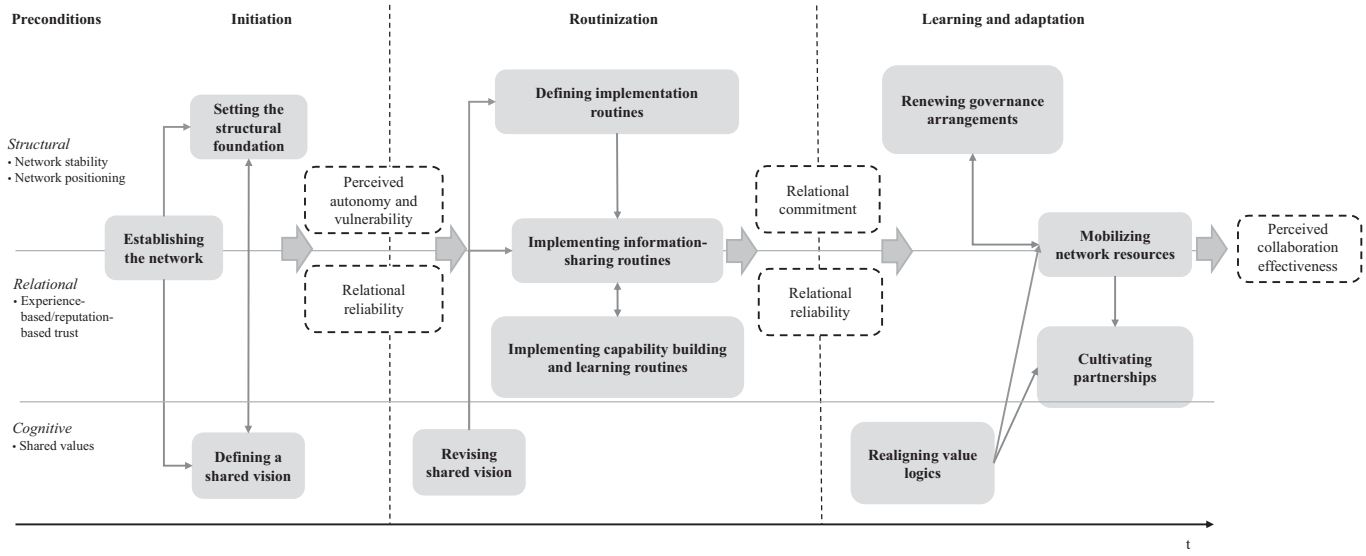

Fig. 1. A process model of collaboration in servitization.

The initiation phase is the period when actors explore goals and incentives and negotiate roles and expectations to establish initial agreements. The routinization phase is characterized by more structured collaboration and the gradual formalization of implementation practices to support ongoing collaboration. The learning and adaptation phase illustrates renewing collaboration arrangements based on previous experience or changes in conditions to mobilize broader network resources and cultivate partnerships. Each phase is described by outlining the dominant collaboration mechanisms and their consequences.

4.1. Preconditions

Structural pre-conditions include two main factors: network stability and network positioning. Regarding network stability, the case studies present two types of networks, established supply chains and emerging networks (Möller & Rajala, 2007). The key characteristics of collaboration in an established supply chain relate to stable actor constellations and clear organizational roles. For example, some studies explored the upstream value chain and collaboration between system integrators and suppliers (Finne & Holmström, 2013) or the downstream value chain and the interactions among manufacturers, customers, and intermediaries (Burton et al., 2016). The existing collaboration often shapes through governance, contracts, boundary management, and power negotiation (Chakkol, Karatzas, Johnson, & Godsell, 2018; Story et al., 2017). These characteristics create preconditions for challenges in controlling organizational and firm boundaries (Huikkola, Rabetino, Kohtamäki, & Gebauer, 2020). The key characteristics of emerging networks relate to fluid actor constellations and blurred organizational boundaries (Sklyar et al., 2019). The contexts of studies in emerging networks often concern digital servitization, platform-based solutions, and sustainability, with an emphasis on digitalization, co-creation, and innovation. Dalenogare et al.'s (2023) study on collaborative configurations in digital servitization and Stegehuis et al.'s (2023) paper on inter-organizational tensions in implementing a circular service proposition are illustrative examples of this type of network. Technological and data-related uncertainties characterize collaboration in an emerging network. Actors express uncertainty about the feasibility and interoperability of technology, data access, and ownership (Tóth et al., 2022). Thus, these preconditions often frame collaboration problems as questions of how to enable and align collaboration in an evolving multi-actor setting (Kamalaldin et al., 2020; Tian, Coreynen, Matthyssens, & Shen, 2022).

Network positioning is another key precondition of collaboration in servitization. As the ultimate goal of the process is to offer value-added services to customers, the actors' positions at the customer interface and thus their bargaining power condition the collaboration. For example, in manufacturer-intermediary-customer relationships in servitization, the actor closer to the customer interface typically holds more power due to their control over the relationships (Löfberg et al., 2015). As manufacturers move into service territories, existing intermediaries may, on the one hand, view this as competition rather than collaboration (Burton et al., 2016). On the other hand, customers may have concerns about losing internal expertise, which could reduce information flow to manufacturers. This dynamic can lead to tensions and conflicts, as less powerful partners may feel marginalized or exploited (Jaakkola & Hakanen, 2013). Thus, network positioning can serve as a precondition influencing decision-making processes, resource allocation, and the overall direction of the collaboration.

Relational preconditions include experience- and reputation-based trust. Trust in this context refers to confidence in partners' intentions and capabilities, which typically develops over the long term in relationships between firms (Hedvall, Jagstedt, & Dubois, 2019; Nenonen, Ahvenniemi, & Martinsuo, 2014). This initial trust facilitates coordination under contractual arrangements, especially in a triadic setting between manufacturer, supplier, and customer. The reputation and image of suppliers in the network can also shape trust, which, in turn, affects the type of collaboration and the roles of actors (Kamalaldin et al., 2021).

Cognitive conditions include shared values. Shared business assumptions and at least partially shared goals and values are considered key preconditions for collaboration in servitization (Herterich, Dremel, Wulf, & Vom Brocke, 2023). The actors' perceptions of the benefits they receive from collaboration and reciprocity may affect subsequent collaboration mechanisms, particularly regarding data sharing across organizational boundaries (Kamalaldin et al., 2020).

4.2. Initiation phase

As in other contexts, collaboration in servitization often begins with an initiation phase that establishes clear roles, responsibilities, and expectations. Through this phase, manufacturers ensure that all parties are aligned in their objectives and can work together effectively. The initiation phase includes three dominant mechanisms: establishing the network, setting the structural foundation, and defining a shared vision.

The main mechanism is ***establishing the network***, which includes configuring the power structure and resources. Through this

mechanism, actors manage interdependencies and maintain accountability across organizational boundaries. Previous studies emphasized the need to define the roles, agree on ecosystem leadership, and set expectations accordingly (Bastl, Johnson, Lightfoot, & Evans, 2012; Kamalaldin et al., 2021). The roles are usually determined based on suppliers' capabilities: *"Indeed, many informants emphasized that taking a leadership role in the ecosystem should be subject to having the necessary capabilities for that role."* (Kamalaldin et al., 2021, p. 10). Thus, assessing partners' capabilities is a key mechanism that has been highlighted in several case studies: *"The cases highlight that even in mature relationships, partners need to invest time and money to learn about each other's capabilities. This involves fully explaining the capabilities one partner possesses and how these might benefit other parties they are considering developing new services with."* (Raddats et al., 2017, p. 387). Beyond the higher-level network roles, collaboration in the early phase requires dedicated employees within each organization involved to ensure the smooth execution of implementation plans (Hakanen, 2014; Kamalaldin et al., 2020). Defining roles and responsibilities mitigates the risk of competition as each actor knows the scope of the task and the specific constraints (Polova & Thomas, 2020). During the initiation phase, manufacturers experience changes in their network roles, moving from product providers and technology users to solution and platform providers, which entail significant operational changes as part of their new business models (Rantala et al., 2023). The literature also acknowledges the possible role ambiguity when firms occupy shifting positions across solution networks, such as acting as a customer in one relationship and a partner or supplier in another, making responsibilities and expectations less clear in the early phase (Hedvall et al., 2019): *"Most of the failures and tensions [in collaboration], I believe, are caused by the lack of clarity on the part of the technology provider, the manufacturer, and the customer. It is always difficult to clearly define the roles. Eventually, even the goals that can or should be achieved with technology adoption."* (Smania, Osiro, et al., 2024, p. 7).

