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Investigating tensional knots in servitizing firms through communicative processes

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ABSTRACT

Tensions and paradoxes have gained considerable traction in the broader general management literature in recent years. Within the servitization domain, however, they are only starting to receive attention. This paper explores the tensions that industrial firms encounter when attempting to integrate services and solutions into their offerings. Following an exploratory multiple case study approach, we identify several tensions experienced at the intra- and interorganizational levels by three industrial firms. By drawing on the four flows model—activity coordination, organizational self-structuring, institutional positioning, and membership negotiation—we identify tensions at the intersection of the flows. The findings elucidate how many of the identified tensions become knotted and movement across organizational levels is created through communicative processes. We make contributions to the literature by drawing on communicative processes to explain how paradoxical tensions emerge within a servitization context and become entangled. As servitizing firms move toward offering advanced services, they are likely to face an increasing number of tensions spanning intra- and interorganizational levels. Our study raises important implications as inextricable entanglements between tensions creates complexity, which requires managers to focus more clearly on the challenge of coping with these on an ongoing basis.

1. Introduction

Life can only be understood backwards; but it must be lived forwards.
Søren Kierkegaard, Danish Philosopher.

The phenomenon of industrial firms attempting to integrate products and services has received considerable attention (Kowalkowski, Gebauer, & Oliva, 2017; Raddats, Kowalkowski, Benedettini, Burton, & Gebauer, 2019), as have the difficulties they face (Alghisi & Saccani, 2015). However, only scant attention has been given to the tensions those firms encounter in such transformations (Burton et al., 2016; Kohtamäki, Einola, & Rabetino, 2020). There is scope for further exploration of the tensions that many successful product firms experience when adding services and solutions to their business models—a phenomenon referred to as servitization. We know from the servitization literature that many industrial manufacturing firms transitioning toward services face a greater risk of bankruptcy (Benedettini, Swink, & Neely, 2017; Neely, 2008) or fail to realize the financial returns from services (Gebauer, Fleisch, & Friedli, 2005; Visnjic & van Looy, 2013). However, empirical findings regarding the tensions and paradoxes that might explain the difficulties encountered by such firms are not well understood, nor are they the main research focus. Paradox theory offers a means of understanding the tensions that emerge (Schad, Lewis, Raisch, & Smith, 2016) within an industrial context so that firms are better able to cope with them.

Shifting toward a "both-and" instead of an "either-or" perspective, as advocated in the paradox literature (Schad et al., 2016; Smith & Lewis, 2011), resonates within a servitization context of combining products and services instead of choosing one or the other. Paradoxes are defined as "contradictory yet interrelated elements that exist simultaneously and persist over time. This definition highlights two components of paradox: (1) underlying tensions—that is, elements that seem logical individually but inconsistent and even absurd when juxtaposed—and (2) responses that embrace tensions simultaneously" (Smith & Lewis, 2011, p. 382). As such, "while all paradoxes are comprised of tensions with contradictory or contravening 'poles' tugging in opposite directions, organizational members do not treat all *tensions* as non-resolvable" (Sheep, Fairhurst, & Khazanchi, 2017, p. 465; italics in original). This explains the inherent relation between paradoxes and tensions. Importantly,

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paradoxical tensions are unlikely to exist purely in isolation and will spur others, so research points toward the need to consider tensions not solely as co-occurring (Jarzabkowski, Lê, & Van de Ven, 2013) but rather as inseparably entangled. Sheep et al. (2017) call on researchers to move beyond focusing on individual tensions to develop an "understanding of how multiple paradoxical tensions might simultaneously emerge, interrelate, and be managed" (p. 464). Their suggestion that tensions may have amplifying or attenuating effects on one another (Sheep et al., 2017) is an interesting line of further inquiry for understanding how tensions might become inextricably knotted (Cunha & Putnam, 2019) within an organization and across organizational boundaries. Moreover, recent research calls for greater attention to exploring "the organizational characteristics within which paradoxes are entangled" (Jarzabkowski, Bednarek, Chalkias, & Cacciatori, 2022). That is particularly relevant for servitizing firms because they have to manage multiple tensions emanating from having both product and service logic. Understanding how those tensions entangle with one another is important for being able to respond to them.

In this paper, we seek to understand not only the tensions servitizing firms encounter but also how some tensions spur others and become knotted at different levels, thus making them difficult to manage. Following Putnam, Fairhurst, and Banghart (2016), who argue that "paradox studies need to encompass research from widely different paradigms" (p. 67), we draw on McPhee and Zaug's (2009) proposed "four analytically distinct but interdependent ways" (McPhee & Iverson, 2009, p. 62) through which organizations are constituted to uncover paradoxical tensions. That is known as the four flows (activity coordination, self-structuring, membership negotiation, and institutional positioning) model. It considers four distinct processes (i.e., flows) that bring organizational forms into existence, both internally and externally. Attending to the intersections of the four flows, necessitates one to cast their gaze across levels of analysis (Kuhn, 2021), which facilitates the understanding of intra- and interorganizational entanglements of tensions. Thus, the four flows model affords a valuable lens for viewing paradoxical tensions and how they knot.

Although we are beginning to understand paradoxical tensions within a servitization context and moving beyond the "either-or" approach (Kohtamäki et al., 2020), knowledge of how those tensions may be knotted and the implications thereof are yet to be explored in detail. To address that research gap, we propose the following research questions: *What tensions emerge in attempting to enact servitization? How can we understand the tensions and their entanglement within organizations and across organizational boundaries?* We address our first research question by exploring the tensions that emerge from various pairings of the four flows (Browning, Greene, Sitkin, Sutcliffe, & Obstfeld, 2009; McPhee & Zaug, 2009). The second research question is then addressed to examine the levels those tensions occur at and how they are knotted. We adopt a multiple case study approach detailing findings from three leading Danish firms that have implemented servitization strategies. Based on 63 extensive interviews undertaken across the case firms, we identify several paradoxical tensions experienced by servitizing firms. Engineering firms are of particular interest because they typically have a strong product-oriented mindset which creates tensions both within the organization and externally when embracing both a product- and a service-oriented mindset.

Our findings identify and elucidate how tensional knots are formed. We make three notable contributions to the literature. First, we show how (paradoxical) tensions intertwine to form tensional knots and span levels to create movement within and across intra- and interorganizational networks. Second, we explore the communicative processes through which organizing for servitization takes place and how their intersections reveal tensions within and across organizational levels. We further contribute by highlighting the increased complexity of coping with knotted tensions. Third, building on Smith and Lewis (2011), we highlight that pairings of different categorizations of organizational tensions (i.e., organizing, performing, and belonging) should not be viewed solely in isolation but rather in relation to one another. As organizing is the prominent categorization across all three cases, we note its importance in relation to the other categorizations.

2. Theoretical background

2.1. Servitization

Servitization is the process whereby typically manufacturing firms transition from a product-orientation to also providing services (Forkmann, Henneberg, Witell, & Kindström, 2017; Forkmann, Ramos, Henneberg, & Naudé, 2017; Kowalkowski, Kindström, Alejandro, Brege, & Biggemann, 2012) and solutions to meet customer needs (Davies, Brady, & Hobday, 2006; Raja, Bourne, Goffin, Çakkol, & Martinez, 2013). Various categorizations and typologies have emerged to describe services delivered over time (Baines & Lightfoot, 2013; Mathieu, 2001; Tukker, 2004). Of those, the Baines and Lightfoot (2013) categorization of base (e.g., spare part provision and warranty), intermediate (e.g., maintenance, repair, and overhaul (MRO), condition monitoring, and training), and advanced services (risk and reward sharing, delivering outcomes focused on product performance) tend to hold sway in the literature in detailing the kinds of services provided.

Recent servitization reviews provide evidence of the burgeoning literature in this domain (Rabetino, Harmsen, Kohtamäki, & Sihvonen, 2018; Raddats et al., 2019), with significant contributions in several areas such as strategy (Baines et al., 2009; Rabetino, Kohtamäki, & Gebauer, 2017), transition process (Kowalkowski, Windahl, Kindström, & Gebauer, 2015; Parida, Sjödin, Wincent, & Kohtamäki, 2014), product-service networks (Bastl, Johnson, Lightfoot, & Evans, 2012; Chakkol, Johnson, Raja, & Raffoni, 2014; Gebauer, Paiola, & Saccani, 2013; Reim, Sjödin, & Parida, 2019; Windahl & Lakemond, 2006), capabilities (Jovanovic, Raja, Visnjic, & Wiengarten, 2019; Story, Raddats, Burton, Zolkiewski, & Baines, 2017), and the trend toward digital servitization and ecosystems (Kohtamäki, Parida, Oghazi, Gebauer, & Baines, 2019; Sklyar, Kowalkowski, Tronvoll, & Sörhammar, 2019; Frandsen, Raja, & Neufang, 2022). Despite important progress in accounting for the different areas, a need remains for better understanding how tensions and paradoxes emerge within organizations embarking on servitization journeys, which require both a product- and service-mindset (Raja, Green, & Leiringer, 2010). The literature is replete with simplistic prescriptions for how firms should manage such transitions (Luoto, Brax, & Kohtamäki, 2017) by viewing it as a trade-off between moving from a product to a service logic (Oliva & Kallenberg, 2003). The alternative views needed to shift from "either-or" to "both-and" thinking (Kohtamäki et al., 2020) necessitate focusing on tensions arising in servitization processes.

Although much remains to be learned from understanding tensions within servitization, some notable studies have examined them. For example, Burton et al. (2016) identified 19 tension types that they categorized into five broad groups within servitization: (i) direct challenge to expertise; (ii) pressure to learn; (iii) cost-focused challenges; (iv) process-change risk aversion; (v) external actor impacts on value creation. They note that tensions can occur at multiple levels (e.g., individual, group, and organization), both within and between organizations. Other work has highlighted the value-eroding effect of tensions and territoriality within servitization (Crowley, Burton, & Zolkiewski, 2018; Wagstaff, Burton, & Zolkiewski, 2020). These studies provide fertile ground for further exploration of the tensions and paradoxes within servitization.

Early servitization work highlighted the so-called "service paradox" of manufacturers investing in service activities without commensurate financial returns (Gebauer et al., 2005). Similarly, Visnjic & van Looy (2013) discuss the "profitability" hurdle whereby manufacturers' investments must be translatable into economies of scale. Johnstone, Wilkinson, and Dainty (2014) called for moving beyond exploring the financial returns from servitization to understanding the human

resource and organizational challenges. Interestingly, although those studies discuss paradoxes within a servitization context, they do not draw on the wider established paradox theory literature, with notable recent exceptions being (Kohtamäki et al., 2020; Kohtamäki, Rabetino, & Einola, 2018). We turn now to that fruitful line of inquiry.

2.2. Paradox theory

Tensions are described as being "often the broadest, most ambiguous of concepts, and the one that scholars frequently use to signify all paradoxical dynamics" (Putnam et al., 2016, p. 68). Building on previous work on paradoxes in the management literature (Lewis, 2000; Schad et al., 2016), "a paradoxical tension denotes a persistent contradiction between two competing yet interdependent forces, which requires ongoing response rather than one-time resolutions" (Wei, Geiger, & Vize, 2022, p. 97). As such, underlying tensions form an essential part of paradoxes, thus highlighting the inherent relation between the two, but it is important to note that not all tensions become paradoxical (i.e., tensions can also refer to either-or choices where alternatives need to be selected from among mutually attractive or unattractive options (see Cameron & Quinn, 1988).

In recent years, the literature on tensions and paradoxes has expanded within management studies (Cunha & Putnam, 2019). For example, paradox theory has been used in studying innovation processes (Andriopoulos & Lewis, 2009), interorganizational coopetition (Gnyawali, Madhavan, He, & Bengtsson, 2016; Raza-Ullah, Bengtsson, & Kock, 2014), demand and supply activities (Gölgeci, Karakas, & Tatoglu, 2019), and servitization (Kohtamäki et al., 2020). Much of that work presents a renewed emphasis on paradoxes discussed by Lewis (2000) and Smith and Lewis (2011). Schad et al. (2016) also point to the persistent nature of contradictions between interdependent elements. Thus, it is not possible simply to eliminate paradoxical tensions; they need to be embraced in a manner that permits a means of coping with the contradictory elements (Clegg, da Cunha, & e Cuhna, 2002).

Smith and Lewis (2011) proposed four categories of paradoxes that are representative of core activities in organizations: organizing (tensions emerging from competing designs and processes), belonging (identity tensions between individuals and groups), performing (tensions emerging between the differing and conflicting demands on internal and external stakeholders), and learning (tensions emerging as systems change, renew, and innovate) (pp. 383–384). Those tensions are said to operate within and across the categories, yet research on relationships *between* categories is still at a nascent stage. For example, previous studies have demonstrated interaction between organizing, performing, and belonging paradoxes that is similar to structuration processes (Clegg et al., 2002; Jarzabkowski et al., 2013). Further understanding of their influence on each other is needed (Jarzabkowski et al., 2022).

