Industrial Marketing Management 105 (2022) 388–403

Contents lists available at ScienceDirect

Industrial Marketing Management

journal homepage: www.elsevier.com/locate/indmarman

Coopetitive tensions across project phases: A paradox perspective

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ARTICLE INFO

Keywords:
Coopetition
Mature industries
Tensions
Innovation project phases
Paradox theory

ABSTRACT

Coopetition is a paradoxical phenomenon that encapsulates the dynamic interplay between cooperation and competition. Management of tensions, inherent in coopetitive relationships, is a success factor for this type of collaboration. Previous research has extensively examined management of tensions in the implementation phase of coopetitive innovation projects but has paid little attention to the dynamics of these tensions across different project phases. This gap is disconcerting since the innovation management literature recognizes the fuzziness and uncertainty of the pre-project phase as critical to the continuity of an innovation project. We argue that differences between project phases are likely to affect tensions, and qualitatively investigate their nature and management in the pre-project and implementation phases. The findings indicate that companies in mature industries often experience strong intra-organizational tensions during the pre-project phase due to performing and organizing paradoxes. These tensions may harm companies' participation in projects and need to be handled by a working-through strategy at the company level. In contrast, inter-organizational tensions are identified as the dominant type of tensions during the project implementation phase due to performing, organizing and learning paradoxes. Inter-organizational tensions need to be addressed by working-through strategy, splitting-and-integration strategy or a combination of the two strategies, respectively.

1. Introduction

Collaboration between competitors in innovation processes, known as *coopetition for innovation*, has been receiving increasing research attention. Companies engaged in this type of collaboration are motivated by various industrial, relational and firm-specific drivers, such as technological convergence and digitalization, shorter product life cycles and high research and development (R&D) costs (Raza-Ullah, Bengtsson, & Kock, 2014; Tidström, Ritala, & Lainema, 2018). A high level of technological similarity and complementarity between competing companies makes coopetition potentially valuable from an innovation perspective (Mention, 2011). However, in this paradoxical relationship (Raza-Ullah, 2020), competitors need to simultaneously cooperate and compete (Bengtsson & Kock, 2000), create and capture value (Ritala & Tidström, 2014) and protect and share knowledge (Jarvenpaa & Majchrzak, 2016), which often cause tensions between and within the participating organizations (Tidström, 2014).

The literature suggests that the success of a coopetitive relationship depends on the appropriate management of tensions (Le Roy, Bez, & Gast, 2021). However, there are ongoing debates about the different types of tensions (Bengtsson, Raza-Ullah, & Vanyushyn, 2016; Le Roy & Fernandez, 2015; Raza-Ullah et al., 2014) as well as the principles and organizational designs for their management (Fernandez, Le Roy, & Chiambaretto, 2018; Fernandez, Le Roy, & Gnyawali, 2014; Le Roy et al., 2021). Most of the coopetition research has focused on tensions in long-term coopetitive alliances and networks (Bengtsson, Kock, Lundgren-Henriksson, & Näsholm, 2016). More recently, studies have begun to investigate tensions at the level of innovation projects (Fernandez & Chiambaretto, 2016). It is important to deepen our understanding of the tensions in short-term project collaborations because innovation projects may require different knowledge sharing and protection mechanisms (Du, Leten and Vanhaverbeke, 2014; d'Armagnac, Geraudel, & Salvetat, 2019) and diverse management practices (Cassiman, di Guardo and Valentini, 2009).

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https://doi.org/10.1016/j.indmarman.2022.06.017
Received 12 November 2020; Received in revised form 15 June 2022; Accepted 24 June 2022
Available online 9 July 2022

Another important characteristic of coopetition that has attracted scholarly attention is coopetitive dynamics. The changing nature of coopetitive relationships, ranging from cooperative to competitive, can be influenced by the time (Pattinson, Nicholson, & Lindgreen, 2018), certain critical events (Tidström & Hagberg-Andersson, 2012) or activities at the relational, organizational or individual level (Tidström & Rajala, 2016). Following this line of reasoning, we can argue that tensions are also manifestations of coopetitive dynamics. Shedding light on changes in their nature and management during coopetitive innovation projects may enhance our understanding of coopetitive dynamics.

Previous research on coopetitive tensions has focused exclusively on the project implementation phase (Le Roy & Fernandez, 2015). On the other hand, the innovation management literature has emphasised the importance of the pre-project phase in shaping the overall project, critically influencing its quality and enhancing value creation (Edkins, Geraldi, Morris, & Smith, 2013). Scholars also warn that mistakes in the pre-project phase can negatively affect or even jeopardize the results as well as the performance and value creation of a project, thus calling for special attention to this phase and its management (Floricel, Michela, & Piperca, 2016). In order to improve knowledge about the nature and dynamics of coopetitive tensions (Gnyawali, Madhavan, He, & Bengtsson, 2016), we focus on coopetitive tensions that arise in the pre-project phase and compare them to those that occur in the project implementation phase. We raise the following questions: (1) How are tensions in the pre-project phase of coopetitive innovation projects in mature industries different from tensions in the implementation phase? (2) How can those tensions be managed in the pre-project and implementation phases? To answer these questions, we used paradox theory (Smith & Lewis, 2011) as a lens and conducted an in-depth study of five strategically sampled projects.

Coopetition has mainly been studied in emerging industries, and echoing other innovation scholars (Bouncken, Fredrich, & Kraus, 2020; Gast, Gundolf, Harms, & Matos Collado, 2019; Jakobsen, 2020; Mathias, Huyghe, Frid, & Galloway, 2018), we posit that empirical data from the context of mature industries may bring relevant insights. Companies in mature industries tend to rely more on the tacit knowledge of their employees and often face challenges when incorporating knowledge from external actors (Chiaroni, Chiesa, & Frattini, 2010; Ciravegna & Maielli, 2011). Therefore, finding the appropriate balance between internal and external sources of knowledge in this context has generated considerable debate (Caiazza, 2015). Furthermore, high industrial maturity, combined with increased costs and shrinking markets, has been recognized as a stimulator of stronger competition between companies (Mathias et al., 2018; Tidström & Rajala, 2016). Under these conditions, maintaining sustainable coopetitive relationships is challenging, and coopetitive tensions may become particularly visible.