Closely connected to role definition, the actors negotiate authority and control to configure the power structure. Especially in established supply chains, manufacturers and intermediaries seek to occupy central positions at customer interfaces (Hakanen, 2014). Some case studies report manufacturers' attempts to decrease the power of intermediaries and sub-system suppliers by building direct relationships with customers (Datta, 2020; Huikkola et al., 2020). In emerging networks, negotiating authority and control often center on access to and use of data, as well as decision-making power over key technological and business issues. For example, some of the case studies report that the dominant partners, such as systems integrators, often maintain indirect control through data rights, subtly influencing collaboration dynamics despite the appearance of balanced power relations (Dalenogare et al., 2023, p. 11): *"Some system integrators offer more advanced types of software, and some customers in industries such as life sciences will give priority to these actors, leading machine builders and sensor providers to become more dependent."* However, power asymmetry is not inherently negative; it can also drive efficiency and innovation. When a powerful partner takes the lead, it can provide the necessary direction and support to ensure that collaboration is focused and effective (Raja & Frandsen, 2017). Here is a quote from (Jaakkola & Hakanen, 2013, p. 54) case study of a marketing solution network that supports this view: *"We should not consider the leader position as a 'better' position than any other position. We can do profitable business as a partner or a sub-contractor and we have no desire even to pursue anything else. This is what we do best."*

The next key mechanism in this phase is ***setting the structural foundation***, including setting contracts and framework agreements, and setting collaboration guidelines. Across the reviewed case studies, collaboration is frequently organized around formal contracts (e.g., transactional or outcome-based) or cooperation agreements between parties involved in upstream and downstream activities to structure relationships among network actors (Kowalkowski, Witell, & Gustafsson, 2013). By establishing contracts and agreements, manufacturers ensure that all parties are aligned on objectives and can work together effectively, especially at the beginning of the relationship (Reim et al., 2023). Some previous studies highlight the change in contractual agreements between industrial firms and customers when the firms move toward more advanced services (Grandinetti et al., 2020, p. 661): *"…on the one side, these contracts relieve the customer from the risk of not being able to reach the operational outcomes necessary for sustaining their most innovative value creation strategies, in terms of efficiency, flexibility, sustainability and so on. Moreover, at the same time, they put suppliers' revenue models at stake, driving (at least part of) the billing mechanism out of the manufacturing industries' traditional upfront invoicing."*

The analysis of case studies shows that this category is affected by the power structure established in the previous mechanism. For example, Huikkola et al. (2020) documented how firms negotiate and manage power in the network through contracts: *"Some initiatives implemented by the analyzed companies include expert heuristics, such as a rule stipulating that a given supplier's sales to the company can account for only 20–50% of its total sales, and other practices, such as the facilitation of the development of key suppliers or the use of a dual-sourcing policy for critical components. In all cases, companies have to safeguard intellectual property rights mainly to protect their profitable and vital spare parts business"* (Huikkola et al., 2020, p. 95). Other examples include establishing a gain/pain-sharing agreement (Datta, 2020) or a risk-sharing partnership (Lockett, Johnson, Evans, & Bastl, 2011) to make collaboration more attractive to suppliers. The impact of the power structure and the configuration of resources and capabilities is also evident in decisions about the technical structure. Several case studies reported how the manufacturers opted for an open or closed system architecture, depending on their own or other network actors' positions and capabilities*: "During this initiation stage, GR establishes a technology framework that promotes active participation and provides clear guidelines on the roles within the ecosystem. This involves developing interfaces that facilitate seamless connectivity, considering the technological maturity of each participant. Additionally, a modular structure is created to encourage participants to offer complementary services."* (Marelli & Dello Sbarba, 2024).

Defining a shared vision is also discussed heavily in this phase, especially in emerging networks where actors come from different supply chains and must overcome context-specific data interpretations and differing business incentives (Altmann & Linder, 2019). Defining a shared vision is described as helping actors coordinate expectations and align the diverse interests across different partnerships (Herterich et al., 2023; Kolagar et al., 2022; Poeppelbuss, Ebel, & Anke, 2022; Sklyar et al., 2019). For example, Poeppelbuss et al. (2022) show that in the early phases of smart service development, collaboration relies on developing a shared vision and a joint understanding of the technical solution through iterative concept building. Hakanen (2014) explains an example of executing this process: *"They also attended a workshop in which they analyzed key customers and their various characteristics – such as purchasing strategy and organization, and decision-making – as well as the competences of an individual purchaser. The teams compared different key accounts and made a joint interpretation of the customer knowledge acquired. The consequence was a common understanding of their key customers, with the process serving as a concrete example of knowledge assimilation in KAM teams."* (Hakanen, 2014, p. 1200). Defining a shared vision across the network is highly related to the network structure and the incentives embedded in contracts and agreements (Datta, 2020; Raja & Frandsen, 2017; Robinson et al., 2016). Some studies emphasize that this mechanism must be complemented by formal contractual mechanisms to ensure accountability and transparency (Smania, Osiro, et al., 2024). For example, a mutually agreed-upon profit margin guides both suppliers and customers toward a shared economic goal in their research and development collaborations (Huikkola et al., 2013).

However, some case studies report the challenges in defining a shared vision and motivating partners to engage due to conflicting business strategies: *"RepairCo's business model is sensitive to ManuCo's policy on whether to replace or repair worn components, which changes under*

the PSS model and RepairCo is concerned that this could lead to a reduction in business for RepairCo. Repair Co's Commercial Director stated: "they want to sell new parts, we want to overhaul parts." (Lockett et al., 2011). Given the complexity of servitization, which involves several functions across different actors' organizations, it is not enough to define the value logics between the leading organizations; this vision should also be disseminated and understood across the network to align sometimes competing or conflicting objectives (Polova & Thomas, 2020).

The collaboration process in the initiation phase may lead to different ***consequences*** for the collaboration. Relational reliability has been discussed in more than half of the cases in this phase. The initiation phase, which involves negotiating over power structure, contracts, and shared values, often leads to increased or decreased competence trust. When structural governance, such as contracts, is weak, actors often express lower levels of relational trust and willingness to share knowledge (Smania, Osiro, et al., 2024). While trust has been typically treated as a facilitating collaboration and supporting inter-organizational relationships (Chakkol et al., 2018; Huikkola et al., 2020; Nenonen et al., 2014), some studies notice that strong relational ties may lead to over-dependence, which has been identified as one of the significant risks associated with collaboration in servitization (Smania, Osiro, et al., 2024). The case study by Raddats et al. (2017) reveals that trust may appear asymmetric in manufacturer-customer relationships, where the manufacturer may see it as an opportunity to build trust, while the customer may see it as a risk of over-reliance on a supplier. Also, manufacturers may be concerned about becoming locked into specific suppliers or systems, exposing them to high aftermarket costs and dependence on underperforming partners who cannot be easily replaced due to intellectual property constraints (Lockett et al., 2011). The case study by Reim et al. (2023) confirms this risk and shows that the need for multiple software creates a challenge regarding actors' dependence on the platform provider due to the desired combined effect. In particular, larger companies often set the terms of collaboration that smaller companies must adapt to.

4.3. Routinization phase

The routinization phase supports day-to-day collaboration and helps stabilize interaction under contractual and hierarchical arrangements. The dominant mechanisms in this phase include defining implementation routines, implementing information-sharing routines, implementing cross-organizational capability building and learning routines, and revising shared vision.

The consequences of the initiation phase shape the collaboration process in the routinization phase. In particular, changes in relational reliability, whether positive or negative, and in perceptions of autonomy and vulnerability affect ***defining implementation routines***. Governance structures may reshape power dynamics, thereby strengthening the position of some actors relative to others in the network (Datta, 2020; Huikkola et al., 2020). For example, a case study in the healthcare industry reveals that while the customer (hospitals) held the upper hand in directing the PSS during the initial stages, the industrial firm possessed more negotiation power in the later stages due to the newly established governance structure (Pereira, Kreye, & Carvalho, 2019). This phase starts by adjusting contracts and agreements. For example, Huikkola et al. (2020) show that manufacturers manage the perceived loss of autonomy and control by formalizing sourcing rules (e.g., dual sourcing and limits on supplier dependency) and increasing downstream integration to strengthen direct customer relationships, while maintaining close, trust-based ties with selected strategic suppliers. The implementation routines are built around defining processes, workflows, and performance goals, as well as progress-monitoring routines. Studies in established supply chains often emphasize clearly defining processes and mapping workflows, as actors typically have stronger ties and more standardized interfaces (Jaakkola & Hakanen, 2013). However, for more innovative solutions, documenting the processes is not always feasible because *"working procedures among different actors are fairly unique, complex and heterogeneous"* (Huikkola et al., 2013, p. 1175). The case studies also reported several routines for progress monitoring, ranging from monitoring performance using key performance indicators in the established supply chains (Raja & Frandsen, 2017) to different project management methodologies, such as agile methodology, to monitor the innovation projects (Poeppelbuss et al., 2022): *"Here, we have meetings every week and it is all about fast cycles of development, then testing, again development, then testing."* (Kamalaldin et al., 2020, p. 315).