It is argued that responses to paradoxes may spur negative and positive reinforcing cycles (Lewis, 2000; Smith & Lewis, 2011). Such responses may influence outcomes at different levels (Jarzabkowski et al., 2013), with an impact on task structure, subunit structure, and coordination mechanisms. In effect, the outcomes are a result of preceding actions related to the paradoxical demands on an organization. Thus, paradoxes are interrelated and evolve dynamically at different levels over time, so they require varied responses (Jarzabkowski et al., 2013).

Moreover, paradoxes are non-resolvable tensions (Fairhurst et al., 2016; Schad et al., 2016; Sheep et al., 2017) and call for iterating responses across levels. For example, oscillating between separating and integrating strategies may allow for transcendence (Gölgeci et al., 2019). Attention has also turned toward understanding how tensions become entangled, meaning how they impact one another by amplifying or mitigating relationships (Gölgeci et al., 2019; Sheep et al., 2017). For example, Sheep et al. (2017) introduce the "concept of tensional 'knots'" (p. 463) and argue that it is through discursive formulations that entanglements between tensions are formed as "naturalistic *groupings* of tensions" (p. 468; italics in original). In other words, language plays a significant role when trying to understand how tensions impact one another to form knots (Putnam et al., 2016; Sheep et al., 2017). Rather than seeing tensions as co-occurring, an inseparable interdependence is formed which resembles an intractable "Gordian" knot (Sheep et al., 2017). Building on this, Fairhurst and Sheep (2019) describe *"'knots' as interdependently connected (mutually affecting or generative) systems of entangled tensions, given substance through communicative processes"* (p. 89; italics in original). Our research focuses on the entanglement between tensions to understand their co-occurrence and mutual impact. As such, we understand tensional knots as inextricable entanglement between two singular tensions. In the case of knots, one is confronted with a plurality of relationships in which the different terms come together (Jarzabkowski et al., 2022). Employing a communicative lens offers an important means for understanding how tensions develop and become entangled. Scope for exploring that further is provided by drawing on the communicative constitution of organizations (CCO) perspective and particularly the four flows model, which serves as a means for elucidating the formation and entanglement of tensions at intra- and inter-organizational levels (Kuhn, 2021).

2.3. The four flows model

The CCO approach considers communication to be a process by which organizations are generated, i.e., *constituted* (Putnam, Nicotera, & McPhee, 2009; Schoeneborn, Blaschke, McPhee, Seidl, & Taylor, 2014), that goes beyond a simple message transmission (Shannon & Weaver, 1949). Thus, it is through communicative instances enacted in social interactions that organizational processes are structured. According to CCO scholars, "organizations, as well as organizational phenomena, come into existence, persist, and are transformed in and through interconnected communication practices" (Schoeneborn, Kuhn, & Kärreman, 2019). Communication is therefore a central aspect of organizing and of organizational existence (Ashcraft, Kuhn, & Cooren, 2009; McPhee, Poole, & Iverson, 2014) as "the means by which organizations are established, composed, designed, and sustained" (Cooren, Kuhn, Cornelissen, & Clark, 2011).

The CCO perspective includes several schools of thought (Schoeneborn et al., 2014). Of particular interest is McPhee & Zaug, 2009 four flows model based on Giddens' (1984) structuration theory. The model focuses on four distinct processes that bring organizational forms into existence. Flows are also referred to as *types of message flows*. Each flow—(1) *membership negotiation,* (2) *organizational self-structuring,* (3) *activity coordination,* and (4) *institutional positioning*—contributes to explaining the constitutive role of communication in organizations by either taking an internal or external perspective (Ashcraft et al., 2009; McPhee, Poole, & Iverson, 2014). Kuhn (2021) points out that the model "directs attention to the tensions, paradoxes, and contradictions across flows" (p. 112) as they emerge at the intersection of flows. We elaborate further on each flow below (see also Appendix A) and discuss how they can aid our understanding of tensions experienced within the servitization context.

2.3.1. Membership negotiation

The question of "Who are we?" addresses the flow of membership negotiation concerned with organizational members' roles and relationships with the organization. Defining who belongs to an organization is a crucial aspect in the constitution of organizations. Recruitment and socialization are decisive when a "new member must be incorporated into the routines and structures of the organization" (McPhee & Zaug, 2009). To address topics such as identification, individual positioning, and commitment, the membership negotiation flow examines how members socialize, interact, and position themselves within the organization. As processes of identity formation and inclusion are reflexive, fluid, and unstable (Alvesson & Willmott, 2002), tensions

of membership construction and belonging could arise. For instance, traditional product-oriented organizations encounter difficulties in bringing organizational members together to establish a sense of unity and belonging when incorporating a service mindset. Having different mindsets (i.e., product- or service-oriented) among organizational members gives rise to tensions (Kohtamäki et al., 2020) of belonging and recognition. It is not uncommon for servitizing organizations to partner with external firms for service-related tasks (Ayala, Gaiardelli, Pezzotta, Le Dain, & Frank, 2021; Ayala, Gerstlberger, & Frank, 2019; Ayala, Paslauski, Ghezzi, & Frank, 2017; Raja & Frandsen, 2017), with resulting tensions at the inter-firm level. At that level, organizational members may face questions of organizational belonging, commitment, and individual positioning within the interorganizational network.

2.3.2. Organizational self-structuring

This flow describes "a communication process among organizational role holders and groups" (McPhee & Zaug, 2009) aimed at coordinating organizational members' activities by means of structuration. The question of "What rules do we operate by?" is addressed to support managerial activities, decision making, and planning procedures through predetermination. Specifically, self-structuring refers to "internal relations, norms, and social entities that are the skeleton for connection, flexing, and shaping of work processes" (McPhee & Zaug, 2009). Official documentation (e.g., organizational charts or operating manuals, constituting policies, and hierarchical relationships) supports organizational self-structuring and provides a frame of reference for organizational members. Rather than reacting to immediate problems in different ways, organizational self-structuring helps to ensure consistency in certain processes and establishes routines. This flow is evident in servitizing firms needing to alter structures in support of advancing services. Whereas some organizations may opt to develop a separate service business unit (Oliva, Gebauer, & Brann, 2012; Oliva & Kallenberg, 2003), others incorporate services into their product-oriented structures and processes (Neu & Brown, 2005). That requires reorganization through organizational chart and rule changes to support managerial activities and decision-making. As product and service life cycles vary, firms need to better analyze, benchmark, and develop their offerings (Rabetino, Kohtamäki, Lehtonen, & Kostama, 2015). For example, service and product sales project planning horizons differ, so the two parts of the organization's milestone schedules and performance measurement systems need to be aligned to address—and potentially avoid—the inevitable tensions of organizing and structuring.

2.3.3. Activity coordination

An organization's existence is bound to one or more manifest purposes that guide all organizational activities (McPhee & Zaug, 2009). Although distinct from the flow of organizational self-structuring, activity coordination is closely interlinked with structuration processes (McPhee & Zaug, 2009). Specific rules and structures imposed by management direct organizational activities and provide a frame of reference, but official documentation cannot anticipate or prevent all possible disruptions or tensions arising from individuals working closely together (Cooren & Martine, 2016). Therefore, coordinated adjustments of frequently occurring difficulties are required (Perrow, 1967). Consequently, the flow of activity coordination deals with the question of "What work do we do together?" and focuses on the need to negotiate and adjust collaborative processes in response to practical issues. Organizational strategies, hierarchical structures, and negotiations guide the organizational coordination of activities. Coordinating service-related work and aligning service business processes with other units, such as research and development (R&D), sales, procurement, and product management, are perennial tasks. Here, negotiations primarily occur internally across functions to determine task responsibilities and align collective work. Despite the common goal of service business growth, tensions and difficulties may be encountered when bringing members from different functional areas together to perform tasks. In a servitization context, a lack of proper activity coordination could lead to tensions of work responsibility and prioritization.

2.3.4. Institutional positioning

While the three previous flows are concerned with internal communication processes, the institutional positioning flow takes an external perspective by considering the question: "What external forces provide legitimacy?" (Cooren & Martine, 2016) explain that institutional positioning "has to do with how the organization positions itself, whether in terms of identity, image or legitimacy" (p. 5). Communication is considered to occur outside organizations with multiple entities—customers, suppliers, competitors, and regulators (McPhee & Zaug, 2009). As Ayala et al. (2017) discuss, knowledge sharing in service collaborations facilitates incorporating and drawing on service suppliers' external knowledge. Those communicative interactions are primarily performed by interlocutors holding boundary-spanning roles to negotiate on behalf and for the benefit of the organization (Ayala et al., 2017; Chakkol, Karatzas, Johnson, & Godsell, 2018). Thus, organizations are not isolated but operate within industries with the power to shape and influence them (Ayala et al., 2019; Finne, Turunen, & Eloranta, 2015). Work relationship time spans can expand for firms incorporating services into their business model, as service contracts typically run for a longer duration (Baines & Lightfoot, 2014). That particularly affects, for example, sales department work processes when preparing bids and tenders for service contracts. Hence, well-aligned internal processes that support an organization's institutional positioning as a trusted and high-quality service provider are indispensable to service business growth. Any discrepancy between the "projected image" (Gioia, Schultz, & Corley, 2000) and the perceived image by an organization's interorganizational network could give rise to tensions of collaboration, institutional positioning, and relationship building.

Taken together, those four flows represent individual message flows that when combined contribute to bringing the organization into existence (see Appendix A for summary of the four flows). Despite their distinctive characteristics, the four flows' syncretic nature means a single message can address multiple flows at once (Browning et al., 2009).

2.4. Summary

In this paper, we posit that combining paradox theory with the four flows has the potential to elucidate the tensions across intra- and interorganizational levels within a servitization context. The four flows model allows us to explore tensions that emerge at the intersection of the flows (Kuhn, 2021) which makes tensional knots discernible. Studying the communicative processes allows us to "zoom in" on the entanglement between two single tensions to understand how tensional knots are formed. As single tensions can be attributed to different flows, i.e., communicative processes, examining the intersections of the flows enables us to identify how knots form (i.e., how single tensions bind together). Better understanding is needed of how tensions within organizations—and in relation to the wider actor network—unfold and become connected to one another. We detail below our adopted research approach and reveal in our findings how the tensions unfold and become knotted.

3. Research approach

3.1. Case research and selection

An exploratory qualitative, case-based research approach was deemed appropriate for our inquiries (Eisenhardt & Graebner, 2007; Siggelkow, 2007; Yin, 2009) to allow for an investigation of tensions within a servitization context. A multiple case study (Yin, 2009) was conducted on three Danish industrial firms that have embarked upon servitization journeys. We adopted a "purposeful sampling" approach

(Lincoln & Guba, 1985; Miles & Huberman, 1994; Patton, 2015), which allowed us to investigate the tensions unfolding for the servitizing firms by interviewing representative individuals from each case firm. We selected three cases from different industries that provide sufficient heterogeneity to facilitate analytical generalizability of the tensional knots identified. All three firms are considered leaders within their respective industries for their product businesses and have adopted a servitization strategy.

3.2. Data collection

As all three case firms are part of a large project exploring servitization within industrial organizations, access to the firms and representatives was extensive. Of the case firms, Alpha has been engaged in the project the longest. An initial exploratory round of data collection was undertaken with Alpha at the outset of the project. That work enabled the research team to sharpen the interview guide (see Appendix B). Beta and Gamma were subsequently incorporated into the research project and the related data collected.

Our main source of data comprised face-to-face interviews, although some interviews with Alpha—and industry core group meetings involving the three case firms—were conducted online during the Covid-19 pandemic. A total of 63 interviews were conducted across the three firms. In selecting interview participants from each case, we took particular care to ensure that they were knowledgeable about the business. Initial respondents were identified jointly with the senior contact person in each firm, then we used a snowballing technique to identify further respondents of interest. Table 1 provides the interviewees' job titles. We conducted semi-structured interviews of 41 to 175 min, guided by our objective of understanding the tensions servitizing firms experience. All interviews were audio recorded and transcribed verbatim. The interview data were supplemented by field observations collected by taking notes where possible and appropriate. We followed good research practice recommendations (Lincoln & Guba, 1985) by taking field notes on informal conversations and observations and by holding post-interview debriefing sessions to share our thoughts on the emerging issues and themes. Desk research on each firm's website and other online sources (e.g., LinkedIn and industry-specific websites), email correspondence, documentation, and on-site observations provided additional data sources enabling us to triangulate our findings (Voss, Tsikriktsis, & Frohlich, 2002). Table 2 further explains the trustworthiness of our research and details the criteria for research quality followed.