Our study contributes to the coopetition literature by deciphering, for the first time, the underlying paradoxes and dynamics of tensions in two different project phases. We propose particular strategies for the successful management of the tensions in each of the phases and reveal different management styles that need to be applied simultaneously at both the firm and project levels (Dorn, Schweiger, & Albers, 2016; Tidström et al., 2018). Notably, our evidence highlights the importance of the pre-project phase and the critical intra-organizational tensions in coopetitive innovation projects in the context of mature industries.

2. Theoretical background

2.1. Organizational tensions: a paradox perspective

Globalization and pressures of technological advancements generate highly competitive and dynamic business environments and pose a variety of contradictory demands to organizations (Margolis & Walsh, 2003; Smith & Tushman, 2005). Some of the contradictory aspects that raise organizational tensions are personal versus organizational sustainability agendas, short-term versus long-term corporate orientations, isomorphism versus structural and technological change, and efficiency versus resilience (Hahn, Pinkse, Preuss, & Figge, 2015). From a broader perspective, Smith and Lewis (2011) have identified four basic categories of organizational tensions: learning, belonging, organizing and performing. According to these authors, learning tensions appear as a response to changes, creativity and innovation. Belonging tensions are related to individual and collective identity, membership and roles. Examples of organizing tensions are those between collaboration and competition, routine and change, and control and flexibility; while performing tensions arise due to the multiple and divergent goals of various stakeholders. Tensions may also appear in the intersection of these four main categories and at several levels: the individual, group, project, organization or between organizations (Smith & Lewis, 2011; Wannags & Gold, 2020).

Numerous definitions of organizational tensions highlighted their underlying paradoxical nature. For instance, Epstein, Buhovac, and Yuthas (2015) defined tension as "two phenomena in a dynamic relationship that involve both competition and complementarity" (p. 37). In a similar vein, Hahn et al. (2015) depicted tensions as a paradoxical relationship between two poles of a paradox. Moreover, Smith and Lewis (2011) claimed that paradoxical tensions appear due to the simultaneous existence of "contradictory but interrelated elements, logical individually but inconsistent or even absurd when combined" (p. 382). Consequently, scholars have argued about the relevance of paradox theory to better understand the nature and the management of organizational tensions (Lewis & Smith, 2014; Smith, Erez, Jarvenpaa, Lewis, & Tracey, 2017). Other theoretical perspectives, such as contingency theory, consider tensions as problems and suggest choosing between dualities ("either/or") and addressing them by logical and rational responses. Paradox theory, on the other hand, suggests simultaneously embracing opposing demands ("both/and") and examining their interplay across levels, time and phenomena (Smith & Lewis, 2011). This holistic view of organizational tensions may enhance the understanding of their underlying sources, mechanisms and dynamics and enable more integrative and complex responses (Lewis & Smith, 2014; Smith et al., 2017).

Paradox theory acknowledges the management of tensions as one of the main determinants of an organization's fate (Smith & Lewis, 2011). Managerial responses to tensions may aim for static equilibrium, i.e., bringing the system back into balance after an accidental event. For instance, Poole and Van de Ven's (1989) solutions range from accepting the consistency of the paradox and "living" with it, to spatial separations of dualities between different business units; temporal separation along different points in time, or synthesis that simultaneously accommodates both sides of the paradox. Meanwhile, the dynamic equilibrium model offered by Smith and Lewis (2011) considers the system as a living environment filled by inherent and socially constructed tensions. In this system, latent organizational tensions become salient due to the complexity of the external environment, change, plurality and scarcity as well as the actors' cognitive reactions to divergent demands. Strategies for managing salient tensions in the dynamic system are as follows: "(1) paradoxical resolution or confronting paradoxical tensions via iterating responses of splitting and integration [and] (2) acceptance or embracing paradoxical tensions via the strategy of working through" (Smith & Lewis, 2011, p. 389).

2.2. Coopetitive tensions

Coopetition, defined as "a paradoxical relationship between two or more actors simultaneously involved in cooperative and competitive interactions…" (Bengtsson & Kock, 2014, p. 182), is typically accompanied by tensions and high risks of opportunism, technology imitation, knowledge leakage or weakening of market position (Gnyawali, Park, & Robert R., 2011; Vanyushyn, Bengtsson, Näsholm, & Boter, 2018). Two main perspectives on tensions exist in the coopetition literature. One group of authors perceive tensions as forms of conflict that can be

avoided or solved (e.g., Tidström, 2014). Bouncken, Fredrich, and Kraus (2020), for instance, defined tension as "two co-existing contradictory forces with conflicting goals that are inherently connected to coopetition itself" (p. 651). Another group of authors perceive tensions to be a result of the coopetition paradox (Bengtsson, Eriksson, & Wincent, 2010; Bengtsson, Raza-Ullah, & Vanyushyn, 2016) that cannot be avoided or permanently resolved but only managed through actions undertaken by various partners (Fernandez et al., 2014; Raza-Ullah et al., 2014). Our study drew on this latter stream of research and explored coopetitive tensions from the intra- and inter-organizational perspectives.