Relational reliability also affects ***implementing information-sharing routines,*** as *"a higher degree of trust is required when a manufacturer is involved in a customer's operations, rather than simply supplying products. In this situation, customers are sharing the operational risks with the manufacturer in order to prevent the failure of the operation itself"* (Raddats et al., 2017, p. 392). Thus, in addition to adjusting the contracts, the need for data agreements has been highlighted in this phase. Data sharing and security agreements are treated in the reviewed papers as a critical condition, as they shape how actors manage and share data securely without compromising sensitive information (Dalenogare et al., 2023). The network partners require investing in shared infrastructure, including data-sharing platforms and information and communication systems. While sharing business information happens through in-person communication, meetings, and ICT technologies (Huikkola et al., 2013), information sharing in servitization increasingly relies on sharing equipment and operational data through advanced digital technology and infrastructure for real-time data sharing, such as IoT and augmented reality (Frandsen, Raja, & Neufang, 2022; Kamalaldin et al., 2020). While these platforms enable innovation and agility within the network (Marelli & Dello Sbarba, 2024), the challenge lies in balancing openness and data security, as firms may hesitate to share sensitive information, even within well-defined governance frameworks (Rantala et al., 2023). To address these concerns, firms may apply different technical solutions or adjust agreements; for example, some firms implemented *"a database center in the Cloud and several decentralized databases in user companies"* (Tian et al., 2022, p. 8) or *"initiated agreements around joint data utilization, which improved data sharing and supported digital service provision."* (Tóth et al., 2022, p. 444).

Implementing information-sharing routines is closely linked to ***implementing capability-building and learning routines***. On one hand, sharing data, information, and knowledge can strengthen relationships and support capability building and co-creation. On the other hand, joint experimentation and partner involvement can enhance information sharing across the network. Building capabilities within the network requires ongoing knowledge transfer and training (Finne, Turunen, & Eloranta, 2015; Jovanovic, Sjödin, & Parida, 2022). The following remarks are illustrative: *"It was a new way of working that is based on cooperation between us and them. It was not that we just have a new system, but we have a platform where there are a lot of solutions that we can jointly work on. So, we share the knowledge and the solutions that come out and thus we progressively become better."*

Servitization demands that firms go beyond the information and communication technologies and integrate the partner's knowledge through involving partners in development and decision-making: *"The technical information that suppliers typically shared, such as operations and maintenance procedures and warranty information, did not provide the needed insights into lifetime performance to permit effective collaboration. For instance, maintenance teams started working more closely with design teams, sharing their knowledge about maintenance routines and associated costs. Maintenance engineers provided feedback to the design teams about which components tended to require frequent, lengthy maintenance, further improving decisions about the design and procurement of systems."* (Robinson et al., 2016, p. 44). The early and continuous involvement of partners in joint activities enables mutual adjustment across organizational boundaries.

Some case studies reveal the changes in the shared values and goals of involved actors along the collaboration, which may create new

tensions regarding misaligned value logic and, in turn, result in ***revising shared vision*** through adapting goals and incentives, such as pricing models, outsourcing agreements, and commercialization plans (Hullova, Laczko, & Frishammar, 2019; Tóth et al., 2022; Töytäri et al., 2018): *"In a participant workshop in 00, attendees agreed that a shift was needed away from the technical development of remote monitoring technologies and the physical product itself toward the use and commercialization of sensor-generated data."* (Altmann & Linder, 2019, p. 42).

The routinization phase may lead to new ***consequences*** and change the structural and relational conditions of the collaboration. Relational reliability has again been the most dominant consequence of the collaboration. In particular, trust appears more frequently and is more extensively discussed in the reviewed case studies. Trust in this context is described in terms of reliability trust, e.g., how partners practice data-handling (Sklyar et al., 2019) or how suppliers ensure the integrity and security of customers' data throughout and beyond the product life cycle (Grandinetti et al., 2020). Establishing data- and knowledge-sharing platforms for sharing customer feedback and other information with development partners gives partners influence over technological and business decisions, thereby supporting relational trust (Sklyar et al., 2019). However, the emphasis on trust in collaboration may vary with the degree of interdependence among actors in their use of each other's data and expertise. The multiple case study by Dalenogare et al. (2023) shows that while collaboration between an industrial firm and an insurance company required limited trust since the two actors had no strong dependency and their businesses were not directly interrelated, collaboration with an AI provider demanded a high level of trust as the industrial firm was dependent on the supplier's capabilities. The progress of the collaboration also allows firms to assess the risk of self-interest behavior of their partners, particularly the rivalry risk: *"If we hand over our digital twin to a customer and then they go to one of our competitors and say: look what Delta has done, this works great. Can you do the same?"* (Reim et al., 2023, p. 3935).

Servitization, as a long and complex process, requires relational commitment from involved actors, reflecting a long-term outlook and a willingness to invest in the partnership, especially when the industrial firm depends on the supplier for ongoing support in developing and delivering services (Dalenogare et al., 2023; Grandinetti et al., 2020). The case studies show that the actors develop a perception of partner commitment in development and engagement in processes. This perception is based on behavioral control of their partners. Explained one distributor: *"In the partnership, mutual respect would be very important for us. We do not feel special now. Paying us a visit would be one way of showing that we are important."* (Aminoff & Hakanen, 2018, p. 1030). The case studies show a strong link between mechanisms such as sharing information, developing capabilities, and integrating partners' knowledge and perception of collaboration effectiveness (Kamalaldin et al., 2020; Karatzas, Johnson, & Bastl, 2017; Sjödin et al., 2020): *"Sometimes it seems that at Supplier x they don't trust us and don't listen to us, or include us in their processes. It's really unfortunate if they can't see the development work that we could do together…"* (Jaakkola & Hakanen, 2013, p. 54).

4.4. Learning and adaptation phase

The learning and adaptation phase addresses the long-term collaborative efforts for servitization. This phase highlights the need for continuous revising and reconfiguring of the collaboration process. The main mechanisms include renewing governance arrangements, mobilizing network resources, realigning value logics, and engaging in inter-firm collaboration routines.

The reviewed studies show that the need for revisions and re-alignments stems from the consequences of previous collaboration phases, which necessitate ***renewing governance arrangements***. The relational aspects, such as trust and commitment, are associated with opening or restricting governance structures and knowledge-sharing agreements and platforms (Dalenogare et al., 2023; Herterich et al., 2023). For example, the study by Reim et al. (2023) on digital platforms shows that transparency strategies for data sharing among partners involved in technological development help build trust and reduce perceived dependency over time. As trust increases, actors become more willing to share data and engage in joint development, which, in turn, makes governance arrangements, such as data governance, more open and flexible (Smania, Osiro, et al., 2024). The ambiguity in service contracts or lack of incentives may also affect commitment and reciprocity among actors (Raja & Frandsen, 2017), which in turn results in the development of new governance structures to ensure promised order volumes, conduct price reviews, and jointly investigate problems (Datta, 2020; Huikkola et al., 2013). Tóth et al. (2022)'s case study in the aerospace industry describes how governance arrangements evolve through evaluating the effectiveness of the current governance structure and revising the agreements: *"Service providers had negative perceptions of such platforms, because they believed that this platform-based 'data monopoly' provided manufacturers with strong advantages in the competition for digital service contracts. To resolve this tension, independent platforms (e.g., Aviatar) were created through cooperation agreements, which enabled the involved parties to upload data while maintaining their ownership. Both manufacturers and service providers thus could offer digital services through the same platform, on more equal terms."* (Tóth et al., 2022, p. 442).

Regarding ***mobilizing network resources***, the drivers of changes are not only consequences of the routinization phase, but also the possible expansion of the network which changes in the network's structural and relational conditions: *"This resulted in changes in power relations as existing actors ceded power to new actors (e.g., with the introduction of institutional regulators such as Ofgem and OFTO, the utility operators' power is reduced)."* (Frandsen et al., 2022, p. 21). Especially in emerging networks, new actors may be taking a central role and organizational boundaries being reconfigured over time (Sklyar et al., 2019). In some cases, such as digital platforms, roles are reconfigured during ongoing interaction rather than being predetermined positions (Reim et al., 2023; Smania, Osiro, et al., 2024). As expressed by one manager: *"Sometimes they [the process industry firm] say that our competitor's solution is the best from a site management perspective and then we need to align to that and connect our autonomous equipment as well as planning tools from perhaps another actor. So we need to consider the whole ecosystem landscape on that site to support our customers in driving process innovation."* (Kamalaldin et al., 2021, p. 9).