3.3. Data analysis

Our data analysis approach is best described as abductive (Dubois & Gadde, 2002; Lewis, 1998), as we cycled between deduction and induction throughout the research process. Our first data analysis step followed the procedures outlined by (Miles & Huberman, 1994) when undertaking a within-case analysis of the individual firms. We read the transcripts carefully to develop an understanding of the occurring changes. We analyzed the interviews by coding segments of the transcribed interview texts deductively using the four flows.

In our second data analysis step, we inductively coded the data by rereading the interview transcripts to identify tensions described by

Table 1
Overview of case studies and data collection.

Case	Revenue (Approx.)	Number of employees (Approx.)	Core product and service offering	Data source	Interviewee titles/roles	Number of interviews per case
Alpha	USD 281 million	1300	*Product:* Systems integrator, provision of products for firefighting and telecommunication equipment *Base:* Spare parts, warranty *Intermediate:* Scheduled maintenance for offshore installation, operator training, (digital) condition monitoring *Advanced:* Service-level agreements, risk and reward sharing, outcome-based contracts	Semi-structured interviews; Internal and external documentation; Site visits; Workshops / Feedback sessions	Vice presidents, After-sales manager, Area sales manager, Head of innovation and digitalization, Head of procurement, O&M manager, Head of service, Procurement and supply chain management assistant, Service manager and coordinators, Project managers, Logistics assistant	34
Beta	USD 878 million	2300	*Product:* Supplier of catalysis and process technology *Base:* Spare parts, warranty services *Intermediate:* Consultancy, catalyst loading, training, field service, technical drawings/calculations, inspections, process optimization services	Semi-structured interviews; Internal and external documentation; Site visits; Workshops / Feedback sessions	Group leader technical support, Director technical support, Director technical service, Head of technical service, GM marketing, Vice president refinery, Sales manager, Group leader technical service	12
Gamma	USD 121 million	1150	*Product:* Manufacturer of advanced sound and vibration measurement equipment *Base:* Warranty, spare parts, calibration *Intermediate:* Environment management, repair, training, condition monitoring *Advanced:* Customized solutions for airports, construction sites, etc.	Semi-structured interviews; Internal and external documentation; Site visits; Workshops / Feedback sessions	Global solutions & support director, Vice president R&D, Innovation manager, R&D manager, Group quality manager, Software development, Vice president of operations, Vice president of production, Vice president of strategic marketing, Product marketing manager, Group logistics manager, Production engineering manager, Business development manager (calibration & repair)	17

Table 2
Criteria for assessing research quality.

Criteria	Explanation of criteria application
Dependability	▪ Detailed explanation of research process is provided to elucidate the steps taken to collect and analyze data in this research ▪ Initial set-up of interview guide was revised after the first round of interviews with one case organization ▪ Careful documentation and detailed recording of data sources and materials was maintained in a case study database ▪ Research team members performed iterative coding, with multiple rounds of reading and rereading interview transcripts, field notes, and additional documentary evidence References: Lincoln & Guba, 1985; Voss et al., 2002
Confirmability	▪ Representatives of different functions, locations, and hierarchical levels within the three case organizations interviewed ▪ Multiple researcher involvement reduced researcher bias ▪ Initial findings discussed and reviewed by experts and researchers not involved in data collection References: Lincoln & Guba, 1985; Miles & Huberman, 1994
Credibility	▪ Triangulation of original research data (conducting follow-up interviews, collecting documents, and taking field notes to corroborate initial findings) ▪ Research process followed several iterations between literature and emergent findings ▪ Dedicated workshops and feedback sessions with each firm to verify findings References: Lincoln & Guba, 1985; Miles & Huberman, 1994
Transferability	▪ Collected data utilized within the scope of this research ▪ Findings discussed with firms participating in a larger research project to ensure analytical generalizability and relevance to other contexts References: Eisenhardt & Graebner, 2007; Lincoln & Guba, 1985

respondents. Following a thorough within-case analysis, we identified other related emergent issues. This step also involved coding additional data sources to better understand (Corbin & Strauss, 2015; Lincoln & Guba, 1985) these tensions. The researchers read (and reread) each interview transcript independently. First, two researchers coded sections of the text using in-vivo codes, i.e., using the respondents' own words (Corbin & Strauss, 2015) for data categorization. Second, the two researchers had numerous discussions regarding the data categorization to compare their coding and refine the identified individual tensions. We then explored the identified tensions—for example, the tension of restricted access to the end-customer and that of service recognition—in relation to the four flows, thus allowing us a means of "meaning condensation" (Lee, 1999) with which to abstract the most relevant themes from the data (Raja, Chakkol, Johnson, & Beltagui, 2018). During our second data analysis step, we paid particular attention to exploring the paradoxical nature of the tensions identified. That involved focusing on the contradiction, interdependence, and persistence of the individual tension. As not all tensions are paradoxical in nature, we carefully reviewed the tensions. Our analysis across the three case studies revealed three tensions and eleven paradoxical tensions (see Tables 3-5). In reporting our findings, we distinguish between "tensions" and "paradoxical tensions," with "(paradoxical) tensions" used to indicate when we are referring to both. We then examine how the identified tensions impacted other tensions and the tensional knots formed, with particular attention paid to the intra- and interorganizational levels. It is important to note that this process involved repetition through several iterative cycles until we reached saturation (Corbin & Strauss, 2015). Fig. 1 depicts our data structure from the coding process.

Following the within-case analyses, our third analysis step involved a cross-case analysis to compare and contrast the three firms' experiences of the tensions identified. At this stage, we also compared the tensions to the Smith and Lewis (2011) categorization of organizational tensions.

We coded all 63 interviews, which involved over 1000 pages of transcriptions. During the data analysis process, we checked the emerging findings with case firm representatives. That ensured the trustworthiness of the tensions identified during our coding process. Our processes ensured the veracity of the data and our interpretations, which we present in Section 4.

3.4. Case overviews

This study draws on the experiences of three global Danish organizations operating in different industries. All are leaders in their respective industries with long product sale and innovation histories. In recent years, they have all embarked on servitization journeys (see Table 1 for overview).

Alpha is a leading supplier of project engineering and solutions for the global energy sector in three main markets: oil and gas, wind power, and power projects. It has operations in Asia, Europe, North America, and Central America. Alpha has recently experienced significant growth in renewable energy operations, specifically offshore wind. Compared to Alpha's more traditional sectors, the wind sector is relatively young, with opportunities and demands for greater service and solution provisions. Alpha provides customers with comprehensive service offerings, ranging from installation, commissioning, repair, and maintenance to through-life support. In that sector, Alpha is positioned as a long-term "one-stop service provider," which is in stark contrast to its traditional project-based approach.

Beta specializes in catalysis technology for the oil and gas, and chemical industries. As the leading premium provider of catalysts, Beta has a strong engineering heritage and is renowned for its innovations. Historically, the firm has focused on product development with very strong R&D capabilities, which sales functions leverage to secure customers. The product business has therefore long been the firm's backbone, with a newer service business established to provide technical services for product offerings. Although technical service is important to customers eager to avoid operational downtime, the relative revenues ensure the catalyst business's core status. Beta recently developed and launched a digital servitization strategy, which includes gathering critical data from customer sites and applying simulation tools for process optimization. The strategic intent is to grow digital services.

Gamma is a leading global supplier of turnkey solutions for advanced sound and vibration (S&V) measurement equipment. As a leader in S&V measurement, it has a reputation for strong and deep technical expertise. Gamma has been behind several product innovation and digitalization advances in the industry. Besides providing customer support services, such as calibration and repair, Gamma has expanded its service offerings to include service agreements and customized solutions. It has also acquired other solution and engineering consultancy providers to advance the service business. Although services are an integral part of Gamma instruments and systems provision, the majority of its revenues come from product sales based on equipment specification, price, and quality.

The next Section 4 presents our within-case analysis findings for each firm by examining three pairings of the four flows.

4. Findings

We present here the within-case analysis of each firm by examining three pairings of the four flows, each containing activity coordination as the prominent flow and the identified tensions. We ascribe a pivotal role to activity coordination due to the need for alignment, collaboration,

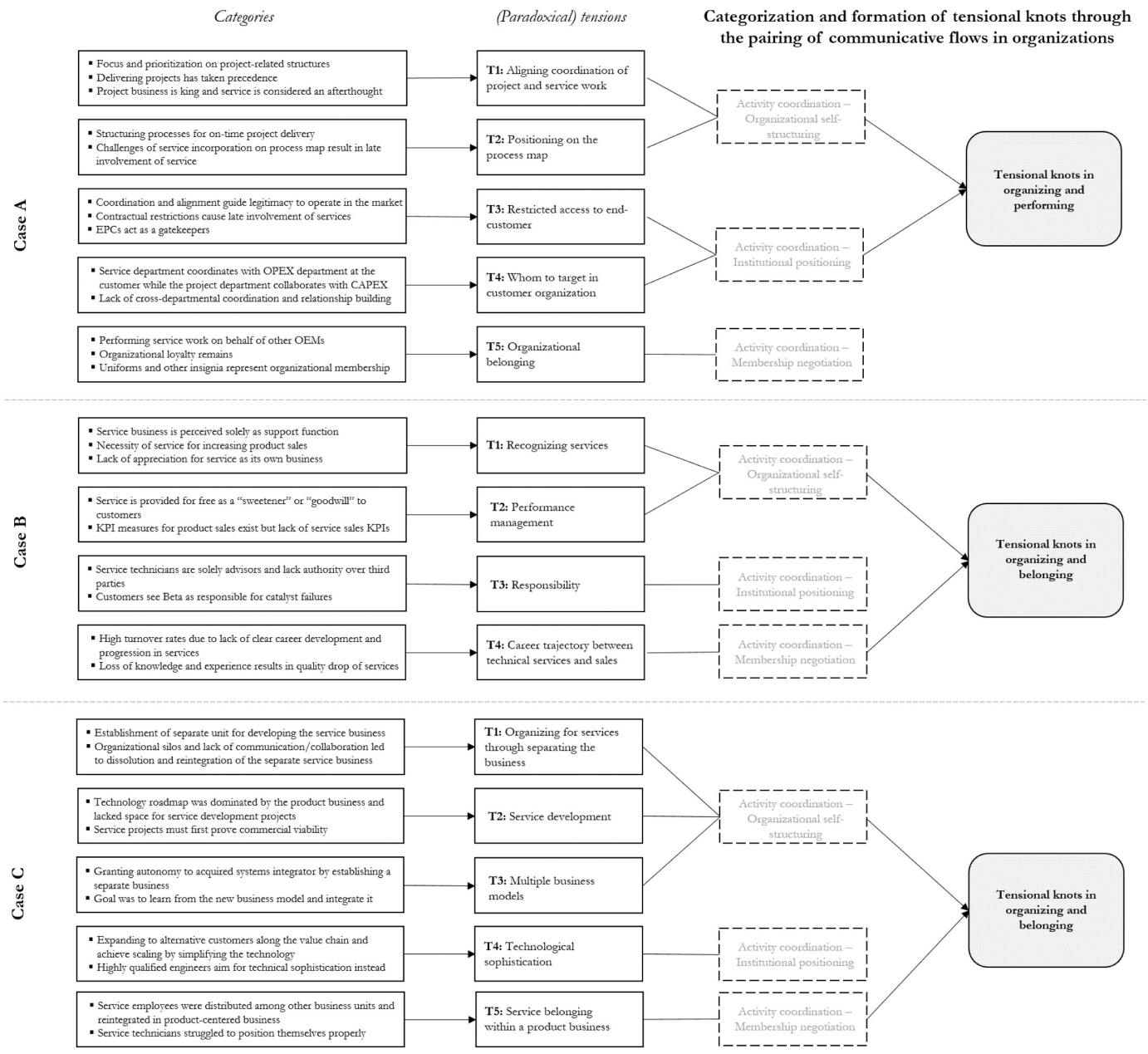

Fig. 1. Data structure.

and coordination between the service business and other units at the intra- and interorganizational levels. Organizations needing both product- and service-mindset while embarking on their servitization journeys often confront various tensions requiring activity coordination. We acknowledge that the identified tensions are not necessarily unique to our cases and that other studies are likely to have identified similar, yet not necessarily the same, tensions. We focus on the tensional knots formed.