2.2.1. Types of tensions in coopetitive innovation projects

Different sources trigger tensions at the inter-organizational and intra-organizational levels (Devece, Ribeiro-Soriano, & Palacios-Marqués, 2019;Fernandez et al., 2014; Raza-Ullah et al., 2014). Two prevalent contradictory demands have been acknowledged as sources of tensions at the inter-organizational level: 1) value creation versus value appropriation and 2) knowledge sharing versus knowledge protection (Vanyushyn et al., 2018).

Value creation and appropriation tensions appear when competitors jointly create "a pie" that is far greater than their individual contributions (Brandenburger & Nalebuff, 1996), and each tries to capture an asymmetrical piece of it (Chiambaretto, Maurice, & Willinger, 2020). These tensions may be influenced by the following: 1) type of partner, e.g., direct competitors may provide more balanced inputs for value creation and have similar opportunities for value appropriation (Bouncken, Fredrich, & Kraus, 2020, Bouncken, Fredrich, Ritala, & Kraus, 2020; Gnyawali et al., 2011; Kraus, Meier, Niemand, Bouncken, & Ritala, 2018); 2) innovation phase and innovation type, e.g., the earlier phases of radical innovation may lead to greater tensions due to the higher risks and uncertainties regarding outcomes at that stage compared to the later launching phase or incremental innovation (Bouncken, Fredrich, Ritala, & Kraus, 2018); 3) overarching coopetitive network structure, e.g., negative interdependences between the companies may lead to power asymmetry and tensions (Chou & Zolkiewski, 2018; Czakon, 2009; Czakon, Niemand, Gast, Kraus, & Frühstück, 2020); and 4) differences between internal personal, social, cultural and other value systems of the partners (Lascaux, 2020; Mele, 2011).

Inter-organizational relationships are often considered as a learning race (Yang, Zheng, & Zaheer, 2015) that entails knowledge sharing and knowledge protection tensions (Gast, Gundolf, Harms, & Matos Collado, 2019; Jarvenpaa & Majchrzak, 2016; Morris, Kocak, & Özer, 2007). Furthermore, knowledge sharing is crucial for value creation and the success of coopetitive collaborations (Ritala, Kraus, & Bouncken, 2016). Knowledge also represents a source of companies' competitive advantage that requires appropriate protection (Rouyre & Fernandez, 2019). Competitors operate in the same or similar markets and typically have similar capabilities, but they may have different learning and knowledge-absorption capabilities (Dussauge, Garrette, & Mitchell, 2000; Fredrich, Bouncken, & Kraus, 2019). Therefore, the risks for opportunistic knowledge leaking and acquisition are deemed exceptionally high (Fernandez & Chiambaretto, 2016) and make competitors more willing to share generic and project-specific knowledge but protect core, company-specific knowledge (Fernandez et al., 2014; Gast, Gundolf, Harms, & Matos Collado, 2019). Several factors may strengthen the intensity of knowledge sharing and protection tensions, including a high competitive overlap and complementarity of capabilities (Dussauge et al., 2000), great ambiguity (Tidström et al., 2018) and weak intellectual property mechanisms (Ritala & Hurmelinna-Laukkanen, 2013). In addition to the two prevalent types, scholars also have discussed inter-organizational tensions (Tidström et al., 2018) rooted in the partners' different strategies and goals (Fernandez et al., 2014), different power and dependence (Jakobsen, 2020), conflicting roles (Bengtsson & Kock, 2000) and opportunistic behaviours (Osarenkhoe, 2010).

Three main types of tensions have been acknowledged at the intra-organizational level: 1) tensions between different business units that compete for resources (Arvidsson, 2009; Chiambaretto, Massé, & Mirc, 2019; Luo et al., 2006; Tsai, 2002); 2) tensions between different levels of management who do not share the same opinion on the value of coopetitive relationships (Bengtsson, Raza-Ullah, & Vanyushyn, 2016; Raza-Ullah et al., 2014); and 3) cognitive and emotional tensions between employees in competing companies who might find it challenging to regard each other as partners (Gnyawali et al., 2011; Raza Ullah, 2017).

2.2.2. Management of tensions in coopetitive innovation projects

Different management principles, organizational forms and mechanisms have been proposed for inter- and intra-organizational tensions (Seran, Pellegrin-Boucher, & Gurau, 2016). The management principles for inter-organizational tensions include: 1) separation between competitive and cooperative activities at the project level; 2) integration of the activities at the individual level; and 3) co-management of the activities at the work group level (Le Roy & Fernandez, 2015). In the case of dyadic coopetition, a coopetitive project team is an organizational form beneficial for radical innovation projects, while a separate project team is appropriate for incremental innovation projects (Fernandez et al., 2018). In the case of oligo-coopetitive projects, "shareholder coopetition" accommodates low-cost, low-risk and low-innovative projects, while "vertical coopetition" and "combined vertical and horizontal coopetition" accommodate high-risk, high-cost and highly innovative projects (Le Roy et al., 2021).

Concerning mechanisms for managing inter-organizational knowledge sharing and protection tensions, formal control is necessary to differentiate between critical and non-critical information, while handling critical information requires using both formal and informal mechanisms (Fernandez & Chiambaretto, 2016; Gast, Gundolf, Harms, & Matos Collado, 2019). Additionally, information systems and digital technology have recently been recognized as enablers for more efficient knowledge sharing (Bouncken & Barwinski, 2021; Crick & Crick, 2020; Liu, Yang, & Zhang, 2021; Randolph, Hu, & Silvernail, 2020). However, different sharing and protection mechanisms may be needed for temporarily coopetitive relationships such as projects, as opposed to alliances and long-term collaborations (d'Armagnac et al., 2019).