The most commonly mentioned mechanism in this phase is ***cultivating partnerships***. Across the reviewed studies, collaboration in this phase is primarily characterized by strengthening relational ties, joint problem solving, building joint teams, and co-creating solutions. These mechanisms reflect how actors integrate their resources to explore new solutions or improve the service-related processes: *"I speak to my channel account manager [at TechCo] every single day, every working day that is. We even meet socially now, it's like […] We did deals together with customers. There's a lot of trust there."* (Chakkol et al., 2018, p. 590). Given the complexity of servitization, which involves inputs from various business units, it is essential to strengthen the relational ties at different interfaces: *"For instance, if we have technical problems or technical questions, then we have a meeting once a week between the people responsible for technical issues. Then, once a week, the customer's purchasing/production team talks to our people responsible for logistics or production. Therefore, we are always aware of what's happening on both sides."* (Huikkola et al., 2013, p. 1176). However, building strong ties is not a desirable state for all actors in all servitization cases. The case study by Jaakkola and Hakanen (2013) illustrates that customer preferences for the level of joint activities varied; some expected extensive involvement, while others preferred minimal joint activities. This variance is often due to structural and relational preconditions, such as network stability and perceptions of benefits and outcomes, which shift collaboration toward transaction-based relationships. A case study in a multi-sided platform further explains this relationship: *"We don't have a relationship with these*

external developers. They sign to the platform, offer their services, and often collaborate with the customers, but we have no interference in their business." (Dalenogare et al., 2023, p. 10). However, in certain cases, like developing autonomous solutions, joint problem-solving, and alignment among actors, were essential for integrating technological innovations (Makkonen, Nordberg-Davies, Saarni, & Huikkola, 2022).

Some case studies reveal that as servitization progresses and new actors join the network, the value logics must be renegotiated. ***Realigning value logics*** ensures that all actors, existing and new, agree on the values and goals and, in turn, reduces tensions between new and existing actors. For example, Altmann and Linder's (2019) study reveals that while the goals and needs of the actors involved in a joint development project were initially aligned, the introduction of new actors into the network created tensions over *"using the same data to pursue conflicting value-capture strategies."* Defining an ecosystem value and adapting the vision and incentives are necessary to address these tensions. This state is what Kolagar et al. (2022) define as *"the highest state of ecosystem involvement"*: *"This will be achieved when they convince existing and new ecosystem actors how value that is created jointly will differentiate them from other global competitors. In this way, all will be able to appreciate the benefits of this cooperation and the shaping of their ecosystem for internationalization."* (Kolagar et al., 2022, p. 154).

While the previously discussed ***consequences***, such as relational reliability and commitment, remain relevant in this phase, the main consequence of the learning and adaptation phase concerns perceived collaboration effectiveness. Through output control, the involved actors develop a perception of servitization outcomes, such as capability and learning outcome, or change in operational, economic, and commercial performance (Lazarevic, Kivimaa, Lukkarinen, & Kangas, 2019; Reim, Sjödin, & Parida, 2019). For example, the weak mobilization of network actors may reduce the service performance due to multiple conflicting processes and unrealistic goals (Smania, Osiro, et al., 2024). Here is an example from implementing a performance-based contract in an established supply chain: *"Thus the Primes lost control over the Near Primes for carrying out many tasks. This resulted in hidden costs in the form of delayed achievement of target availability in delivery and adaptation stages."* (Datta, 2020, p. 672) In the case of an emerging network, the case studies show the risk of unmonitored shifts in goals and motivations that leads to an uncertain economic and commercialization performance: *"I'm not sure about the specific market aspects that were addressed. Because the academics, SME, and big companies…were concentrated on technology, technology and technology."* (Polova & Thomas, 2020, p. 238).

5. Discussion

This study explores how multi-actor collaboration unfolds over time in servitization by developing a process theory. Prior research has widely acknowledged collaboration as a foundational and strategic element of servitization (Dalenogare et al., 2023). However, the literature has predominantly treated collaboration as a static condition linking antecedents to outcomes (Wang et al., 2023) or through a typology approach (Dalenogare et al., 2023; Kamalaldin et al., 2021). The process perspective adopted in this study conceptualizes collaboration as a configuration of interrelated mechanisms whose interactions generate consequences that reshape subsequent collaboration dynamics. In this section, we leverage the process theory (Langley et al., 2013) to revisit assumptions about preconditions, mechanisms, and governance dynamics over time.

In the literature on servitization and inter-organizational collaboration, collaboration is mainly analyzed through the perspectives of network embeddedness and relational governance, in which structural configuration and relational qualities, such as contracts, trust, and commitment, are considered the basis for effective collaboration (Kamalaldin et al., 2020; Poppo & Zenger, 2002). In servitization contexts, beyond structural embeddedness and relational ties, cognitive alignment (e.g., shared understandings of value creation, risk distribution, and strategic intent) emerges as a critical precondition for collaboration. Servitization typically involves long time horizons, high uncertainty, and networks comprising multiple actors with heterogeneous goals (Rabetino et al., 2018). Under such conditions, collaboration depends not only on network configuration and relationship quality but also on whether actors interpret the purpose and direction of collaboration in compatible ways (Töytäri et al., 2018).

Proposition 1. In servitization contexts, effective collaboration relies on cognitive alignment among actors, in addition to structural configuration and relational quality. Misalignment at the cognitive level can weaken collaboration even when structural and relational conditions are met.

Existing servitization research has mainly adopted a mechanism-based or practice-based view of collaboration, examining mechanisms such as co-creation (Sjödin et al., 2020), joint learning (Huikkola et al., 2013), or capability development (Momeni, Raddats, & Martinsuo, 2023) in relative isolation. It seems the literature has applied an implicit additive logic, assuming that collaboration mechanisms contribute independently to collaborative outcomes. Drawing on a process theory (Langley et al., 2013), the findings reframe collaboration mechanisms as interconnected elements whose interactions and relative importance change over time. The findings reveal that collaboration mechanisms interact dynamically, with tensions or failures in one mechanism causing adjustments in others. For instance, ambiguity in service contracts or misaligned incentives can weaken relational reliability among manufacturers, intermediaries, and customers (Raja & Frandsen, 2017). In response, actors may engage in joint problem-solving, revise contracts and pricing structures, or establish new framework agreements (Datta, 2020; Robinson et al., 2016).

Throughout the synthesis process, four mechanisms stand out as particularly important: establishing the network, defining a shared vision, establishing information-sharing routines, and cultivating partnerships. Establishing the network emphasizes that servitization relies primarily on who is connected to whom, rather than on transactional contracts alone (Rantala et al., 2023). Defining a shared vision addresses the interpretive challenges arising from differing assumptions about value creation, risk, and revenue, especially given the incomplete nature of servitized offerings in their early phases (Poeppelbuss et al., 2022). Information-sharing routines are the most influential mechanism for collaboration, showing that relational mechanisms, such as informal or ad hoc communication alone, are not enough in servitization; they need to be combined with structural mechanisms to enable the sharing of operational and business data across the network (Gebauer, Paiola, & Saccani, 2013; Kamalaldin et al., 2020). Cultivating partnerships reflects the long-term commitments, mutual dependence, and co-creation required, particularly in delivering advanced innovation solutions during servitization (Polova & Thomas, 2020).

Proposition 2. Collaboration in servitization is driven by configurations of interdependent mechanisms rather than by isolated collaboration practices, with changes in one mechanism triggering adjustments in others over time.

Dominant governance perspectives, especially transaction cost economics and relational governance theory, often imply a linear progression where collaborations move from structural to relational governance (Kamalaldin et al., 2020; Sjödin et al., 2019). This study challenges this idea by showing that servitization collaborations frequently experience repeated shifts between structural and relational governance, driven by changing perceptions of autonomy, vulnerability, and partner performance. By doing so, the findings explain how the governance structure changes and why.

Furthermore, reliance on relational governance depends on contextual factors like capability dependence and the need for co-creation (Dalenogare et al., 2023). This view of governance aligns with emerging insights from digital platform studies, which highlight the

importance of modularity, standardized interfaces, and formal coordination mechanisms for enabling collaboration without requiring deep relational embeddedness (Rantala et al., 2023).

Proposition 3. Collaboration governance in servitization does not follow a linear path from structural to relational mechanisms but involves repeated reconfigurations driven by changing assessments of reliability, autonomy, vulnerability, and partner performance.

Servitization research has highlighted trust, commitment, power, and reciprocity as key elements of collaboration (Dalenogare et al., 2023). However, these concepts are often viewed as stable enablers rather than as dynamic components whose meaning and role evolve. Mapping mechanisms and consequences in this study challenge this view by showing that the effects of collaboration mechanisms and their consequences are specific to each phase and change over time. For instance, the findings indicate that trust manifests differently at various stages of collaboration. As a prerequisite, trust can be experience- or reputation-based, rooted in prior supply chain relationships, or cognitive, based on reputational signals such as a technology provider's perceived competence. During the initiation phase, when actors negotiate goals, incentives, and agreements, competence trust becomes prominent as they assess partners' capabilities and commitment. As collaboration progresses into routinization, reliability trust, i.e., evaluations of partners' ability to execute complex service tasks, becomes increasingly critical (Poeppelbuss et al., 2022).