4.1. Case A: Alpha

4.1.1. Organizational self-structuring and activity coordination

T1: The paradoxical tension of aligning the coordination of project and service work (Prioritizing projects vs. *service as an afterthought)*. As a strongly project-oriented firm, Alpha's internal processes are largely determined by project-related structures. While that ensures organizational members' focus on and commitment to projects, it also demands flexibility and adaptability to new emerging circumstances where support may be required after project delivery. Despite belonging to a specific internal department, organizational members' responsibilities shift when mobilized to work on a new construction project, so Alpha's strong project-focus impacts the service role. Intraorganizational activities require detailed coordination to ensure customers' demands are met and differing departmental objectives are aligned. The precedence Alpha gives project delivery affects its servitization strategy of being a "one-stop service provider." Offering through-life service and maintenance to their customers poses significant internal resources availability challenges for Alpha, which has traditionally considered that the "project business is king." That idea persists, and our respondents intimate that selling services will require a longer-term orientation to gain wider acceptance.

As the service business is relatively new and requires different resources on a different time frame from typical project processes, it receives less recognition and prioritization when planning and coordinating valuable internal resources. A paradoxical tension thus arises from prioritizing project work and considering service work as

Table 3
Data table with quotes from Alpha across the three pairings.

Pairings	Identified (paradoxical) tensions		Illustrative quotes
Organizational self-structuring–activity coordination	**T1:** The paradoxical tension of aligning the coordination of project and service work	*Contradictory*: Prioritizing projects vs. service as an afterthought *Interrelated*: Service- and project-mindset persist simultaneously *Persistent*: Changing mindsets to include services requires a long-term orientation	"The service products should be designed into the solutions that we sell. Right. But that takes the core company to understand the concept of selling service as part of our complete business. Right now they are very project focused. It is a mindset. We will change that in the future." (Service coordinator, telecommunications)
	T2: The paradoxical tension of positioning on the process map	*Contradictory*: Detailed planning of coordination activities vs. late involvement of service *Interrelated*: Service is visible on the process map but struggles to become involved in tendering processes earlier *Persistent*: Industry regulations continue to restrict earlier service involvement	"It would be a very good idea [for] after-sales services [if service] would actually get involved when the project is running so we would have a better chance to maybe make a quotation on commissioning of the systems and maybe participate in the FAT test where the client or the owner of the system is actually present. It's not always possible on projects for new buildings because it's normally the yard that owns that and the yard just wants everything done as easy as possible." (Service coordinator for fire fighting)
Institutional positioning–activity coordination	**T3:** The tension of restricted access to the end-customer	That FAT symbolizes the service department's first encounter with end-customers challenges the organization's external positioning as a service provider	"Often we try to either hand over to the service department, so (they) always know who to contact. When we are over a project (…) the intention is that service is participating in the FAT or pre-FAT in order for them to know the product then when they're going to the commission part, then they know the product, or if they're going to do service afterwards, then they know the product and what actually was delivered at that point. That's the intention but it's not up and running yet." (Manager telecommunications)
	T4: The paradoxical tension of who to target in the customer organization	*Contradictory*: CAPEX vs. OPEX *Interrelated*: Those responsible for maintenance (OPEX) and projects (CAPEX) are measured against conflicting financial incentives *Persistent*: Fixed bureaucratic structures affect access to and influence customer decision makers	"It's two different organizations also with the customer, because there is a project organization, (…) their goal is just to get this built and completed and handed over internally in their organization to their operation. When the operation then takes over (…) that's the time when they come and order their spare parts (…) And here with us it's very often then, of course it goes over to service." (Product responsible, telecommunications)
Membership negotiation–activity coordination	**T5:** The paradoxical tension of organizational belonging	*Contradictory*: Representing Alpha vs. representing the Client *Interrelated*: Individuals are conflicted by belonging to and representing different organizations simultaneously while maintaining their own integrity as a service technician *Persistent*: Industry requirements continue to persist	"We wear their clothes when we go out. (…) It matters for them [customer organization name], that they show that they are impartial to all the system integrators out there. But that is again a perception because one of our guys is out there [and] everybody knows he works for Alpha. That is how the market is, that small." (Head of innovation and digitalization)

secondary despite customers' ongoing service support needs. Hence, balancing project and service work is a perennial task. Both are deeply engrained in the organizational understanding, so the project business has a strong belief in service, but projects are still prioritized.

T2: The paradoxical tension of positioning on the process map (detailed planning of coordination activities vs. *late involvement of service)*. Related to Alpha's strongly project-focused nature, organizing and planning are core priorities that shape the coordination of various activities. Delivering projects on time while ensuring cost efficiency and quality requires a detailed overview of all activities and actors involved as well as precise milestones. A comprehensive process map provides that overview. Developed and used internally, the process map organizes intra- and interorganizational actors for the project duration and the handover to the service unit. The map is used to structure involvement with various entities within and across organizational boundaries. It provides an overview of activities that require coordination throughout the planning process. Although service has gained greater prominence in an organizational strategy aimed at becoming "an even bigger player in this market," incorporating service into the process map poses challenges. For example, the factory assessment test (FAT)—when systems are delivered to end-customers—is a critical process involving the service department in direct customer engagement. That phase is crucial in promoting the organization's services at an interorganizational level and positioning them within that network.

While the strategy considers service and deems it important, the paradoxical tension arises from the service department's late involvement in projects. To address that, the service department created the process map to position itself within the heavily project-focused process. Despite service gaining visibility at the intraorganizational level and recognition of its commercial contribution, it still struggles to find a place in bid and tendering processes. Consequently, service continues to join late in the process, when the system handover (i.e., system commissioning) is to occur. Although service is part of the process map and should figure in the coordination of activities, it is still relegated to the latter stages in planned activities.

4.1.2. Institutional positioning and activity coordination

T3: The tension of restricted access to the end-customer (contractual

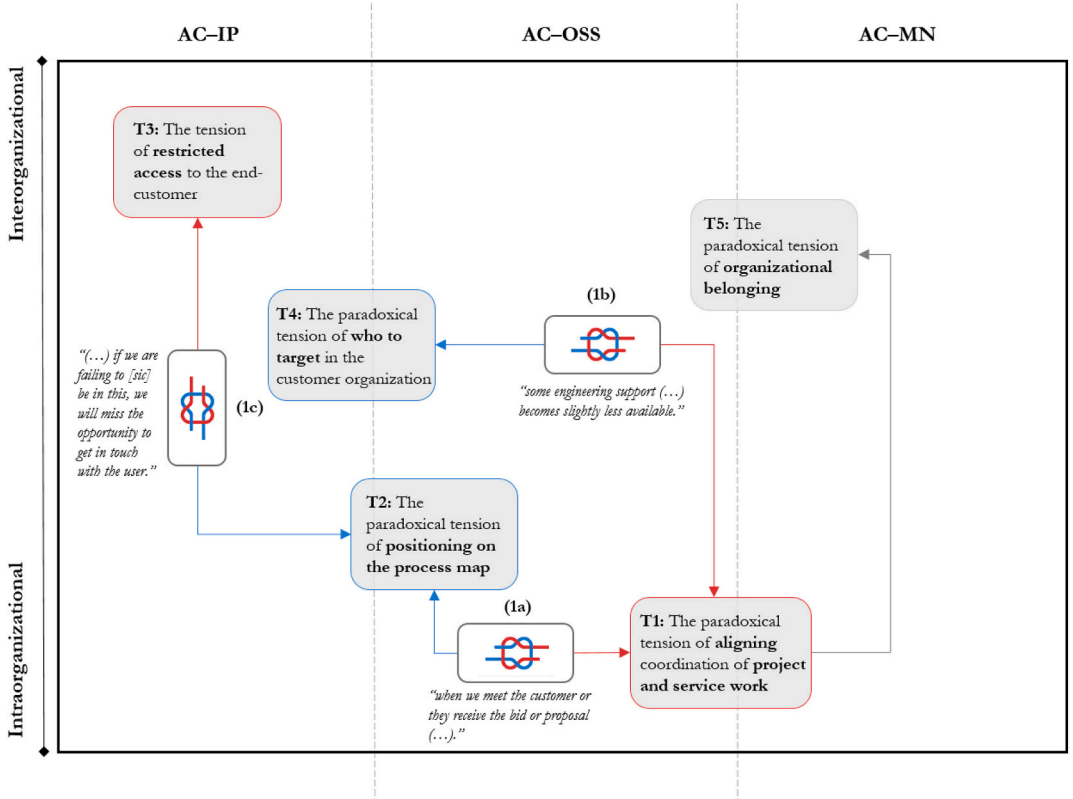

Fig. 2. Identified tensional knots within Alpha.
Note. *In Figs. 2–4, we utilize a grief knot (Grief knot, 2020) to illustrate the inextricable entanglement between two tensions which is closer to a Gordian knot. We consider the grief knot a better representation of the inextricability of the knot, which is extremely difficult to untangle compared to a reef knot (Reef knot, 2021), which Sheep et al. (2017) use.
**Although the figures depict the tensional knots as being static, the reality is that they emerge, entangle, and amplify over time.

restrictions vs. *late involvement of service)*. For Alpha, the coordination of activities to ensure institutional positioning among external entities includes, among others, planning, selling, negotiating, and servicing. Alpha's interorganizational network has a variety of actors in the offshore oil and gas, and wind industries. Coordination, alignment, and positioning in relation to customers, suppliers, and governmental institutions (e.g., regulators) guide internal processes that give Alpha market legitimacy. For example, when delivering its systems to a shipyard as part of a larger engineering, procurement, and construction (EPC) contract installation, Alpha can present itself as both a systems integrator and a provider of complementary services and solutions to the end-customer to support equipment operation and maintenance. Projects typically first encounter end-customers at FATs, which ensure functionality and delivery quality before systems commissioning. Confidentiality and other contractual clauses forbidding Alpha from approaching end-customers prior to system delivery create service business prioritization and growth challenges. In effect, the EPC acts as a gatekeeper restricting access to the end-customer until the project has been delivered (cf. Ayala et al., 2019; Ayala et al., 2017).

While the previous paradoxical tension pertains to involvement within the firm, the tension of restricted access to end-customers is at the interorganizational level. It is the EPC contractual arrangements which limit service development at an earlier stage.

T4: The paradoxical tension of who to target in the customer organization (CAPEX vs. *OPEX)*. While the project business tenders for large capital projects requiring close contact with the customer's contact responsible for all capital expenditures (CAPEX), the service department requires access to the operations and maintenance part of the customer's business, i.e., operational expenditure (OPEX). From a task-related perspective, Alpha's service department coordinates activities that occur after project delivery, and it interacts closely with customer operations and maintenance departments. Negotiations are therefore with those responsible for the customer's operational expenditures (OPEX), whereas Alpha's project business is in contact with those managing capital expenditures (CAPEX). Although it is crucial for the service department to secure long-term customer relationships that build on the project commissioning phase, such restrictions on who and when to target are detrimental for through-life system support.

Those responsible for customer maintenance (OPEX) and projects (CAPEX) are measured on conflicting financial incentives (Kohtamäki et al., 2020), thus creating a contradictory and persistent paradoxical tension with consequences for both services and projects in accessing and influencing customer decision makers to shift the concern toward service.

4.1.3. Membership negotiation and activity coordination

T5: The paradoxical tension of organizational belonging (representing Alpha vs. *representing the client)*. Organizational members may belong internally to different departments but they signal their affiliation with organizational origin through uniforms, organization tags, etc. When performing offshore service and maintenance tasks, Alpha employees are provided with uniforms signifying their membership. Alpha performs service and maintenance work offshore and delivers training in other original equipment manufacturers' (OEMs) systems. When performing service work on behalf of other OEMs or contracting firms, Alpha's service engineers are sometimes required to wear the other party's uniform and insignia. Workers contracted externally to represent Alpha also wear the firm's service uniforms. A sense of belonging and individual positioning develops which adds complexity to the understanding of the organization, what constitutes and characterizes it, and

where organizational members position themselves within prevailing hierarchical structures.

In both cases, whether representing Alpha or working on behalf of other contracting firms, a paradoxical tension arises whereby organizational members' identification and individual positioning processes are being disrupted by means of organizational signification and representation. Questions pertaining to identity in terms of "who are we" and which organization do we belong to and represent arise. For service workers, questions of loyalty and protecting the interest of the different parties arise and persist as individuals are torn between belonging and representing different organizations simultaneously while maintaining their own integrity as a service technician.

Table 3 summarizes the identified tensions across the three different pairings and presents illustrative quotes from the data.

4.1.4. Tensional knots identified within Alpha

Building on the (paradoxical) tensions identified within Alpha, we present the findings from our analysis of how some of those become inextricably knotted. We identified three tensional knots in Alpha: at the intraorganizational level (1a) and spanning intra- and interorganizational levels (1b and 1c). Those knots are detailed below. No tensional knots were identified solely at the interorganizational level.