When exploring the management of intra-organizational tensions, scholars have discussed capabilities that are necessary at the company level (Bengtsson, Raza-Ullah, & Vanyushyn, 2016). They highlighted the critical role of ambidextrous managers in managing intra-organizational tensions (Eisenhardt, Furr, & Bingham, 2010). These are top managers with capabilities to appropriately understand, communicate, prioritize, allocate or reallocate resources across the organization (Bengtsson, Raza-Ullah, & Vanyushyn, 2016). Some scholars also have found that a hierarchical organizational structure, formalization and standardization applied within companies minimize the risks of internal tensions and negative consequences of collaboration with competitors (Klimas, 2016). The importance of building an organizational culture characterized by engagement, loyalty, trust and commitment also has been noted (Gast, Gundolf, Harms, & Matos Collado, 2019).

2.3. Project lifecycle phases

The project management literature discusses particular project management styles, practices and tools (Brandon & Guimaraes, 2016; Ng & Walker, 2008; van den Ende & van Marrewijk, 2014; Vuorinen & Martinsuo, 2019) required for initiation, planning, implementation and finalization of projects (Besner & Hobbs, 2006). Significant attention has been paid to the early project phase (Jalali Sohi, Bosch-Rekveldt, & Hertogh, 2019), often called the pre-project (e.g., Hill, Russell, & Smith, 1988) or the front-end project phase (e.g., Edkins et al., 2013). This phase includes all activities that precede the project implementation phase (Labuschagne & Brent, 2005): starting from the project idea, through to the consortium agreement negotiations and project

structuring (e.g., Besner & Hobbs, 2006). The pre-project phase has been labelled as a fuzzy, ambiguous and chaotic phase in which the presence of various stakeholders and multiple interests may pose challenges to positioning and alignment of the participating organizations (Karlsson, Larsson, & Öhrwall Rönnbäck, 2018). The level of uncertainty and risks in the pre-project phase are much higher than those in later phases (Floricel et al., 2016), while creativity at the individual and group levels appears to be more important in the pre-project phase than during the implementation phase (Axtell et al., 2000).

The pre-project phase has been recognized as crucial for the fate and quality of an entire project (Edkins et al., 2013). Failures or mistakes in this phase can also endanger the outcomes, performance and value generation of a project (Kolltveit & Grønhaug, 2004). Therefore, addressing uncertainty and risks, integrating the organizations involved and managing their social interactions are the most critical managerial tasks in this phase (Artto, Ahola, & Vartiainen, 2016; Floricel et al., 2016).

However, there is no single way to manage the pre-project phase (Nobelius & Trygg, 2002). Its management may depend on the industrial and organizational context, innovation type, political and other factors (Edkins et al., 2013). Some scholars claim the relevance of a flexible project management style in the early project phases, stemming from an open and proactive attitude of the project managers and continuous adaptation of project organization (Jalali Sohi et al., 2019; Nguyen, Killen, Kock, & Gemünden, 2018). Formal rules may undermine the creative nature of the activities and are therefore less important in the pre-project phase than in the project implementation phase (Poskela & Martinsuo, 2009). Other scholars, however, are in favour of a formal project management style (Larsson, Eriksson, & Pesämaa, 2018) or a certain mix of flexibility and control that may increase responsiveness to change in the pre-project phase (Kock, Heising, & Gemünden, 2016; Koppenjan, Veeneman, van der Voort, ten Heuvelhof, & Leijten, 2011).

The project implementation phase starts with the "kick-off" meeting (Project Management Institute, 2013). Persistence, stamina and intrinsic motivation mitigate the resistance to change that may appear in an organization during this phase (Christiansen & Varnes, 2009; Ettlie & Elsenbach, 2007; Farr, Sin, & Tesluk, 2003). Scholars have also noted the higher importance of innovation-supportive organizational cultures (Axtell et al., 2000; Hammond, Neff, Farr, Schwall, & Zhao, 2011) and a formal process management style in the project implementation phase (Christiansen & Varnes, 2009) compared to the pre-project phase.

2.4. The context of mature industries

The literature acknowledges variations between innovation propensity and practices in different phases of the industry lifecycle (Bodas Freitas et al., 2013; McGahan & Silverman, 2001). As the industry becomes more mature, companies' strategies move from a product-orientated approach towards a more process-oriented approach, and firms start to search for different knowledge sources for innovation (Laursen & Salter, 2006).

Coopetition for innovation has been studied to a limited extent in the context of mature industries (Bouncken, Fredrich, Ritala, & Kraus, 2020; Czakon & Rogalski, 2014; Jakobsen, 2020). Technology and costs represent the main sources of competitive advantage in these industries; therefore, companies may be more reluctant to cooperate and be afraid to reveal core competencies that may undermine their existing competitive positions (Tidström & Rajala, 2016). However, as coopetition strategies become inevitable at a certain point, companies face the need to adjust their business models (Bonel & Rocco, 2007). According to Mathias et al. (2018), collective identity and norms become critical for enduring coopetitive collaborations in these industries. Meanwhile, Jakobsen (2020) determined the importance of structural dependence between companies in the early stages and psychological dependence in the later stages of coopetitive alliances in this context.

3. Theoretical assumptions

This study compares the tensions and their management in two distinct phases of coopetitive innovation projects: (1) the pre-project phase that includes initiation and planning (Hill et al., 1988), and (2) the implementation phase that starts with the kick-off meeting (Project Management Institute, 2013). Paradox theory, specifically Smith and Lewis's (2011) classification of paradoxical tensions, serves as the basis for the development of broader theoretical assumptions related to the types of coopetitive tensions that may appear in each phase in the mature-industry context.