6. Future research directions

This section synthesizes the identified gaps and provides recommendations for future research directions (Table 3). Because the study is based on a qualitative meta-synthesis, these opportunities primarily concern refining the theory, specifying boundary conditions, and conducting empirical testing. The research directions are derived from the cross-case synthesis of patterns, tensions, and gray areas found across the reviewed studies, as well as the linkage-exploring review matrix (Table D3, Supporting material).

First, future research should more explicitly examine the process dynamics of collaboration through longitudinal and process-oriented research methods (Langley, 1999; Van De Ven, 1992). Many current studies depend on cross-sectional data or single snapshots of collaboration. Building on the process framework developed in this study, future research could explore how collaboration mechanisms and governance arrangements evolve within the same servitization context. Longitudinal case studies, event-history approaches, and mixed-method designs would be especially effective for capturing these dynamics and testing the phase-specific relationships proposed here.

Second, the configurational view of collaboration mechanisms highlights opportunities for comparative and configurational analyses (Liu, Mezei, Kostakos, & Li, 2017). Instead of concentrating on individual collaboration practices, future research could explore various configurations of collaboration mechanisms and how these configurations influence servitization paths. Techniques such as qualitative comparative analysis (QCA) can be useful for uncovering patterns of combinations of mechanisms linked to different collaboration outcomes.

Third, the dynamic view of governance in this study highlights the need for more research on governance reconfiguration (Krystallis et al., 2025) in servitization. Future research could explore how firms manage structural and relational governance over time, how shifts in perceived autonomy and vulnerability affect governance choices, and how different forms of relational reliability and commitment develop, fade, or coexist during the servitization process. Such research would help improve governance theories that are often based on static or linear assumptions.

Fourth, future research could expand the findings of this study beyond the servitization context by exploring other complex, multi-actor collaboration environments, such as digital platforms,

Table 3
Identified gaps and future research directions.

Research gap	Future research direction	Illustrative research questions	Suggested method
Most existing studies on collaboration in servitization rely on cross-sectional designs or single snapshots of collaboration. As a result, there is limited empirical work that directly examines how collaboration mechanisms, governance arrangements, and collaboration outcomes develop over time within the same servitization initiative.	More explicitly examine the process dynamics of collaboration through longitudinal and process-oriented research methods.	How do collaboration mechanisms change across different stages of a servitization initiative? When and why do collaboration mechanisms stabilize, intensify, or break down during servitization?	Longitudinal case studies, process tracing, event-history analysis, and mixed-method designs combining qualitative process data with repeated quantitative measures.
Much servitization collaboration research focuses on individual practices or mechanisms in isolation. There is limited empirical work examining how different combinations of collaboration mechanisms jointly shape servitization trajectories and outcomes.	Explore various configurations of collaboration mechanisms and how these configurations influence servitization paths.	What configurations of collaboration mechanisms are associated with different servitization paths? How do changes in one collaboration mechanism trigger adjustments in others? Are certain configurations more robust under high uncertainty or high interdependence?	Configurational approaches, such as qualitative comparative analysis (QCA) or typological analyses based on large case samples.
There is limited empirical evidence on how governance is repeatedly reconfigured over time and how these shifts affect servitization performance.	Explore the shifts in structural, relational, and cognitive conditions during servitization.	How do perceptions of relational reliability, autonomy, vulnerability, and partner performance influence governance reconfiguration? How do different forms of relational reliability and commitment develop, fade, or coexist during the servitization?	Comparative case studies across different servitization settings, and experimental vignette studies focusing on interpretive differences among actors.
There is limited research on collaboration in emerging contexts such as digital ecosystems, digital platforms, and	Expand the findings of this study beyond the dyadic or triadic servitization settings by exploring other complex, multi-actor	How do collaboration mechanisms differ between servitization contexts and more modular or platform-based collaboration settings?	Comparative studies across industries and collaboration contexts, and cross-sector case analyses.

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Table 3 (*continued*)

Research gap	Future research direction	Illustrative research questions	Suggested method
sustainability in servitization.	collaboration environments.	How do governance arrangements differ in digitally-mediated or regulatory-mediated environments with heterogeneous actors?	
There is a dominant assumption in the servitization literature that relational trust and commitment are always facilitators and supportive.	Study conditions under which trust, commitment, and reciprocity become liabilities ('dark side' outcomes).	When and why relationship structures characterized by high relational embeddedness hinder rather than facilitate collaboration?	Multiple case studies, critical incident analysis, and experimental vignette studies focusing on interpretive differences among actors.
Most studies on servitization focus on the routinization phase, with less attention to the dynamics of initiation, learning, and adaptation.	Examine multi-actor collaboration during the less mature phase (i.e., initiation) and the more mature phase (i.e., learning and adaptation).	How do early collaboration arrangements shape later governance choices and collaboration outcomes? How do actors revise governance arrangements and control mechanisms during the learning and adaptation phase as servitization relationships mature? How do learning and experience in servitization collaborations lead to the expansion, contraction, or reorientation of collaborative networks over time?	Longitudinal research designs, process studies, and comparative case studies.

ecosystems, or large-scale solution networks (Battistella, Colucci, De Toni, & Nonino, 2013; Wareham, Fox, & Cano Giner, 2014). Comparative studies across different contexts would help determine whether the collaboration patterns observed here are unique to servitization or reflect broader trends in settings characterized by uncertainty, long-term horizons, and interdependence.

Fifth, although relational trust and commitment are typically viewed as conditions that support collaboration, the strong relational ties may also entail risks, such as becoming overly reliant on digital partners or losing customer expertise (Smania, Ayala, et al., 2024). Future studies should examine these potential downsides by exploring when and why relationship structures characterized by high relational embeddedness hinder rather than facilitate collaboration (Anderson & Jap, 2005; Noordhoff, Kyriakopoulos, Moorman, Pauwels, & Dellaert, 2011). Such works would challenge prevailing assumptions in servitization research and help refine the discussion of inter-firm collaboration by clarifying the boundary conditions.

Finally, the Linkage matrix (Table D3, Supporting material) shows that previous research on servitization has mainly focused on the routinization phase, which is understandable given its key role in shaping collaboration routines, building infrastructure, advancing projects, and developing capabilities. However, less attention to the initiation phase limits understanding of how early negotiations over goals, incentives, roles, and expectations affect later collaboration paths. Likewise, the limited number of studies on learning and adaptation limits insight into how collaboration arrangements are renewed through experience or changing conditions. Future research should explore collaboration dynamics across phases, particularly how phase-specific challenges and mechanisms shape servitization outcomes.

7. Conclusions

7.1. Theoretical contributions

This study makes three contributions to the literature on servitization and inter-organizational collaboration. First, it develops a process theory of multi-actor collaboration in servitization. Prior research has generated valuable insights into collaboration practices such as co-creation, knowledge sharing, partner alignment, joint learning, and capability development (Huikkola et al., 2013; Sjödin et al., 2020; Story et al., 2017). However, these mechanisms have often been examined separately or treated as stable antecedents or enablers of servitization, which limits understanding of how collaboration unfolds as a process. By synthesizing 57 qualitative case studies, this study links collaboration preconditions, mechanisms, and consequences across initiation, routinization, and learning and adaptation phases (Habersang & Reihlen, 2025). The resulting process theory shows that collaboration unfolds through a recursive mechanism–consequence process: collaboration mechanisms generate consequences such as relational reliability, perceived autonomy and vulnerability, relational commitment, and perceived effectiveness, which then shape the mechanisms in later phases.

Second, the study contributes by advancing a temporal view of collaboration governance, in which servitization governance evolves through repeated recombination of structural, relational, and cognitive mechanisms. Previous research, often motivated by transaction-cost or relational governance perspectives, has often implicitly assumed stable or linearly changing forms of collaboration and governance (Kamalaldin et al., 2020). The findings refine this view by showing that safeguarding and trust-building are not sequential stages in servitization but rather recurring mechanisms that are reconfigured as collaboration develops (Gulati, 1995; Kohtamäki et al., 2013; Reuer & Ariño, 2007). The findings also extend network and social exchange views by showing that in servitization, contracts, role definitions, data-sharing protocols, decision rights, trust, and commitment are not alternative governance modes that replace one another over time (Dalenogare et al., 2023; Swierczek, 2019; Yang et al., 2023). They are repeatedly recombined as actors reassess partner reliability, autonomy, vulnerability, power positions, and performance. This temporal view clarifies why structural, relational, and cognitive mechanisms need to be understood as interacting elements rather than as separate governance alternatives.