1a: Tensional knot of aligning coordination of project and service work (T1) and *positioning on the process map* (T2). Alpha's project business is found to be dominant, with service to a large extent left to play a secondary, supportive role, thus limiting its growth potential. In a mirroring of activities that require coordination in a project, the process map is used as a means of structuring work processes within the intraorganizational network. Guided by the strong position project business holds, the process map only provides limited space for service to be included as an auxiliary activity. Hence, T1 and T2 are found to be mutually impacting as they have amplifying effects on one another, thus leading to a tensional knot at the intraorganizational level (see Fig. 2), i.e., the two paradoxical tensions form a tensional knot. Despite attempts to position service on the process map, project and service work demarcation leads to challenges of coordinating work internally in a more optimal way. However, the service department's lack of involvement leads to its service engineers finding themselves isolated and on the fringes.

1b: Tensional knot of aligning coordination of project and service work (T1) and *who to target in the customer organization* (T4). As discussed, the tension of *aligning coordination of project and service work* (T1) acts to negate servitization strategy progression. We found that projects are prioritized and determine the allocation of organizational resources.

> The genuine difficulty we face is that because we are a heavily project-related organization, as soon as your next construction project comes in, the people that you can rely on, then some engineering support perhaps becomes slightly less available. That can impact your ability from a service point of view. (O&M manager).

Related to that is the prevailing tension of *who to target in the customer organization* (T4). The project business and service function are found to target different parts of customers. Information deficits and time management restraints result, as Alpha's service department cannot target the right tier to position service offerings. Hence, T1 and T4 are found to mutually impact one another with amplifying effects on the persistence of the two paradoxical tensions. Their interdependence is illustrated by their tensional knot spanning intra- and interorganizational levels.

1c: Tensional knot of positioning on the process map (T2) and *restricted access to the end-customer* (T3). Interactions with entities outside of the organization shape Alpha's external positioning in relation to customers, suppliers, governmental institutions, and competitors. FATs are often the service department's first contact with end-customers. It is through FATs that service positions itself within interorganizational networks. Late involvement in project processes hinders Alpha's ability to secure long-term service contracts after commissioning for large projects. Utilized as an element for the organizational self-structuring of project coordination, the process map includes relevant project-related activities such as the FAT. Although that inclusion shows the service department's involvement in projects, its ability to take on more responsibility throughout entire project processes remains limited, as internal awareness and prioritization of service do not increase. Hence, T2 and T3 are found to mutually impact each other in an amplifying manner, which results in their tensional knot spanning the intra- and interorganizational levels.

Fig. 2 depicts the tensions identified for Alpha from the pairings of the four flows and their tensional knots within and across intra- and interorganizational levels.

4.2. Case B: Beta

4.2.1. Organizational self-structuring and activity coordination

T1: The paradoxical tension of service recognition (necessity of service for sales function vs. *lack of appreciation)*. Beta's product business forms the organization's backbone. Most of its activities and organizational structures are centered on and directed toward product sales. Despite the strategic intent to grow and commercialize Beta's service business, it is perceived solely as a sales support function directly linked to products, not as its own business. Prevailing organizational structures thus hamper attempts to develop the internal service business. Services are viewed as a necessity for increasing sales but lack a clear strategy and supporting resources. The strategic coordination necessary for facilitating service business growth and expansion is found wanting, with a resulting lack of recognition for technical services' work and activities. The service business seems overlooked and forgotten in product sales processes, with information on tender project outcomes not always being shared with the service department.

At the intra-organizational level, the paradoxical tension occurs because service is a necessity for the sales function, but a perception exists of not being fully involved or receiving the recognition and appreciation it deserves. References to "technical service" show how service is seen as a product business add-on with no independent commercial value. Hence, the paradoxical tension is that service is considered so integral for selling products that it is given away for free.

T2: *The paradoxical tension of performance management (KPI measures for product sales* vs. *lack of incentives for service sales)*. As mentioned, Beta has a long history of technical innovation and strong R&D capabilities. Its organizational coordination and structure focus strongly on products, with services as an add-on supporting product sales. That is reflected at the intraorganizational level, with services provided, sometimes for free, by sales personnel to support and boost catalyst sales to high-value customers. The existing key performance indicators (KPIs) center on product sales and do not fully account for the service role. Moreover, the sales department's reluctance to sell services individually is reflected in service bundling in product pricing. The lack of service-related KPIs for sales personnel provides no incentive to promote and sell services with value-capture potential. Unsurprisingly, the sales department lacks motivation because the rewards are not aligned with service sales. Indeed, providing free services as a "sweetener" and "goodwill" to secure product sales is not uncommon. That also makes it difficult to convince customers to pay for previously free services.

A paradoxical tension arises whereby Beta considered services strategically important but omitted them from KPIs for sales personnel, who thus gave them away for free. The performance management system therefore paradoxically drives routines that act against elevating services.

4.2.2. Institutional positioning and activity coordination

T3: The paradoxical tension of responsibility (lack of authority over third parties vs. *responsible for failures)*. Beta's service technicians commonly travel to customer sites when accompanying catalyst transportation to and loading at customer sites, but customers are responsible for hiring third-party loading companies and logistical coordination. Beta's

Table 4
Data table with quotes from Beta across the three pairings.

Pairings	Identified (paradoxical) tensions		Illustrative quotes
Organizational self-structuring–activity coordination	**T1:** The paradoxical tension of service recognition	*Contradictory*: Necessity for sales function vs. lack of appreciation *Interrelated*: Service is given away for free as it is perceived as integral for product sales *Persistent*: Organizational structures hampering service recognition prevail	"It's difficult to see technical services as a profit/loss because the services we're providing support the sales of catalyst […] So, should we put our efforts there, or should we sell our services individually? And it's a much better business getting one project agreement than selling ten services […] So, we're very linked to our products, because that is where the business comes from." (Group leader technical support)
	T2: The paradoxical tension of performance management	*Contradictory*: KPI measures for product sales vs. lack of incentives for service sales *Interrelated*: Existing KPI structure does not account for service sales, thus resulting in a lack of sales representative incentives *Persistent*: Performance management system drives routines that act against elevating services	"We have a problem, because Sales does not want to sell [services] because it makes no sense to them, they do not see the value of service in their KPI." (Director technical support)
Institutional positioning–activity coordination	**T3:** The paradoxical tension of responsibility	*Contradictory*: Lack of authority over third parties vs. responsible for failures *Interrelated*: Service technicians are held accountable for catalyst performance without having full authority over third parties *Persistent*: Regulations restricting full control over all processes performed by a third party prevail	"And some customers just see us coming; 'There's a Beta hat, and they just go like this and say,' [puts hands up in a defensive manner] 'this must be your responsibility.' But it is not. So, getting some clients to understand that it's actually their responsibility that the processes are done correctly, that's something we struggle with." (Director technical support)
Membership negotiation–activity coordination	**T4:** The paradoxical tension of career trajectory between technical services and sales	*Contradictory*: Retention vs. progression *Interrelated*: Service technician continuity and experience required for sales support, but lack of career progression paths leads to service department staff retention and high turnover difficulties *Persistent*: Service department development and progression is affected	"We have had a lot of retention issues. So, people change out. Like two years in this job, and then we go on, because that's the reputation of tech support before. And we want to change that reputation so people stay for much longer in tech support. This is a career. This is not just a starting job. This is a career." (Group leader technical service)

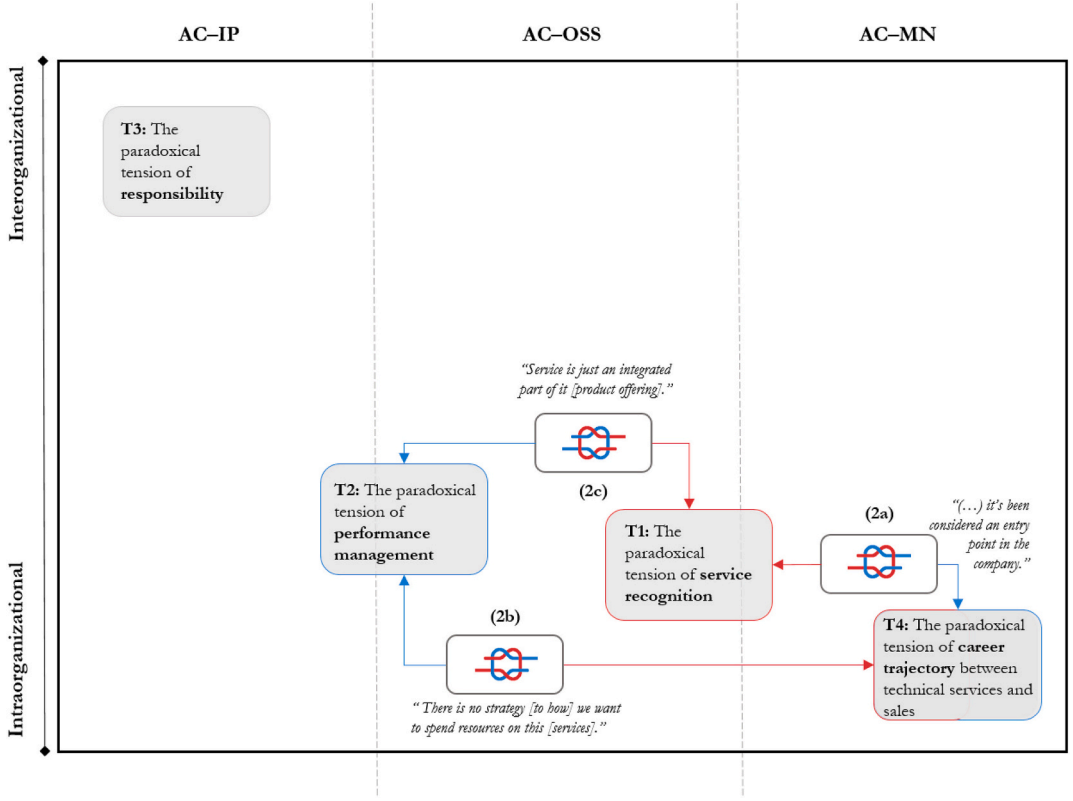

Fig. 3. Identified tensional knots within Beta.

service technicians function solely in an advisory capacity, with little to no control over third-party loading companies.

> We sell them the catalyst. And we go for trips as advisors. So, it's their responsibility to do it correctly. They hire a loading company to do the physical work, and then we are there to consult to get the best out of the catalysts and ensure the unit doesn't fail. But we do not have direct responsibility. (Group leader technical service support).

Beta is thus not responsible for catalyst storage, loading, activation, or reloading at customer sites (e.g., refineries). Those tasks are performed by third-party companies. Beta has no authority over how third-party loading companies manage those processes; Beta technicians merely observe the catalyst commissioning process. Although catalyst performance may be affected by processes not directly managed by Beta, customers often hold it responsible for related failures.

As failures are highly costly in large continuous operation processes such as in refineries, a paradoxical tension arises from Beta being responsible for guaranteeing the high performance of its catalysts without having authority or control over the loading process.

4.2.3. Membership negotiation and activity coordination

T4: The paradoxical tension of career trajectory between technical services and sales (retention vs. *progression)*. Given Beta's engineering culture, the technical service department highly prizes its engineers' quality, knowledge, and experience. In many ways, technical engineers are vital to Beta's long-term service business success and development. Their knowledge and expertise are crucial for technical proposals, tenders, and after-sales activities. Service contracts run for an average of two to four years, so service technician and related knowledge retention is crucial for ensuring long-term coordination and customer support for customers. However, the lack of clear career paths leads the majority of technicians to move to sales or product functions with clearer career trajectories. The resulting high turnover among service technicians causes a knowledge and experience drain. Replacement service technician recruits require significant training in work processes, systems, and regulations.

Service employees' lack of clear career progression pathways generates workforce retention tensions. Technical service employees experience conflict between service business loyalty and their career aspirations. High technician turnover affects service business unit operations, development, and ultimately ability to strengthen its intra-organizational positioning. That generates a paradoxical tension between the need for strong capabilities and knowledge to coordinate service activities and the failure to create the right conditions for service personnel career progression and retention.

Table 4 summarizes the identified tensions across the three different pairings and provides illustrative quotes from the data.

4.2.4. Tensional knots identified within Beta

Building on the paradoxical tensions identified within Beta, we present the findings from our analysis of how some of those become inextricably knotted. The analysis reveals three tensional knots at the intraorganizational level. No tensional knots were identified solely at the interorganizational level. We discuss those three tensions below.

2a: Tensional knot of service recognition (T1) and *career trajectory between technical services and sales* (T4). Considering services as an "add-on" to product sales amplifies the perception of the service department as "an entry point in the company." A clear career trajectory is lacking for technical services employees, who experience paradoxical tensions between organizational belonging, commitment to services, and career advancement.

> So, you go, you stay there [services] for a few years, you do a lot of traveling, but you're not being challenged that much. And then you move on to sales or marketing or product management. (Group leader technical support).

The mutually impacting T1 and T4 are found to have amplifying effects on one another where the prevalence of one tension strengthens the existence of the other, as illustrated by their tensional knot at the intraorganizational level.