The pre-project phase is often characterized by a high degree of uncertainty (Floricel et al., 2016). Therefore, it could be expected that the value creation and value appropriation goals of different internal stakeholders are not yet aligned at this stage and that such performing paradoxes may lead to intra-organizational tensions. Furthermore, different internal stakeholders may have divergent views on whether the firm's most valuable resources should be allocated to the coopetitive project. As tacit knowledge is of particular importance in mature industries (Asheim & Coenen, 2005), these organizing paradoxes are expected to lead to intra-organizational tensions. In the pre-project phase, the firm's internal stakeholders may also have different views on whether it is most valuable to be creative, to hold onto existing business, or to protect or share knowledge. Such learning paradoxes may lead to strong intra-organizational tensions in mature industries, where core competencies are often the source of competitive advantage (Lei & Slocum, 2005) and where managers are often reluctant to endanger existing business (Strebel, 1987).

Assumption 1. Performing, learning and organizing paradoxes will lead to strong intra-organizational tensions in the pre-project phase. Belonging paradoxes are not expected to lead to tensions in this phase.

Conflicting value creation and value appropriation goals of competing firms may become visible in the implementation phase, and such performing paradoxes could lead to inter-organizational tensions. The participating companies may have different cultures, leadership styles and management control systems. These factors are particularly important in the implementation phase (Axtell et al., 2000; Christiansen & Varnes, 2009), and these organizing paradoxes could lead to inter-organizational tensions. Furthermore, we assume that participating companies are likely to have different knowledge protection and sharing approaches in the project implementation phase, and learning paradoxes may lead to inter-organizational tensions. Additionally, belonging paradoxes are expected to lead to intra-organizational tensions due to the competing roles of the participants. Since persistence and stamina are important in this phase (Farr et al., 2003), it may be difficult for key individuals to balance their tasks and responsibilities within the company and their obligations to the coopetitive projects.

Assumption 2. Learning, performing and organizing paradoxes will lead to strong inter-organizational tensions, while belonging paradoxes will lead to strong intra-organizational tensions in the implementation phase.

4. Research methodology

4.1. Research design and sampling

This study used a qualitative, interview-based research methodology (Raj et al., 2020; Zomerdijk & Voss, 2011), which is appropriate when the aim is to understand a complex phenomenon, such as coopetition, and build a theory (Eisenhardt & Graebner, 2007). The unit of analysis is the project. To enable purposive sampling (Palys, 2008) of innovation projects between two or more competitors from mature industries, we first consulted two managers in an innovation-oriented business cluster in Norway. Members of this cluster are leading worldwide

manufacturers of equipment to oil and maritime industries that have been involved in several coopetitive innovation projects. Based on consultations, extensive review of the information and evidence of coopetition practices available in project and company web pages and newspapers, five relevant projects were selected for this study.

These projects were in different phases when the first round of data was collected: one was in the pre-project phase, three were in the implementation phase, and one was finalized. The one in the pre-project phase underwent a second round of data collection when it reached the implementation phase. In two projects, because of tensions, one competitor had decided to leave the project in the pre-project phase. The characteristics of the selected projects are presented in Table 1.

4.2. Data collection

Data collection started with semi-structured in-depth interviews with the project manager of each of the projects. Based on the snowballing procedure, they directed us to other relevant informants who directly participated in the projects and were authorized to discuss this sensitive matter. This procedure enabled us to build trust with the informants, which was particularly important for their willingness to participate in the interviews about sensitive topics such as coopetition (Atkinson & Flint, 2004). Furthermore, snowballing has proved valuable for reaching the managers involved in the sampled projects, who belong to elite groups (Atkinson & Flint, 2004).

We conducted a total of 39 in-depth semi-structured interviews with the decision-makers from mid- and high-level management, project managers, cluster managers and researchers from research institutes and universities involved in the projects. Follow-up interviews with some of the informants were conducted to clarify and deepen the findings. Data were collected between September 2018 and February 2020. The information about the informants by project is provided in Table 1.

Most interviews (29) were conducted face-to-face, while 10 were conducted over Skype with informants located in other countries. Each interview lasted between 60 and 90 min. An interview guide was developed that consisted of open-ended questions organized around a few main themes related to the company's innovation strategy, decision-making process, concrete project details, information about sources of tensions and their management in different project phases. The guide was aligned to the perspectives of different partners: research partners, project managers and cluster managers. Each question was followed by a list of follow-up questions. All interviews were audio recorded and transcribed verbatim.

4.3. Data analysis

A flexible pattern-matching approach was employed to analyse the data. This approach has been suggested as very valuable for both theory building and extension of current knowledge (e.g., Sinkovics, Choksy, Sinkovics, & Mudambi, 2019). It is based on an iterative comparison between theoretical patterns that are deducted from the literature and empirical observations that are inducted from the data (Bouncken & Barwinski, 2021). The mismatches that may be identified in this way enable refinement of previously developed theoretical assumptions (Bouncken, Qiu, Sinkovics, & Kürsten, 2021; Sinkovics, Sinkovics, & Yamin, 2014). Following this approach, interview data were firstly descriptively summarized and then grouped into Smith and Lewis's (2011) four groups of organizational paradoxes: performing, learning, organizing and belonging. These paradoxes are considered as sources of tensions that appear in the two distinct project phases. Next, the tensions

Table 1
The sample.