Third, the study extends broader theories of inter-organizational collaboration and governance by showing how collaborative arrangements develop when actors must share resources they also seek to protect (Krystallis et al., 2025; Roehrich et al., 2020). The synthesis shows that servitization requires actors to share data, capabilities, service knowledge, and customer access, while these same resources become sources of power, control, and value capture (Dalenogare et al., 2023; Smania, Osiro, et al., 2024). This tension is visible across the process model: actors first negotiate roles and shared value logics, then establish information-sharing and capability-building routines, and later revise governance arrangements as dependencies, technologies, and actor constellations change. These findings extend sensemaking and governance perspectives by showing that shared understandings are not merely established at the beginning of collaboration, but are repeatedly renegotiated as actors confront new tensions over openness and control, trust and safeguarding, joint value creation and individual value

capture, and collaboration and dependence (Einola et al., 2017; Henneberg et al., 2010; Möller, 2010).

7.2. Managerial implications

Our findings suggest that managers need to approach collaboration in servitization as an evolving process. Since servitization often involves changing power dynamics through redefining value, control, and customer access, it is important to clarify each actor's expected roles, perceived values, and risks. For instance, customers might resist sharing operational data, intermediaries may fear being bypassed, or suppliers could be concerned about margin pressures. Managers should address these issues by discussing roles, decision rights, data access, revenue sharing, and risk allocation early in the process. These early negotiations help define a shared vision among the actors involved, provide an initial agreement on how to create and capture value, and, in turn, affect actors' trust, perceived autonomy, and vulnerability.

Our synthesis indicates that many tensions in servitization collaborations stem not from actors' goodwill but from unclear routines for data sharing, customer feedback, and performance monitoring, as well as misaligned value logics. Misalignments or a lack of clarity may, in turn, affect relational reliability and commitment within actor networks. Managers should therefore combine relational mechanisms, such as developing capabilities and joint learning practices, with structural mechanisms, such as data-sharing agreements, shared performance metrics, and information-sharing platforms. These mechanisms should be complemented by adjusting value logics and revising the shared vision as the network changes or as partners' motivations shift.

Finally, managers should regularly review collaboration agreements as servitization progresses. Early arrangements that work may no longer be suitable as services scale, technologies evolve, new participants join the network, or a partner's role becomes more central. Managers need to regularly evaluate risks and rewards, data access, partners' contributions, customer relationships, and reliance on a dominant partner. Viewing collaboration as an ongoing process helps managers recognize the importance of learning and adaptation as a key stage of the collaboration process in servitization.

7.3. Limitations

The study has four main limitations. First, although the meta-synthesis approach provides a structured and integrative understanding of collaboration in servitization, its scope and the diversity of original qualitative studies are limited, potentially overlooking certain types of collaboration or industry contexts. Second, despite careful planning of the search strategy, relevant studies may have been missed due to differences in terminology and indexing. To overcome this limitation, we employed snowballing and cross-checked the identified papers to determine if the authors used alternative terminologies. We then included those in the research string. Third, as in any review, the synthesis relies on the interpretation of primary studies, which introduces the possibility of interpretive bias. To accurately extract data, we employed a systematic data analysis approach, as outlined by Hoon (2013), which guided researchers in synthesizing data and facilitated an iterative comparison across qualitative data sources. Thus, the findings of this study provide a theoretically informed collaboration framework that guides further conceptual development and empirical investigation, instead of universal generalizability. Fourth, very recent publications might not be fully captured due to delays in database indexing, possibly excluding emerging developments in the field.

CRediT authorship contribution statement

Beheshte Momeni: Visualization, Project administration, Methodology, Formal analysis, Conceptualization, Writing – original draft. **Rodrigo Rabetino:** Visualization, Methodology, Formal analysis, Conceptualization, Writing – original draft. **Marko Kohtamäki:** Visualization, Methodology, Formal analysis, Conceptualization, Writing – original draft.

Declaration of competing interest

None.

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Appendix A

Table A1
Examples of open coding.

Example quote	First-order code
Even if trust between the parties is the desired way of collaborating, some kind of contract is needed that describes the standards of the collaboration and the consequences if it is not followed, especially at the beginning of a partnership. (Reim et al., 2023, p. 3938)	Setting contracts and framework agreements
Guided by a set of specific principles, the implementation of this platform follows certain guidelines, providing the foundation for designing and integrating the new way of collaboration. (Marelli & Dello Sbarba, 2024)	Setting collaboration guidelines
… key tactic is to establish an open digital architecture for joint value creation. Through this digital architecture, the other ecosystem actors are able to connect to their individual digital solutions, and the orchestrator coordinates their joint efforts in seeking to realize higher customer value. (Kamalaldin et al., 2021, p. 12)	Deciding on system architecture
During this initiation stage, GR establishes a technology framework that promotes active participation and provides clear guidelines on the roles within the ecosystem. This involves developing interfaces that facilitate seamless connectivity, considering the technological maturity of each participant. Additionally, a modular structure is created to encourage participants to offer complementary services. (Marelli & Dello Sbarba, 2024)	Setting the technology framework
For instance, it is common that the provider organization assumes the roles of the Project Sponsor and contracts an IT firm to take on the roles of Digital Innovator and System Integrator. (Poeppelbuss et al., 2022, p. 608)	Defining roles and responsibilities
As a consequence, three of those ten firms … have initiated to change their positioning in the value system …, in order to improve their relational intimacy with customers. (Grandinetti et al., 2020, p. 658)	Negotiating authority and control

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Table A1 (*continued*)

Example quote	First-order code
The service provider identifies and gathers several external knowledge sources. These external knowledge sources provide complementary information, needs, skills and competences for the development of an innovative product-as-a-service model for the façade element. In particular, the external knowledge sources involved are the following: the integrated design consultancy company, the façade manufacturer and the final users. (Sgambaro, Chiaroni, & Urbinati, 2025, p. 10)	Configuring resource contributions
1a knows it has gaps in its capabilities for new advanced services, and attempts to identify potential partners that offer the missing pieces. Both parties went on to talk about how better communication of capabilities enabled 1b to jointly bid with 1a for a new contract, which might have been impossible without this knowledge exchange, since neither party had the right mix of capabilities to win the bid on its own. (Raddats et al., 2017, p. 388)	Assessing partners' capabilities
For example, a provider may typically view optimizing the operation of a particular equipment as a clear value but this may not increase the overall throughput of the customer site if other equipment or issues are constraining throughput. Thus, some detailed discussions and negotiations are needed on both sides to define a value to the identified needs and to select one to address in further development. (Sjödin et al., 2020, p. 485)	Identifying goals and motivations
The general manager (Case B) highlighted this: "We are all committed to try to visit all the hospitals in the regional bases and try to convince them that we have good equipment and a good service organization. […] And then if their chief is interested, you try to come up with a proposal while visiting sites." (Pereira et al., 2019, p. 740)	Disseminating the vision across the network
Important actions for modifying the profit equation were about introducing cost-and-revenue sharing models for clarifying the costs and revenues for partners when developing and delivering digital services. (Markfort et al., 2022, p. 87)	Refining incentives and value capture methods
As the use of digital twins expanded beyond organizational boundaries, there was a need to add common rules on factors such as what could be displayed in the digital environment and to whom, what interfaces could be opened in different organizations' ERP systems, and who owned data movement in the two-sided platform. (Rantala et al., 2023, p. 10)	Refining data sharing and security agreements
We have documented these processes even though it's rather difficult because the projects are different. However, we tried to describe it, and we have made a project handbook. (Huikkola et al., 2013, p. 1175)	Documenting processes
The activities between the network actors were clearly defined and the suppliers were able to map the solution process beforehand. (Jaakkola & Hakanen, 2013, p. 52)	Mapping workflow
"We have penalty and bonus systems based on mutually-agreed performance parameters, so number of days off the road. That might cause a penalty but it might cause a bonus if it's (the vehicle) off the road less often than is assumed and we can operate it more and generate more revenue accordingly" (Story et al., 2017, p. 61)	Setting performance goals/KPIs
Each year, EngCo China re-accredits its ASPs, requiring them to meet a checklist of demands. Failure to meet the set criteria or underperformance makes an ASP susceptible to losing its license as an authorized partner. This acts as an important incentive for the ASPs to develop and maintain relations with EngCo China. (Raja & Frandsen, 2017, p. 1666)	Controlling performance
We meet regularly to report progress to this committee and discuss the next steps of the integration process. We learn from each other and exchange experiences and expectations, including all strategic and operational issues. (Xing et al., 2017, p. 14)	Monitoring innovative projects
As one informant explained, the novel and intangible nature of digital offerings prompted Oceana to increase transparency—for example, by creating "common platforms" for sharing customer feedback and other information. This change "boosted the relationship with the customer," which became "more of a partnership." To support this transformation, Oceana sought to enhance ICT-enabled information and knowledge exchange with its MNC partners, as well as between its central and local organizations. (Sklyar et al., 2019, p. 454)	Setting up data-sharing platforms
We try to include all service providers in Jira [..] And they can be from different organizations. [They] can also be freelancers and so on. But the goal is that we have a common view on the whole topic. And ideally, as in agile by the book, we also share this with the client. (Poeppelbuss et al., 2022, p. 611)	Setting up information and communication systems
Furthermore, specifically related to the aforementioned circumstance, a significant data sharing activity is going on in these supplier–customer relationships, involving the information relevant for monitoring the supplied product's (machinery, equipment and systems) conditions. (Grandinetti et al., 2020, p. 659)	Sharing equipment/operational data
We discuss [issues]; we share knowledge between us. Similarly, we try to figure out whether this picture is accurate, and we try to ensure that everybody has the same understanding of the overall market situation. (Huikkola et al., 2013, p. 1175)	Sharing business information
We have been working for a long time on educating dealers about the potential of our (platform name) system and how to use it in their service processes. Some dealers are more progressive in picking this up and others need more support from us. It is still a conservative industry and there can be resistance. But, we realize that we need our dealers on board to deliver increased customer value from our digital investments. (Jovanovic et al., 2022, p. 8)	Providing training
… maintenance teams started working more closely with design teams, sharing their knowledge about maintenance routines and associated costs. Maintenance engineers provided feedback to the design teams about which components tended to require frequent, lengthy maintenance, further improving decisions about the design and procurement of systems. (Robinson et al., 2016, p. 44)	Transferring knowledge
With this provider, we have to work with them all along the life of the product because for artificial intelligence; we need to make them evolve all along the life of the product. (Dalenogare et al., 2023, p. 9)	Involving partners in development
GR aims to foster an environment of open dialogue and participatory decision-making to strengthen the platform architecture. This approach involves engaging with a variety of actors to tailor the platform's architecture to their specific informational and technological requirements. (Marelli & Dello Sbarba, 2024)	Applying participatory decision-making
Conversely RepairCo reported a lack of alignment between their business and that of ManuCo. One specific example cited by RepairCo was ManuCo's policy on whether to replace or repair worn and damaged components in their products. RepairCo's business model is sensitive to ManuCo's policy on whether to replace or repair worn components, which changes under the PSS model and RepairCo is concerned that this could lead to a reduction in business for RepairCo. (Lockett et al., 2011)	Identifying the misalignments in value logics
In a participant workshop in 2019, attendees agreed that a shift was needed away from the technical development of remote monitoring technologies and the physical product itself toward the use and commercialization of sensor-generated data. (Altmann & Linder, 2019, p. 42)	Aligning partners' motivations
We try to evaluate [the process description of the relationship] biannually in terms of whether we do still act according to it. However, at least once a year, we thoroughly evaluate whether this is reality… and in special cases, we have discussions if they are exceptions or if they happen regularly and why we did it this way. Then, we have a conversation about whether we need to make changes or not in our procedures. (Huikkola et al., 2013, p. 1175)	Evaluating the current governance structure
Since HQ sees difficulties in its current and future service delivery model, it relies heavily on its ASPN and needs its cooperation. Focusing chiefly on creating end-user benefits, HQ applies strict measures to bring its ASPN into compliance with HQ standards. For example, after it became known that some ASPs address, and seek to satisfy, their own interests first, HQ initiated a campaign to remove accreditations from substandard service partners. (Raja & Frandsen, 2017, p. 1668)	Revising contracts and agreements
As the project advanced, new activities were introduced, such as deep market analyses, the creation and sale of new service packages, the process of internationalization, and the design of a unique and global service platform. (Carloni & Galvani, 2024)	Setting long-term goals