2b: Tensional knot of career trajectory between technical services (T4) and *sales and performance management* (T2). High turnover among service technicians results in knowledge and experience loss within the service department and reduced quality of technical proposals. As accurate calculations are critical for winning new tenders, the interdependency calls for close sales and services collaboration.

> I think most of them [sales managers] appreciate it and know it's important, but we also have had, because we have a lot of young engineers, so we have had some quality issues with the technical proposal lately. It's not perfect, but they know that they have to rely on each other. (Vice president refinery).

Despite the importance of working together, the lack of clear service sales KPIs hinders the service business from taking a more prominent position within the intraorganizational network. Sales representatives have little incentive to promote services separately. Service technicians aiming to progress within the organization can thus see clearer career trajectories elsewhere in the interorganizational network. Hence, T4 and T2 are found to be mutually impacting. Those amplifying effects generate a tensional knot between the two paradoxical tensions at the intraorganizational level.

2c: Tensional knot of performance management (T2) and *service recognition* (T1). Despite being necessary for product sales, service is perceived as an add-on rather than its own business with profit and loss responsibilities. Additional services are either included in a bundle with the product sale offer or provided "for free" to customers. Intra-organizational network members clearly lack a common understanding of the value and costs involved in providing additional services.

> I think the sales managers who are throwing in this pilot plan-test have no clue how expensive it is to run a client test. But I do because I used to do it. So, indirectly they run client test. We're doing it to get a better understanding. But again, it's quite expensive and extensive. (Director technical support).

Although a clear performance management system for product sales is in place, sales representatives have no KPIs reflecting service sales performance. Consequently, they lack incentives to sell services and contribute to firm growth. Hence, T2 and T1 are found to be mutually impacting and thus amplify one another, as shown in their tensional knot at the intraorganizational level.

Fig. 3 depicts the paradoxical tensions identified for Beta according to the pairings of the four flows and their tensional knots at the intra-organizational level.

4.3. Case C: Gamma

4.3.1. Organizational self-structuring and activity coordination

T1: The paradoxical tension of organizing for services through separating the business (separating vs. *integrating)*. Gamma initially followed a servitization strategy by providing "services as an add-on" to products. That resulted in difficulties in elevating the service business, which was dominated by the product mindset and operational methods. To develop the services business and integrate services with products, Gamma established a separate service business unit with new leadership and personnel to foster a greater service-orientation and its own profit and loss responsibilities following a separation strategy for organizing services (Oliva et al., 2012; Oliva & Kallenberg, 2003). Although senior management approved that decision, it led a few years later to paradoxical tensions between the product and service businesses surfacing in the form of organizational silos lacking in communication and cooperation.

At the intraorganizational level, those prevailing paradoxical tensions caused the board to reintegrate service with the product business (Kohtamäki et al., 2020). Consequently, the vice president for services was asked to leave Gamma. Although the initial rationale for separating

Table 5
Data table with quotes from Gamma across the three pairings.

Pairings	Identified (paradoxical) tensions		Illustrative quotes
Organizational self-structuring–activity coordination	**T1:** The paradoxical tension of organizing for services through separating the business	*Contradictory*: Separating vs. integrating *Interrelated*: Establishing a separate service business resulted in silos and eventually the reintegration of product and service units. The original tension resurfaced between products and services *Persistent*: Reintegrating services brought temporary stabilization, from which new tensions will arise in the long term	"One of those values we add in is a much more comprehensive set of services on top of products. To support this transformation from being a product-company-supplier to… a services company, we created a Global Services Organization some years ago when we put all the services teams and people into that, into one group. With a VP reporting to Senior Management as part of the senior management team. That failed completely." (Global solutions and support director)
	T2: The paradoxical tension of service development	*Contradictory*: The commercial viability of service vs. deemed too successful for resource allocation *Interrelated*: Resource allocation should be on the technical roadmap, but service has to prove its commercial potential first *Persistent*: Technical roadmap understanding and use continues to impede future service development	"In respect of figuring out what should be on the roadmap, so what kind of products should we develop for the future, we have a whole setup around insuring that what we do is what the customers would like to see a benefit from and then we allocate the resources where that makes the most sense. So, we have formed a strategy team around that and on a quarterly basis we agree what is on the roadmap and what is not on the roadmap, which is as important in our prioritization discussions." (Vice president, R&D)
	T3: The paradoxical tension of multiple business models	*Contradictory*: Autonomy as separate business vs. integrate to learn *Interrelated*: Maintaining a separate solutions business to learn from it while creating distance from and difficulties in incorporating it into the main business *Persistent*: Challenge of learning from innovative acquisition without hampering its autonomy and flexibility	"And that model we thought that would be very nice, to get more understanding of that business model and expand it on some of the other areas we have. So we acquired them and got rid of our own… or we took the best from both worlds, we took the software from their side and the hardware from GAMMA but took the business model." (Vice president, R&D) "I would say that our customers know less and less about the noise and vibration; they need more and more solutions to their problems. They don't need an instrument anymore." (Innovation manager)
Institutional positioning–activity coordination	**T4:** The tension of technological sophistication	Simplicity in product manufacturing imposes challenges for employees' technical engineering mindset	"So, we are very much focused on the R&D labs of our customers and we have a pretty ok foothold in that area. What we are trying to do now is to expand and say, in the same companies they need our expertise in the production lines or when they have deployed their wind farms and need to make maintenance checks and so on, so we try to look beyond the R&D area, beyond the R&D lab where we have been for 70 years and then we are saying if we are going to grow where are the possibilities." (Vice president, R&D)
Membership negotiation–activity coordination	**T5:** The tension of service belonging within a product business	Tension between separating services and reintegrating with products caused employees to experience belonging and positioning issues	"We need to get some fresh blood in from the outside that has some experience in this, and who are able to drive it through the organization. Also, it's both good and bad, you get some fresh blood in, but also how is their position in the company?" (Global solutions and support director)

services was to elevate them, the process was deemed too problematic for internal cooperation and coordination. The decision to reintegrate parts of the business to a certain extent reintroduced the initial paradoxical tension whereby service played a supporting role to the dominant product business, thus causing difficulties in growing service offerings.

T2: The paradoxical tension of service development (the commercial viability of service vs. *deemed too successful for resource allocation)*. Roadmaps function as devices to guide an organization in achieving its strategy. The process itself is particularly important for Gamma in planning and organizing future opportunities and providing perspective on which activities bring the most value. A technology roadmap provides structure, focus, and resources to areas in which the firm's efforts are invested. The Gamma product business was found to dominate its roadmap, with no space left for service development projects.

Without a roadmap presence, tensions arose from difficulties in allocating resources to service-related projects from product development projects. Top management needed to see service projects' commercial potential before allocating additional resources for developing, testing, and refining prototypes. That lack of resources led service business to develop a pilot cloud-based solution for a large customer "under the radar" (Burgelman, 2002), without top management knowledge. The project was deemed such a success that it received the customer's internal innovation competition prize. To develop the project further for commercialization and scalability, the service business

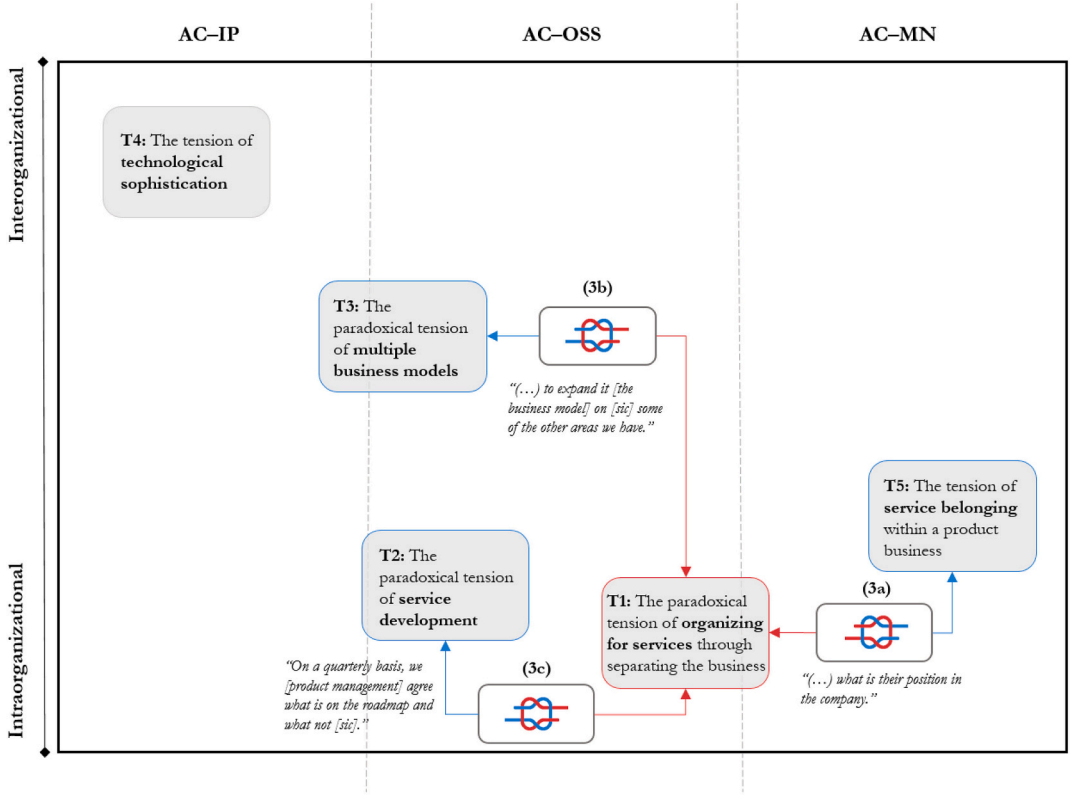

Fig. 4. Identified tensional knots within Gamma.

required resources that could only be allocated using the roadmap, but the project was deemed "too successful" to be on the roadmap. The paradoxical tension here exists between the high degrees of service project uncertainty and the next-generation character of most new products. Thus, it is difficult to position service on the roadmap where space is limited, which in turn creates a paradoxical tension indicating that service should be there to propel the service strategy and receive resources to further the business.

T3: The paradoxical tension of multiple business models (autonomy as separate business vs. *integrate to learn)*. As a product-centric organization, Gamma has traditionally focused strongly on R&D and product sales. Calibration and repair are part of its customer support services, which complement the product offering. To expand the service business, Gamma acquired a systems integrator that provides total solutions for customers' noise-monitoring needs. The acquired firm deals with all its stakeholders by operating on an outcome-based business model. The acquisition rationale resulted from the potential threat to Gamma's S&V equipment sales, i.e., its equipment could easily be replaced by competitor products. Moreover, Gamma wanted to learn from the acquired firm's business model and replicate it for application in other areas.

Making the acquisition an autonomous business unit limited Gamma's ability to learn from it and incorporate its knowledge and practices. The paradoxical tension here is between Gamma's desire to learn from the acquisition without hampering its autonomy and flexibility.

4.3.2. Institutional positioning and activity coordination

T4: The tension of technological sophistication (technological complexity vs. *technological simplicity)*. Gamma is known for manufacturing the highest quality S&V equipment for advanced measurements. Its traditional customers need high specification equipment for R&D purposes, but Gamma sought to expand its customer base along the value chain to include, for example, manufacturers with production line operations. As that industrial context prioritizes reliability over absolute precision, production lines generally require lower technical specifications than R&D labs. That raised tensions between Gamma's highly qualified organizational members, who are dedicated to perfection, engineering culture, and developing the most advanced analytical equipment, and the simplification of products and services required for scalability.

The challenge is to understand and address evolving customer needs. For management, the ability to meet those changing needs is paramount for advancing the service business. However, for highly skilled engineers, that can translate into reduced technical sophistication, changed routines, and new ways of working. The tension between leveraging and reconfiguring the firm's core capabilities for service contexts and the need for simplification to achieve scalability is difficult to reconcile.

4.3.3. Membership negotiation and activity coordination

T5: The tension of service belonging within a product business (departmental affiliation of services vs. *integration in product-centered business)*. To foster internal development and growth, management separated service from products. Under the leadership of an externally recruited vice president, a separate service division was created, with "a senior board of directors" and approximately a "couple of hundred people" (Global solution and support director). External recruitment was prioritized during the separation to bring in experience and knowledge. That affected the identification and individual positioning processes of new organizational members, culminating in intraorganizational difficulties and eventually the dissolution of the service division. Former service employees were then distributed across functional areas, e.g., marketing and operations, during the process of reintegration with the product-centric business.

At an intraorganizational level, service technicians experienced tensions of belonging and identification as they struggled to position themselves and their activities within product-focused structures. Although it makes sense to integrate the already interrelated product and service businesses, maintaining a service-oriented identity is challenging in a product-centric organization. Cognitive dissonance arises from service personnel trying to maintain their identity in a service unit within a product-centric business.