Project	Participants	Description and status	Funding	Types of informants	Number of informants
A	Four competing companies, one university, one research institute and a business cluster. The companies participating in the project were of different sizes, and the companies' owners came from Norway and the USA.	The aim of the project was to develop a new technology. At the time of the investigation, the project had reached its mid-term evaluation. The research and development activities were carried out in several work packages, and the competitors were involved in most of them.	The project was funded by the companies and the Research Council of Norway.	PM, HLM, MLM, CM, RIE, UE	15
B	Four competing companies, a few non-competing companies, one business cluster and one university. The participating Norwegian and US companies were of different sizes.	The aim of the project was to develop and implement a new test laboratory. It was already finalized at the time of our investigation.	Establishment of the laboratory was funded by the university, but the laboratory needed to sustain itself based on market principles.	PM, HLM, MLM, CM, RIE	7
C	Two competing companies and several other companies and universities. The participating companies had the same country of ownership and had similar sizes.	The aim of the project was to develop a new model for data sharing. The competing companies were separated in two different work packages. The project implementation phase had just begun at the time of the investigation.	The project was funded by the companies and Government organization.	PM, HLM, MLM	3
D	Two competing companies, two non-competing companies, one university and one research institute. The competing Norwegian companies were of different sizes.	The aim of the project was to develop and implement new business models. The project was in the pre-project phase at the time of the first round of data collection; due to tensions, one competitor left the project just before our investigation began. Later, another competing company joined the project, and we conducted follow-up interviews to enable analysis of the project implementation phase.	The project was funded by the companies and the Research Council of Norway.	PM, HLM, CM, UE, RIE	6
E	Two competing companies, three non-competing companies, one university, one research institute and one business cluster. Both Norwegian and US competing companies were large.	The aim of the project was to develop and implement new service-oriented business models. The project implementation phase had just begun at the time of the investigation.	The project was funded by the companies and the Research Council of Norway.	PM, HLM, MLM, CM, RIE	8

PM: Project manager; HLM: High-level manager (CEO, vice president); MLM: Mid-level manager; CM: Cluster manager; RIE: Research institute employee; UE: University employee.

Table 2
Summary of observed tensions compared with our theoretical assumptions.

Smith and Lewis's (2011) groups of paradoxes that are considered as sources of tensions	Pre-project phase		Project implementation phase	
	Expected tensions	Observed tensions	Expected Tensions	Observed tensions
Performing	Strong intra-organizational tensions	Strong intra-organizational tensions	Strong inter-organizational tensions	Strong inter-organizational tensions
Learning	Strong intra-organizational tensions	Strong inter-organizational tensions	Strong inter-organizational tensions	Strong inter-organizational tensions
Organizing	Strong intra-organizational tensions	Strong intra-organizational tensions	Strong intra-organizational tensions	Strong inter-organizational tensions
Belonging	Not expected	Not observed	Strong intra-organizational tensions	Not observed

identified in each phase were categorized as intra- or inter-organizational tensions (Appendix A). Finally, an iterative comparison between theoretical assumptions and empirical observations was performed. Identified mismatches indicated how initially developed theoretical assumptions need to be refined in line with observed sources and types of tensions in the pre-project and project implementation phases.

4.4. Trustworthiness of the data

Following the established criteria for qualitative studies (Lincoln & Guba, 1985), the trustworthiness of the data was enhanced in several ways. Triangulation of data sources (Denzin, 1978) was achieved by interviews and follow-up interviews conducted at different time points with a wide range of knowledgeable informants involved in the same project. Comparing and contrasting the viewpoints of various informants, not only from competing companies but also project and cluster managers and research partners, strengthened the credibility of the data (Shenton, 2004). The informants were also asked for examples and illustrations to ensure more reliable and nuanced interpretations (Korstjens & Moser, 2018). During data analysis, information obtained in the interviews was complemented with archival data, such as internal project documentation describing its organizational structure, annual progress reports for the projects, documentation regarding the project phases, project-related presentations from individual companies, press releases and publicly available data from companies' and projects' web pages. These pieces of information were used to ensure an appropriate understanding of the different projects' phases, current status and progress achieved as well as a better understanding of the organizational structures and cultures of the participating companies.

Investigator triangulation (Denzin, 1978) was achieved by having the data analysis performed by more than one author. All interview transcriptions were first read separately by two authors, who then discussed and analysed them together. After that, the analysis was presented and discussed with the third author until the most comprehensive interpretation of the data had been reached. At the very final stage, the findings were presented and discussed with other researchers who were not involved in this study and practitioners involved in the sampled projects during several seminars and one workshop. This also improved the credibility of the data and verified its understanding. Lastly, transparency of the research steps and thick descriptions of the context and the findings empowered the confirmability and transferability of this study (Korstjens & Moser, 2018).

5. Findings

The findings highlight differences between the sources, types and management of tensions in the pre-project phase compared to those in the implementation phase. Table 2 summarizes the expected (i.e., theoretical assumptions initially developed) and the observed tensions across project phases, the initially developed theoretical assumptions about the sources and types of tensions, and observations from the empirical data.

5.1. The pre-project phase[1]

We expected strong intra-organizational tensions driven by performing, learning and organizing paradoxes in the pre-project phase of coopetitive innovation projects in mature industries. Belonging paradoxes were expected to be absent in this phase. The empirical data supported these assumptions, except the one related to learning paradoxes.

Our informants confirmed the existence of strong intra-organizational tensions stemming from performing paradoxes. These tensions arose when the internal stakeholders had different opinions regarding the choice between value creation at the company level and value creation at the project level and in the case of risk-averse managerial behaviour (Quotes 1 and 2). Informants also pointed out strong intra-organizational tensions caused by organizing paradoxes. These tensions were rooted in the organizational cultures and the companies' internal decision-making processes. Several informants reported that a closed internal corporate culture led to a high degree of intra-organizational tensions during the pre-project phase, which could limit the negotiations (Quote 3). Furthermore, companies whose employees indicated more hierarchical and bureaucratic decision-making procedures appeared to be more oriented towards closed than collaborative innovation practices and experienced greater intra-organizational tensions. Companies whose decision-making process were described as flatter were more inclined to collaborate with external actors during innovation processes (Quotes 4 and 5). Lastly, as expected, belonging paradoxes were not identified in our data.

The findings revealed that intra-organizational tensions need to be managed within companies (Quote 6). Among those examined, only one company had not been able to manage tensions rooted in organizational paradoxes, specifically those related to internal decision-making processes, and decided to leave the project (Quote 7).