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Table A1 (*continued*)

Example quote	First-order code
Moreover, it needs to find ways to (re)organize its resource base and business model to support short and long-term value propositions for customers, drivers and complementors. Different phases in the service ecosystem transformation to autonomous solutions require different types of resources. (Makkonen et al., 2022, p. 555)	Reorganizing roles
One respondent gave an example of transferring the ownership of the digital twin from the end-customer to the integrator … In this way, a suitable payment model is created and also, the ownership situation becomes clearer. Moreover, this will ensure that the digital twin is owned by a party that knows how to keep it updated. (Reim et al., 2023, p. 3938)	Renegotiating power structure
Certain partners were more important for further advancement of the platform, such as technology partners and specialized service partners. Technology partners were necessary to fast-track certain API developments while their brands added quality assurance to conservative customers. On the other hand, specialized service partners ensured that the touchpoints with customers are well-organized and managed. (Jovanovic et al., 2022, p. 10)	Identifying new capability needs
If partners cannot keep up with the speed of development, a once profitable relationship can soon turn into an unprofitable and outdated collaboration. It is thus important for companies to monitor and evaluate complementarity dynamics (i.e. changes in complementarity) in the relationships in order to make sure that partners can deliver superior value creation than the alternatives. (Kamalaldin et al., 2020, p. 9)	Acquiring/dismissing partners
This will be achieved when they convince existing and new ecosystem actors how value that is created jointly will differentiate them from other global competitors. In this way, all will be able to appreciate the benefits of this cooperation and the shaping of their ecosystem for internationalization. (Kolagar et al., 2022, p. 154)	Defining ecosystem value
The teams generally work together for a longer period of time and personal bonds develop between individuals… In this case, the majority of the firms operated at the customer interface: for example, brand managers in the customer organization cooperated with art designers. So personal bonds developed between actors at all levels of the supplier and customer organizations. (Jaakkola & Hakanen, 2013, p. 53)	Strengthening relational ties
The MoD and the Prime came forward and built a joint integrated project team (IPT) for managing behavioral conflicts. This issue was taken care of in PBCs 3 and 4 where the customer was involved right from manufacturing stage. (Datta, 2020, p. 680)	Joint problem solving
I would say 10 to 15 people from our side across the business and marketing area, and maybe 10 to 15 people from networks, commercial and marketing from Eta's side… who were working on refining together. These joint teams tend to generate many new ideas for improving operations or innovating new solutions. (Kamalaldin et al., 2020, p. 11)	Building joint teams
The supplier and customer often jointly analyze the data, seeking ways to develop the customer's processes and reduce breakdowns and downtime. (Huikkola et al., 2013, p. 1174)	Co-creating solutions
The architect is exhibiting a lack of trust in WinCo's incentives. Also, architects indicated that they doubted whether WinCo would be able to ensure the circular process given the long-term character of its service contract. (Stegehuis et al., 2023, p. 214)	Competence trust
By setting small, realizable goals and making small investments, providers can develop trust and commitment from customers and legitimate their innovation processes while reducing risk. (Sjödin et al., 2020, p. 488)	Reliability trust
The probable reason behind the partners being reluctant to provide comprehensive customer knowledge is that it is against an intermediary's own interests. After all, their competitive advantage accrues from customer closeness and the knowledge acquired in long-term customer relationships locally, and they do not want to jeopardize their position in the distribution chain. (Hakanen, Helander, & Valkokari, 2017, p. 173)	Following one's own interests
Though the projects were characterized by quite good repartition of tasks between the complementary actors and independent teams, but it was combined with some degree of internal competition that was sometimes challenging for the collective effort. "There was some competition with big industrial partners, because, in fact, they thought (Leader) was like…competitor…they were a bit afraid to be there, the relationship was a little bit strange." (Polova & Thomas, 2020, p. 238)	Rivalry risk
Even though some respondents claim that their platform solution allows customers to seamlessly integrate different software programs, it has been found that the most optimized solution is created when using software from one single provider which another respondent expressed clearly is a challenge: '… one complete Alpha solution will give optimized benefits, but simultaneously one has backed the customer into a corner that they can never get out of, and they do not like that.' (Reim et al., 2023, p. 3933)	Overdependence on a partner's software
Another sacrifice noted was the risk of becoming too dependable and tightly linked with the other actors in the solution network: some suppliers felt that intense resource ties and activity links were a restraint in developing their business in the direction they wished. Some actors pointed out that they wanted to remain open to co-operation with actors outside this solution network. (Jaakkola & Hakanen, 2013, p. 54)	Overdependence on a partner's capabilities
… if the services are outsourced to sub-contractors, the manufacturers may have very limited possibilities to affect the outcome for the end customer. However, it is important to note that manufacturers currently have limited possibilities to solely select distributors; however, distributors that are customers have the power to select which manufacturers' products they purchase, and certainly they have their own selection criteria. (Aminoff & Hakanen, 2018, p. 1035)	Fear of high-power asymmetry
A servitizing manufacturer develops expanded capabilities and moves into areas of expertise historically provided by other actors, those other actors may feel their value-creating assets are under threat and move to defend their place in the value chain. (Raddats et al., 2017, p. 39)	Fear of losing interfaces and decision-making power
This way some of the participants were not in the project scope and unable to establish any collaborative relation. "We were there just because they were needing academic partner, not because they were willing to do real things with us…what we were doing was interesting to no one. And so that was it – we were just left on ourselves…" (Polova & Thomas, 2020, p. 237)	Perceived partner commitment in development
An informant from SupXi stressed that role vagueness can delay or hinder efforts to move toward DEPI: "Many larger players [are] trying to capitalize on digitalization. The challenge is that it is not fully clear what would be our role in the future, and this has delayed our efforts at collaboration." (Kamalaldin et al., 2021, p. 10)	Perceived partner engagement in processes
They also benefitted from manufacturing industry customer insight, which could be integrated into their own R&D processes. (Jaakkola & Hakanen, 2013, p. 54)	Capability/learning outcome
The customer representative (CD1) was unwilling to invest a large sum to reduce cost of service just because they would have to share the savings with the Primes. A Near Prime representative (ONP21) said that there was no urge to generate savings as a firm price is guaranteed throughout the life of the PBC. (Datta, 2020, p. 678)	Change in operational, economic, and commercial performance