Table 5 summarizes the identified tensions discussed and provides illustrative quotes from the data.

4.3.4. Tensional knots identified within Gamma

Building on the (paradoxical) tensions identified within Gamma, we present the findings from our analysis of how some of those become inextricably knotted. Our analysis revealed three tensional knots, of which two are found at the intraorganizational level (3a and 3b) and one spans the intra- and interorganizational levels (3c). Those are discussed below. No tensional knots were identified solely at the interorganizational level.

3a: Tensional knot of organizing for services through separating the business (T1) and *service belonging within a product business* (T5). The separation and integration of services presented organizational members with organizational changes requiring them to adapt to new structures and processes. The membership negotiation flow illustrates the importance of organizational members' socialization and identification after the reintegration of Gamma's service business. Service technicians distributed across functional areas struggle to position themselves and their service-related activities within an intraorganizational network based on product-oriented structures. Hence, T1 and T5 are found to be mutually impacting. Those amplifying effects are illustrated through their tensional knot at the intraorganizational level.

3b: Tensional knot of organizing for services through separating the business (T1) and *multiple business models* (T4). Gamma deemed its separation of services from products to be unsuccessful. The service business was reintegrated into various functional areas, with a resulting loss of focus on and recognition of the processes and structures required to build a service business. In contrast, when Gamma acquired a systems integrator providing customers with comprehensive solutions to the customers, Gamma sought to learn from the acquisition's solution-based business model by operating it as a separate and autonomous business unit. However, multiple coexisting business models hindered that knowledge and practices from being incorporated into Gamma's core business. Hence, T1 and T3 are found to mutually impact and amplify each other, as illustrated through their tensional knot between the intra- and interorganizational levels.

3c: Tensional knot of organizing for services through separating the business (T1) and *service development* (T2). The reintegration process scattered the service business across functional areas. Service continuously struggles to position itself within the intraorganizational network and to gain more prominence within the strongly product-oriented structures. Service is also excluded from the technical roadmap for lacking an integration requirement, i.e., it is not large enough to be granted space on the technical roadmap.

> If somebody is disagreeing or saying: "We should also work on this product or that service," then we can say: "Okay, fine. We are kind of booked now, but which of these [development projects] should we then stop working on in order to get this one up front?"

Organizational structures require services to prove their commercial potential to qualify for technical roadmap integration. Hence, T1 and T2 are found to mutually impact and amplify one another, as illustrated by their tensional knot at the intraorganizational level.

Fig. 4 illustrates the tensions identified for Gamma in the pairings of the four flows and their tensional knots within and across intra- and interorganizational levels.

5. Cross-case analysis

We analyzed each case individually in the previous section to ascertain whether the (paradoxical) tensions identified occur at an inter- or intraorganizational level. We focused on the tensional knots between the tensions to investigate how tensions spur and mutually impact one another. Across the three cases, we identified three tensions and eleven paradoxical tensions (see Figs. 2–4) and nine tensional knots (see Table 6). We now analyze similarities across the cases and draw on the prevalent specific differences.

Table 6
Cross-case comparison.*

Cases	(Paradoxical) tensions (incl. Tensional knots)			Intraorganizational level	Intra- & interorganizational level	Pairings of four flows	Categorization of tensional knots
Alpha	**T1:** The paradoxical tension of **aligning** the coordination of **project and service work**		**T2:** The paradoxical tension of **positioning on the process map**	T1–T2		AC–OSS AC–OSS	Organizing–performing
			**T4:** The paradoxical tension of **whom to target** in the customer organization		T1–T4	AC–OSS AC–IP	
	T2: The paradoxical tension of **positioning on the process map**		**T3:** The tension of **restricted access** to the end-customer		T2–T3	AC–OSS AC–IP	
	T5: The paradoxical tension of **organizational belonging**		*No tensional knot identified*				
Beta	**T1:** The paradoxical tension of **recognizing services**		**T4:** The paradoxical tension of **career trajectory** between technical services and sales	T1–T4		AC–OSS AC–MN	Organizing–belonging
	T4: The paradoxical tension of **career trajectory** between technical services and sales		**T2:** The paradoxical tension of **performance management**	T4–T2		AC–MN AC–OSS	
	T2: The paradoxical tension of **performance management**		**T1:** The paradoxical tension of **recognizing services**	T2–T1		AC–OSS AC–OSS	
	T3: The paradoxical tension of **responsibility**		*No tensional knot identified*				
Gamma	**T1:** The paradoxical tension of **organizing for services** through separating the business		**T5:** The tension of **service belonging** within a product business	T1–T5		AC–OSS AC–MN	Organizing–belonging
			**T3:** The paradoxical tension of **multiple business models**		T1–T3	AC–OSS AC–OSS	
			**T2:** The paradoxical tension of **service development**	T1–T2		AC–OSS AC–OSS	
	T4: The tension of **technological sophistication**		*No tensional knot identified*				

* **Note**. No tensional knots were identified at the interorganizational level.

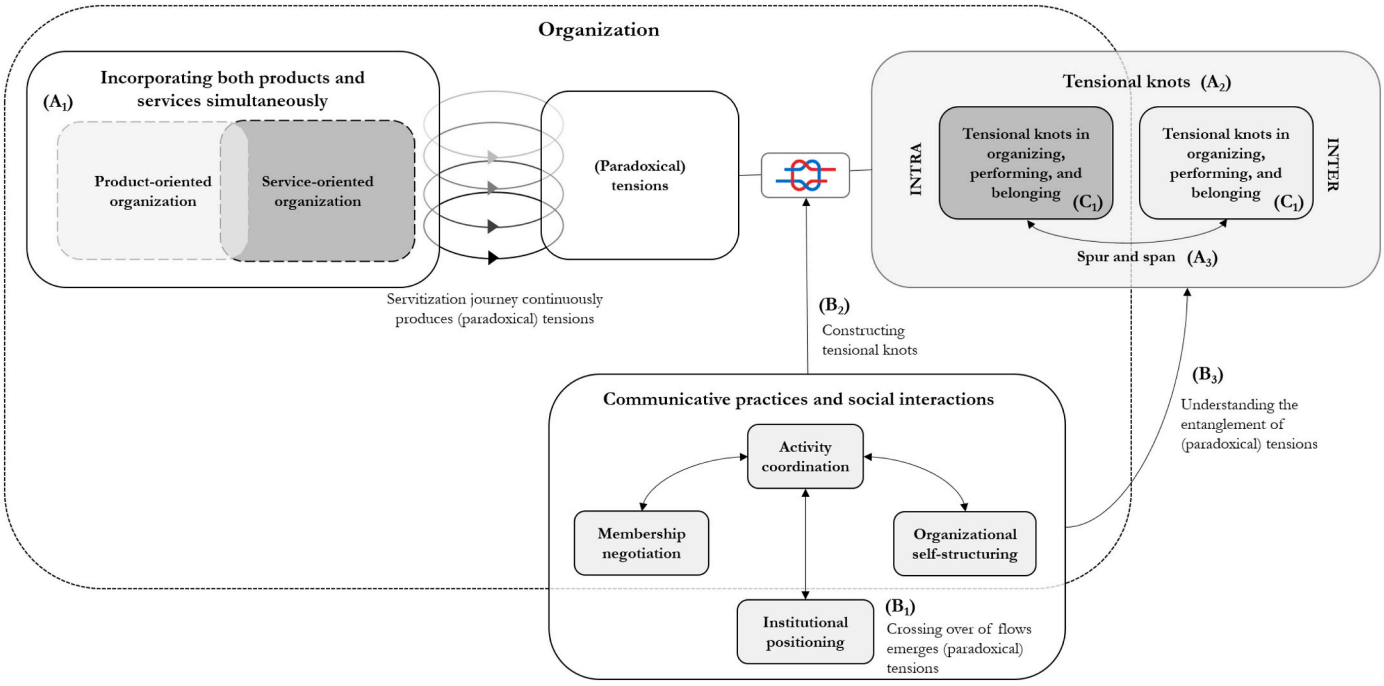

Fig. 5. A model of tensional knots produced within servitizing organizations.

When examining our three cases, we can see tensional knots connecting different pairings of the four flows, thereby indicating their interdependent and syncretic nature. In considering those tensional knots, the majority of those identified occur at the intraorganizational level, thus indicating that organizations face internal contradictions, which highlights their inability to decide between competing options and the need to balance both poles. Similarly to Sheep et al. (2017), the knots identified indicate that the tensions mutually impact one another and thus become inextricably entangled. Although no tensional knots were identified that occurred solely at the interorganizational level, analyzing our three cases reveals tensional knots that span the intra- and interorganizational levels. However, that only accounts for Alpha and Gamma. For Beta, it is interesting to note that no tensional knots were identified that span the two levels.

As all three cases represent organizations on their servitization journey, our analysis suggests that they are at different stages in their development. Whereas product sales result in rather short-term interactions with entities in a firm's interorganizational network, selling services to customers extends that relationship and the related activities over a longer period. While Alpha and Gamma had already shifted their interactions further toward an interorganizational network level (indicated through tensional knots at that level), Beta experiences tensional knots at an intraorganizational level. As organizations progress their servitization strategies, they inevitably engage with more external entities, such as clients, customers, and suppliers, because the very nature of service entails greater interaction. As such, tensions are likely to be inextricably knotted with more interactions on an interorganizational level due to the increased numbers of stakeholders involved.

In contrast to Beta, Alpha and Gamma are further along their servitization journey and provide customers with advanced services and solutions. Advanced services necessitate closer relationships with customers and suppliers (Baines & Lightfoot, 2014). That could explain why servitizing firms moving toward advanced services and solutions are likely to experience tensional knots spanning the intra- and interorganizational levels. Moreover, the tensional knots identified in our cases suggest that the tensions mutually impact, i.e., amplify, each other (Sheep et al., 2017). Surprisingly, no attenuating effect of the entanglements was identified.

Drawing on the Smith and Lewis (2011) paradox categorizations, we find tensions of *organizing* to be the most prominent across the three cases studied (see Table 6, last column). That links back to the understanding of organizing as a process through which to respond to and cope with tensions (Jarzabkowski et al., 2022; Schad et al., 2016). To further understand the tensional knots formed, we account for the different levels at which they occur. The comparison across the cases reveals not only that tensions occur at different levels but also that tensional knots may generate entanglements across intra- and interorganizational levels, as in the Alpha and Gamma cases. As discussed, (paradoxical) tensions span and are entangled across the intra- and interorganizational levels, thus increasing managerial complexity.

Table 6 summarizes the identified tensions and knots among them. It also shows which pairings of the four flows and which categorizations of tensional knots are applicable. It also lists the tensions for which no tensional knots were identified.

6. Discussion and implications

6.1. Theoretical contributions

Our study contributes to the servitization literature that discusses the tensions organizations encounter (Burton et al., 2016; Kohtamäki et al., 2020) and to the paradox literature exploring entanglements of tensions (Sheep et al., 2017). Industrial firms face numerous tensions that ought to be comprehended when reshaping their product-oriented business models to incorporate a greater service orientation (Baines & Lightfoot, 2013; Burton et al., 2016; Kohtamäki et al., 2020). Our study of three case firms identified several (paradoxical) tensions[1] by drawing on the four flows model (McPhee & Zaug, 2009) to understand how they become inextricably knotted. Based on this, we make four main contributions and provide a model (letters are included in the explanation below for cross-referencing purposes in conjunction with Fig. 5).

Our first contribution pertains to identifying numerous (paradoxical) tensions that servitizing firms encounter to move beyond the discussion

[1] We clearly delineate between tensions and paradoxical tensions using parentheses to maintain the distinction between the two concepts. The former is a component of the latter (see Smith & Lewis, 2011). Importantly, our focus is on understanding how (paradoxical) tensions exist in relation to one another and knot.

of the service paradox that focuses on financial outcomes (Benedettini et al., 2017; Gebauer et al., 2005; Neely, 2008). In our study, we draw on paradox theory rather than simply the paradox label in the existing servitization literature (Gebauer et al., 2005; Visnjic & van Looy, 2013). We build on the work of Kohtamäki et al. (2018, 2020) that studies the servitization context and advocates for adopting a "both-and" thinking approach. That is a move away from the "either-or" approach largely depicted in the transition argument that suggests the need to move from a product to a service orientation (Forkmann, Henneberg, et al., 2017; Forkmann, Ramos, et al., 2017; Kowalkowski et al., 2012). Our findings support earlier research suggesting that firms grapple with concurrently attempting to accommodate both product *and* service mindsets (Raja et al., 2010). More specifically, we find that servitizing firms do not simply embark on making a choice between product or service orientation but rather attempt to manage both simultaneously (A_1). This gives rise to numerous (paradoxical) tensions that in many cases become knotted at different levels, thus suggesting the need to broaden our understanding to account for the network (Bastl et al., 2012; Chakkol et al., 2014; Gebauer et al., 2013; Reim et al., 2019; Windahl & Lakemond, 2006) and ecosystem (Frandsen et al., 2022; Kohtamäki et al., 2019; Sklyar et al., 2019) levels.