Our assumption that learning paradoxes will cause strong intra-organizational tensions in the pre-project phase was not confirmed. The data indicated that learning paradoxes, which are rooted in the need to simultaneously share and protect a company's knowledge and core competencies, caused strong inter-organizational tensions in the pre-project phase. These tensions arose between competing companies if the project management team had not put enough efforts into develop a

[1] All quotes related to Section 5.1 (the pre-project phase) are presented in Table 3.

Table 3
Illustrative quotes: Pre-project phase.

Quote no.	Illustrative quote	Type of paradox	Type of tension
1	"I could have two engineers for the cost of the financial involvement [in the project], so I need to eliminate two more people to be able to participate in the project. Then, I need to decide, is it worth it? Is the outcome of the project for our company better than keeping two more resources in-house? This is the kind of discussion we had internally. One issue is financial, but we need to participate with other resources. The hours we put into the project: is this the best way can use these hours, or could we use them to produce products we could sell?" *HLM, company in Project A*	Performing paradox (value creation at the project level versus the firm level)	Intra-organizational tensions
2	"Managers get bonuses based on their performance and revenues.… They have some personal incentives … and that can be a barrier because if you want to participate in the project, you have to risk losing something in order to gain something. If they want their bonuses, by continuing as usual, they will be more likely to obtain their bonuses in the short term." *MLM, company in Project E*	Performing paradox (risk-averse managers)	Intra-organizational tensions
3	"There is no internal culture for interaction with universities or collaboration at all.… Coopetition, that is like … it is like you are … leaking knowledge or you are doing something that's not allowed … Really, tension, in the beginning, is internal." *MLM, company in Project A*	Organizing paradox (organizational culture)	Intra-organizational tensions
4	"The strategy for our company is that the decisions are taken by the management at headquarter, which is far from here, so we cannot participate in projects in the same way as our competitor because of the differences in structure and organization." *MLM, company in Project E*	Organizing paradox (decision-making processes and organizational culture)	Intra-organizational tensions
5	"[There was] a difference between a [foreign] and a Norwegian organization and mentality. We are flatter in organization, operate more informally and communicate easily. They are more hierarchical." *MLM, company in Project E*	Organizing paradox (organizational culture)	Intra-organizational tensions
6	"Decisions were made in stages; in the beginning, it was only … this was only taken care of by the global director in Norway. He was the one I was talking to; I guess he was trying to sell it to his people. He sold it, and I think he saw that this is the right thing to do. But it took him a year or more to get the support internally that we should do this. It was a lot of selling, internal meetings, participating in project conferences.... And slowly we caught the attention of middle management, and they found it interesting." *MLM, company in Project A*	Organizing paradoxes (decision-making processes successfully managed)	Successful management of intra-organizational tensions caused by organizing paradoxes
7	"I think it was kind of strange that we were involved in that.… I'm not sure if the management in Norway was too much involved." *MLM, company in Project E*	Organizing paradoxes (decision-making processes unsuccessfully managed)	Unsuccessful management of intra-organizational tensions caused by organizing paradoxes
8	"People could have spent less time on unimportant issues and focused more on the scope of work, getting a very detailed scope of work … because then the initial tension would have been lower." *MLM, company in Project A*	Learning paradoxes (scope of work)	Inter-organizational tensions
9	"We want to have control of it. We want to be able to steer it, so our background information was not necessarily shared with the rest, because then we don't have control of the information." *HLM, company in Project E*	Learning paradoxes (data sharing versus protection)	Inter-organizational tensions
10	"I put my money on the table in this project and the competitor says, 'I don't want to put any money on the table,' but then, two, three years down the road, the project is about to file an IPR that could be very useful for the competitor. The competitor decides to enter the system, but it has not put any effort into making that IPR happen." *HLM, company in Project A*	Learning paradoxes (intellectual property rights protection)	Inter-organizational tensions
11	"I had the best lawyer on my side: a very old and experienced lawyer, who has written international contract agreements, who was a good mediator between different companies and their lawyers." *Project manager in Project A*	Learning paradoxes (management)	Successful management of inter-organizational tensions caused by learning paradoxes
12	"The research contributions are shared, of course, and that's the nature of the game, but company-specific information is, of course, something that is regulated." *HLM, company in Project C*	Learning paradoxes (data sharing versus protection: clear regulation of sharing sensitive information)	Successful management of inter-organizational tensions caused by learning paradoxes
13	"That was a decision we all wanted: competing companies did not want to be in the same work package but in the same overall framework." *Project manager in Project C*	Learning paradoxes (data sharing versus protection-separation principle)	Successful management of inter-organizational tensions caused by learning paradoxes
14	"The main issue is how we share information and what information can be shared between the partners.… When it goes to the researchers, it doesn't have to go to all the participants.… We would like to learn from other companies that are not directly competing with us." *Project manager in Project D and HLM at a competing company*	Learning paradoxes (data sharing versus protection)	Unsuccessful management of inter-organizational tensions caused by learning paradoxes

detailed scope of work (Quote 8), to provide precise rules for data sharing and protection (Quote 9) and to strictly regulate the intellectual property rights (Quote 10).

Learning-related inter-organizational tensions in the pre-project phase were managed by project managers. Three ways to successfully manage these tensions were identified: 1) establish clear contractual regulations in a formal consortium agreement established by lawyers through a long, iterative and dialogue-based process (Quote 11); 2) define precise rules stipulating that a company's sensitive information can only be shared with project managers, not with competitors (Quote 12); and 3) separate competing companies within the same project framework (Quote 13).

The exception was Project D, where these tensions became too severe to overcome. The lead company in project D expressed serious concerns regarding losing proprietary knowledge due to the involvement of their direct competitor (Quote 14). Since a high-level manager from the company that triggered the tension also served as the project manager of Project D, no solution could be found, and the competitor had to withdraw from the project.