Appendix B

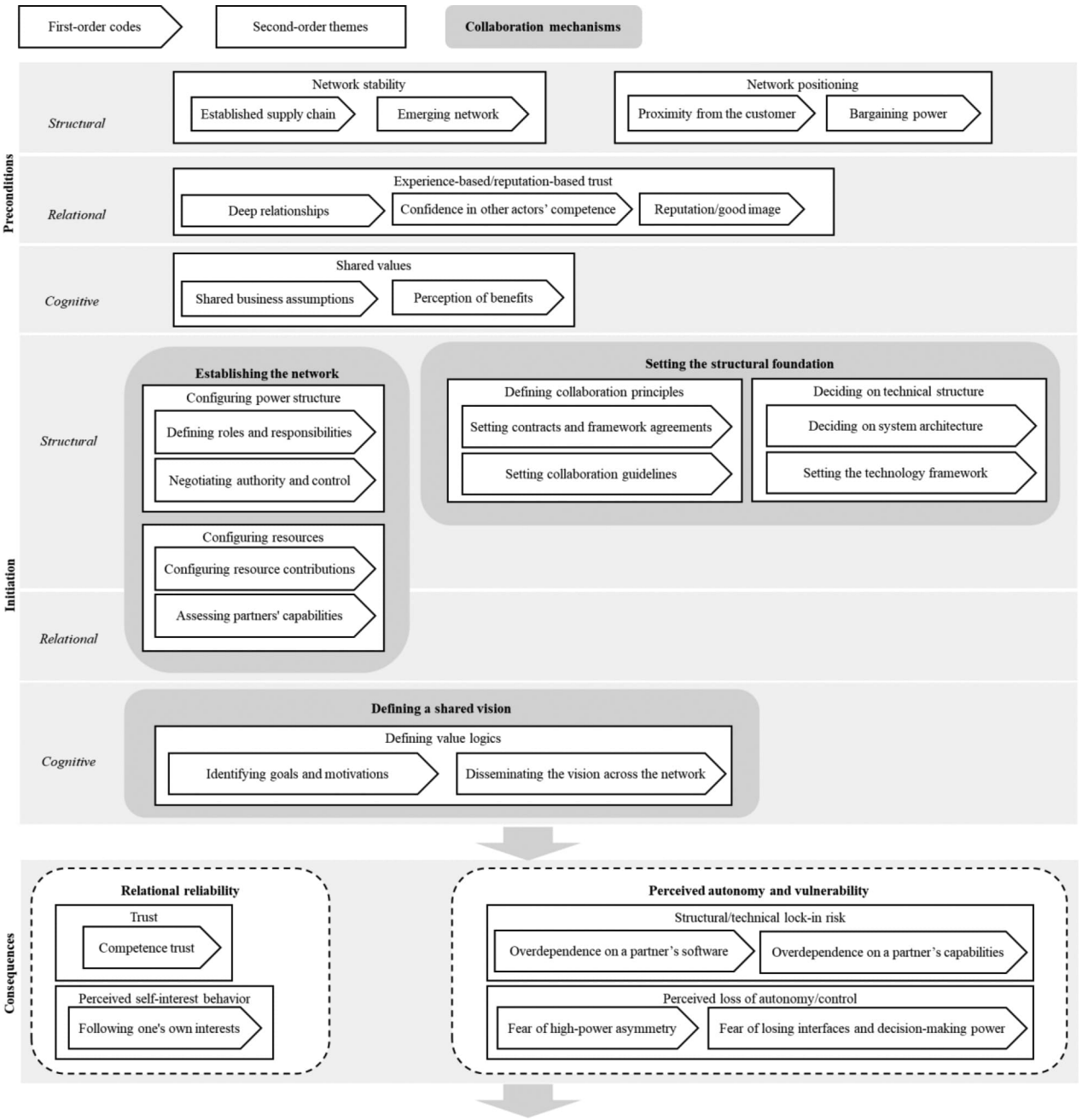

Fig. A1. A process view of collaboration in servitization and the data structure.
Figure A (continued). A process view of collaboration in servitization and the data structure.

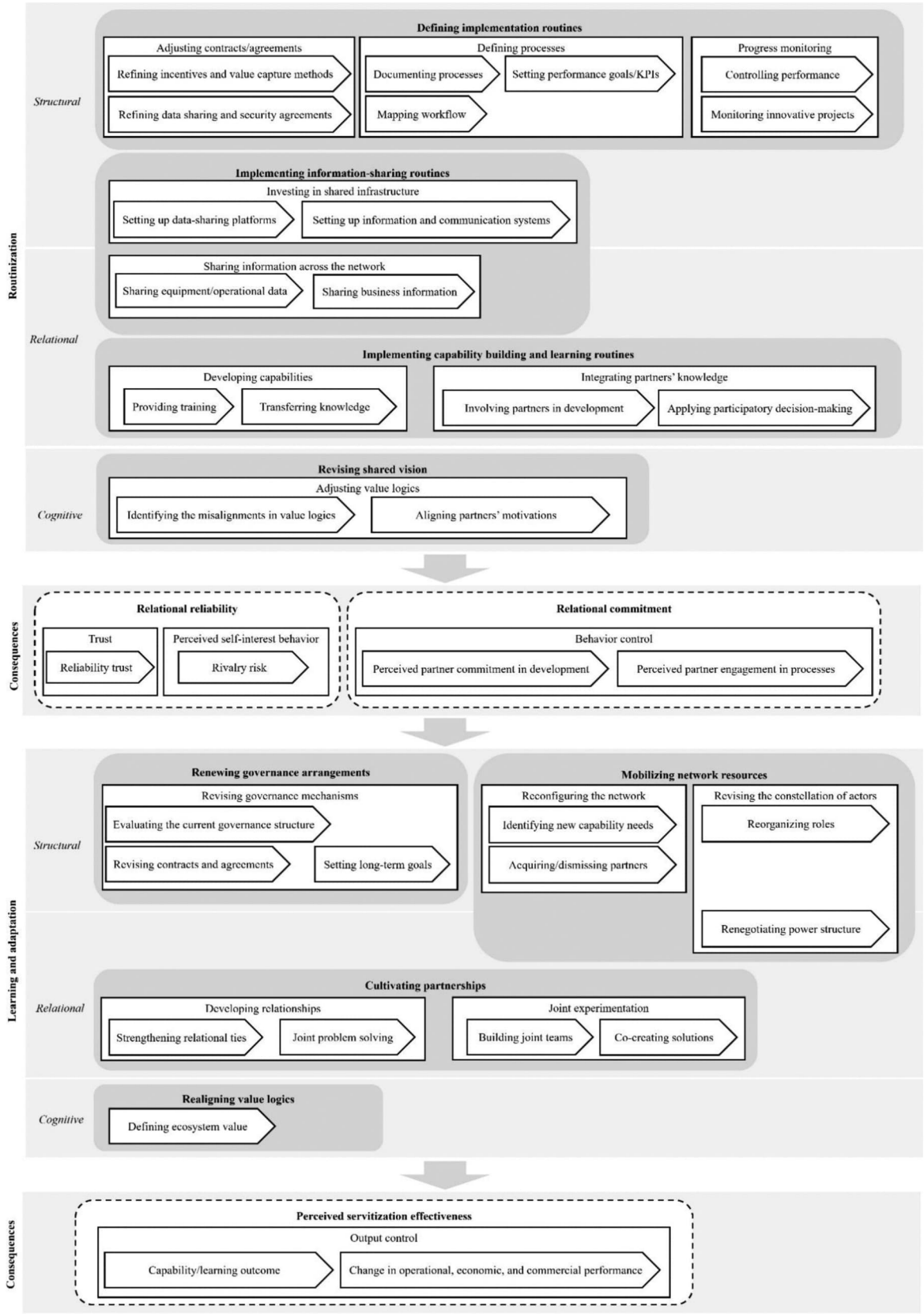

Fig. A1. (*continued*).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.indmarman.2026.06.001.

Data availability

No data was used for the research described in the article.

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