This leads to our second contribution, which illustrates the inextricable entanglement of tensions. We investigated tensional knots at the intra- and interorganizational levels of analysis (A_2) and how they are modified by dynamics and structures at those levels (Jarzabkowski et al., 2013). Sheep et al. (2017) discuss the inextricable entanglement of multiple tensions and their amplifying or mitigating effects. Rather than considering the grouping of tensions, we explore inextricable entanglements by focusing on the tensional knot between two singular tensions. Our research illustrates that (paradoxical) tensions are spurred which may expand spatially to one or other levels (A_3). We contribute by showing that those tensions create movement by spurring within intraorganizational and across interorganizational networks. In so doing, we build on the existing servitization literature (Kohtamäki et al., 2020) by detailing the entanglements of (paradoxical) tensions. For organizations initiating servitization, it is crucial both to consider the existence of individual tensions in isolation and to understand how tensions intertwine and span their network, both intra- and interorganizational. Offering services likely results in expanding networks and establishing new relationships with partners, hence, new tensional knots are created. As our research indicates, tensional knots exist within and across organizations, thus posing challenges for firms trying to exploit service potentials. To better understand how to cope with tensions that knot different parts of the organization or various organizations across a network, it is necessary to first be aware of and explore the inextricable entanglements of tensions that reside within and across the organization.

Our third contribution pertains to building on the CCO approach, specifically the four flows model (Kuhn, 2021; McPhee, Poole, & Iverson, 2014; McPhee & Zaug, 2009), to direct attention to the (paradoxical) tensions that emerge at the intersection of the flows. It is within communicative practices and social interactions that (paradoxical) tensions emerge (B_1) and tensional knots are constructed (B_2). Building on Sheep et al.'s (2017) study, in which tensional knots are argued to be discursive constructions, our findings support and extend this by showing knots to be socially constructed through communicative practices and social interactions. Actors engage with and make sense of the tensions to be able to cope with them. Although each flow is ontologically distinct in McPhee and Zaug's (2009) model, it takes all four flows to constitute complex organizations (Putnam, Nicotera, & McPhee, 2009). Following Browning et al. (2009), we combined activity coordination with the other three flows (membership negotiation, institutional positioning, and organizational self-structuring) to show how constitutive complexity is produced. Drawing on their research, we explored the overlap between two flows (following the notion of activity coordination as the prominent flow) at different levels to better understand the entanglement of (paradoxical) tensions in intra- and interorganizational networks (B_3).

Furthermore, we contribute by highlighting that it is the intersection and the overlap of the flows that brings forth (paradoxical) tensions in inter- and intraorganizational networks. It is through the crossing of organizational boundaries and the accompanying coordination of activities across those boundaries (i.e., represented in the overlap between two flows) that (paradoxical) tensions develop. Although research has started to explore strategies for coping with tensions in a servitization context (cf. Kohtamäki et al., 2020), our study suggests the need to examine how organizations can cope with tensional knots. Tensions do not necessarily occur in isolation, so they must be viewed in relation to one another. Thus, we extend the existing research by showing that entanglement between tensions at different organizational levels increases the complexity of coping mechanisms.

Our fourth contribution refers to how pairings of different categorizations of organizational tensions—organizing, performing, and belonging—can occur at different levels and are not to be viewed in isolation but rather in relation to each other (C_1). Building on Smith and Lewis's (2011) conceptual paper, we account for pairings of tensional categorizations and consider their interrelations (Jarzabkowski et al., 2013) by exploring entanglements between the identified tensions. The formation of those tensional knots reveals relationships between the Smith and Lewis (2011) categorizations (see last column, Table 6) by drawing attention to their entanglements. As organizing is the prominent categorization across all three cases, there is a clear link to the pairings of the four flows whereby coordination and structuration processes preponderate. Specifically, in a servitization context, organizing for services plays an important role in organizations' successful implementation of new business models. That often involves an initial separation and possible reintegration of the service business as tensions emerge (Kohtamäki et al., 2020; Oliva et al., 2012; Oliva & Kallenberg, 2003). A potential consequence of service business separation is territoriality loss (Wagstaff et al., 2020), so individuals may seek to protect what they consider their "fiefdom." That highlights the resulting tensions to be managed between product and service business units.

6.2. Managerial implications

This research has three managerial implications. First, due to the interrelated and persistent nature of paradoxical tensions found in servitization, this research proposes that managers not only identify the individual tensions but also focus on relationships between the different tensions that exist. Put simply, most tensions are unlikely to exist in isolation. Thus, it is incumbent upon managers to consider the ways in which multiple tensions occur simultaneously and exist in relation to one another.

Second, the number of tensional knots has implications for the complexity and intensity of coping mechanisms. It is likely that with more tensional knots, the individual tension's complexity increases, and it becomes more tightly intertwined. Consequently, managers need to be able to better mobilize the right coping mechanisms for the prevalent interdependence complexity in paradoxical tensions. The entanglement between tensional knots creates complexity, which requires managers to focus more clearly on the challenge of coping on an ongoing basis. When facing tensional knots that occur solely at the intraorganizational level, management may be able to cope with them more directly than when tensions are intertwined across levels. Managing tensions across levels is likely to require greater coordination of managerial activities when addressing tensional knots because that involves multiple stakeholders over which management is unlikely to have control or authority. Thus, coping with those tensions becomes more complex. That is particularly important for organizations embarking on servitization journeys, as the need for internal and external coordination of activities across functions increases when attempting to integrate or separate service units.

Third, long-term firm servitization strategy success requires greater focus on organizational members' belonging and identification. Management is responsible for ensuring that appropriate processes, norms, and official documentation exist to support the servitization transition,

as reflected in the organizational self-structuring flow. However, organizing for services is far more complex and requires management to break up existing self-structuring processes to understand organizational members' core motivations and relationships. When incorporating a service mindset into organizational structures, bringing organizational members together through socialization and establishing a sense of unity is crucial for management to gain process acceptance and collaboration across an intraorganizational network. Given their syncretic nature, it takes all four flows to establish complex organizations, so there is a clear need to understand organizing and coordination processes to the same extent as recognition, identification, and collaboration.

6.3. Limitations and future research

Our findings have certain limitations. The focus of this paper was not to discuss mechanisms for coping with the identified tensions. Previous studies have discussed that topic (Kohtamäki et al., 2020) and further research is needed. Future research could consider what managerial practices are needed to cope with identified tensions and the resulting entanglements across different levels. As paradoxical tensions are unresolvable, it could be interesting to consider how coping with one has implications for other entangled paradoxical tensions. Our study particularly examined tensional knots between two tensions to illustrate their mutual impacts, i.e., how they form a tensional knot. Further research is needed to consider entanglement's effects on the nestedness of paradoxical tensions.

No tensional knots were identified at the interorganizational level in our three cases. Importantly, we do not claim that such knots do not exist but rather that our research focuses on the focal firms. Scholars would benefit from further researching the interorganizational network perspective in more detail by closely examining customers, clients, suppliers, and regulators. We chose to pair the activity coordination flow with the other three flows due to its significance for industrial operations. Due to the complexity of industrial operation work processes, it is crucial to coordinate activities and adjustments of frequently occurring difficulties in collaborations. Hence, addressing the question of "What work do we do together?" responds to immediate practical issues in industrial operations. Additional research in other contexts may account for alternative pairings of the four flows. For instance, paradox research in human resource management could benefit from pairing the membership negotiation flow with the other three flows to better account for the identity implications. Although our study considers the temporal aspect within the cases examined, there is scope for other researchers to address how a communicative approach can support an understanding of how paradoxical tensions span space (i.e., across intra- and interorganizational service networks) and time (i.e., entanglements between past occurrences and future innovations to account for intertemporal tensions).

6.4. Concluding remarks

We opened with Søren Aaby Kierkegaard's quote explaining that to make sense of and live life, we must reflect on what happened previously. Servitizing firms may reflect on that when considering their product heritage as they attempt to progress toward services. A firm's strong product history and related legacy could constrain its future services development. It is to be expected that organizing for services will bring forth tensions that management must learn to cope with. Following Kierkegaard's notion, expanding toward services is not a matter of avoiding paradoxical tensions but rather of focusing on and embracing their existence so as to propel an organization forward. In this paper, our aim has been to highlight the significance of the tensional knots that entangle the future with the past.

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Appendix A. Four flows table

Flows, description of the flows, tensions, and questions to ask (Adapted from McPhee & Zaug, 2009).

Flows	Description of flows		Tensions	Asks question:
	Key expressions	Explanation		
Membership negotiation	Socialization, identification, and individual positioning activities within, for example, departments, groups (formal and informal), teams, communities of practice, third-party organizations, etc.	Recruitment processes and socialization of organizational members determines who is considered part of the organization. Onboarding processes facilitate creation of a sense of belonging and ownership.	Belonging, recognition, identification	"Who are we?"
Organizational self-structuring	Reflexive structuring and control activities, especially managerial activities, i.e., *organizational charts, policies and procedures, operating manuals, decision-making and planning forums, budgeting, accounting,* etc.	Organizational manuals, official documents, certifications, etc., are tools for organizational self-structuring. They create consistency by establishing routines and contribute to reflexive self-structuring.	Organizing, structuring	"What rules do we operate by?"
Activity coordination	Adaption of the ordinary, division of labor, and need to negotiate within social groups to address several attitudes and behaviors.	The flow is influenced by relationships and interactions. A process of adjusting the predetermined work process is aimed at solving immediate practical problems. Activities are coordinated to work together toward the same goal.	Responsibility, prioritization	"What work do we do together?"
Institutional positioning	External perspective, includes entities such as suppliers, customers, regulators, competitors, and partners.	Organizations coexist with multiple actors in different industries, so communications also occur outside the organization. Industry-specific regulations shape organizational operations internally and externally.	Collaboration, institutional positioning, relationship building	"What external forces provide legitimacy?"

Appendix B. Sample interview protocol

Organizational and personal history

1. Can you tell us about your background and how you came to work in your current role?
2. Can you briefly describe the evolution of your organization and the industry over the last 5–10 years?
3. Can you describe the organizational structure and how it has changed in recent years? What, if any, tensions have you experienced or witnessed in that period?

Strategic overview

4. Can you describe the markets in which you operate? What changes have you seen over the last 10 years?
5. What would you say were the key aspects/capabilities that make your company competitive?
6. What are the strategic priorities for your company?
7. How would you describe your business model(s)? Are there any tensions between the product and service business models?

The company as a product-service provider

8. What does the service and solution strategy in your company entail? What services does your company provide? How do you categorize services?
9. How do you integrate products and services to provide customer solutions? What risks are associated with offering services and solutions (or managing the whole network)?
10. How are you involved with the service business?
11. How does providing services affect your relationship with customers (and other external actors)?

Organizing, performing, belonging, and learning

12. How do you organize for products and services in your organization?
13. What does a typical onboarding process entail within your company? How do new organizational members become part of an existing team?
14. What does it mean to you to be part of this company? How would you describe the company's identity? How do you think outsiders perceive your company?
15. Could you describe the routines you have in place for sharing knowledge? How do you share information/knowledge between product and service units?
16. How do you see the potential of existing expertise in products play out for establishing a service business in your organization?
17. How is performance evaluated in the product (project) and service business? What KPIs are used to measure evaluate performance? How appropriate are those for the service business?

Interactions at intra- and interorganizational levels

18. How do you communicate across functions within your company?
19. How would you describe the relationships across functions, divisions, and teams within your company?
20. How does the project−/product-based nature of working in your company influence the work relationships and communication with the service part of the business? Do you know of or have you experienced any tensions in this regard?
21. Can you please describe how work is organized, planned, prioritized, and coordinated within your company? How long are people involved in projects? How easily can people switch between projects?
22. To what extent are you able adjust work processes and schedules in your service work?
23. Can you tell us about a time when you monitored or reviewed information and detected a problem? How did you respond?
24. How is your company perceived by competitors and customers within the industry?
25. How does the regulatory context in which you operate influence the type of relationships you have (with customers, suppliers, contractors, etc.)?

Customers

26. How would you describe the relationship with your customers? How do you get close to customers? Have you experienced any tensions with customers? If so, please describe those tensions. How did you respond?
27. How does providing services affect your relationship with customers? What risks are associated with the provision of services to customers?

Others

28. In your opinion, is there anything we have overlooked?

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