5.2. The project implementation phase[2]

In the project implementation phase, we expected strong inter-organizational tensions driven by performing, learning and organizing paradoxes and strong intra-organizational tensions driven by belonging paradoxes. The empirical data supported these assumptions, except the one related to belonging paradoxes.

Our informants confirmed the presence of strong inter-organizational tensions stemming from performing paradoxes. These tensions arose due to the different strategies and goals of the competing companies and were reflected in their efforts to contribute to the projects. For instance, some companies decided to limit their contributions and shift their focus to obtaining knowledge from others (Quote 15). The findings revealed that these types of tensions need to be managed at the project level. The tensions related to limited monetary contributions were managed by formal mechanisms, while tensions related to contributions in terms of time commitment were first addressed less formally through discussion. If discussion could not resolve these tensions, formal mechanisms were introduced (Quote 16).

The informants also indicated the presence of inter-organizational tensions caused by learning paradoxes, which stem from the need for simultaneous data sharing and protection. High levels of complementarity and similarity between competitors may increase companies' perception of vulnerability. In this situation, some companies directed their efforts to learning from others while overprotecting their own information, which caused strong inter-organizational tensions (Quotes 17 and 18). Project managers were responsible for resolving tensions related to data sharing and protection in the project implementation phase. They addressed these tensions by adopting different formal and informal procedures for data sharing, which were tailored to the specific needs of a particular company (Quote 19). Interestingly, some informants also stressed that resolving such tension also required company-level intervention, with the requirement for companies to identify the type of information that they are willing to share with competitors (Quote 20).

Lastly, our data indicated the presence of inter-organizational tensions due to organizing paradoxes. Some companies requested changes to the organization of collaboration during the implementation phase (Quote 21). To successfully address these tensions, project managers introduced several groups of researchers to separately collaborate with different competing companies (Quotes 22 and 23). Contrary to what we expected, we did not find evidence that belonging paradoxes caused any tensions in the implementation phase.

[2] All quotes related to Section 5.2 (the project implementation phase) are presented in Table 4.

6. Discussion

The findings of this study contribute to debates about intra- and inter-organizational tensions in the coopetition literature by providing project-level insights from the context of mature industries (e.g., Raza-Ullah et al., 2014; Tidström, 2014). We used paradox theory (Smith & Lewis, 2011) as a lens to reveal the underlying factors of inter- and intra-organizational tensions and their appropriate management styles in two distinct project phases: the pre-project phase and the project implementation phase of coopetitive innovation projects. A discussion of the findings in relation to existing research follows.

6.1. Type of tensions and their management in the pre-project phase

Coopetition scholars have described intra-organizational tensions to be due to the spill over of inter-organizational tensions into companies (Bengtsson, Raza-Ullah, & Vanyushyn, 2016; Raza-Ullah et al., 2014). Such tensions often arise if the companies lack the internal managerial capabilities to think paradoxically (Eisenhardt et al., 2010; Raza-Ullah, 2020) and to assess and properly communicate the benefits of coopetitive collaborations (Crick, 2021; Crick & Crick, 2021), the so-called coopetition capability (Bengtsson, Raza-Ullah, & Vanyushyn, 2016).

Our findings extend the prior knowledge by revealing that intra-organizational tensions are the dominant type of tension in the pre-project phase. We identify performing and organizing paradoxes as the main sources of these tensions. Performing paradoxes, as indicated in the previous literature, stem from the abilities of management to assess the value of coopetitive collaboration and face subsequent risks. The organizing paradoxes appeared to be particularly affected by the context of the mature industries. Scholars have indicated lower levels of collaborative orientation of companies in mature industries (Chesbrough & Crowther, 2006; Bodas Freitas et al., 2013; Tidström & Rajala, 2016). We clarify how organizational paradoxes affect their collaborative orientation.

In contrast to the research on emerging industries, where organizational culture has been identified as a key source of inter-organizational tensions (Fernandez et al., 2014; Tidström, 2009; Zeng, 2003), organizational culture appeared to be the main driver of organizational paradoxes and strong intra-organizational tensions in the pre-project phase of the sampled projects. This finding can be discussed in relation to Quinn and Rohrbaugh's (1983) organizational competing values: stability versus flexibility, internal versus external and objectives versus means; and Büschgens, Bausch, and Balkin's (2013) explanation of organizational culture as a coordination tool that may either foster or undermine innovation processes. Our data indicated that companies with hierarchical and internally oriented organizational cultures were more inclined to preserve internally stable processes. These companies experienced stronger organizational paradoxes and stronger intra-organizational tensions in the pre-project phase. This finding contradicts the claims by Klimas (2016) that companies with a hierarchical organizational structure are typically more eager to engage in coopetition because formalization, standardization and strict norms mitigate coopetitive risks and negative consequences within a company. Klimas (2016) did not identify corporate culture as an obstacle for coopetitive collaboration; however, in our sample, it was especially apparent in companies whose headquarters were in a different country and in those more oriented towards firm-centric innovation practices. Companies with a more externally oriented organizational culture, on the contrary, were more able to embrace innovation opportunities from outside their firm. Accordingly, our findings allow us to formulate the following propositions:

P1a: Performing and organizing paradoxes are the dominant sources of intra-organizational tensions that companies in mature industries experience in the pre-project phase of coopetitive innovation projects.

Table 4
Illustrative quotes: Project implementation phase.

Quote no.	Illustrative quote	Type of paradox	Type of tension
15	"Companies can obtain information without contributing, or smaller companies that put in less money or fewer hours or whatever can also obtain benefits. It might be that those companies get more out of this project than we do. We put in a lot of effort, money and hours." *MLM, company in Project A*	Performing paradox (contribution)	Inter-organizational tensions
16	"It's informal to start with. We give them a chance. But now in December, they will have the in-kind reports, and we will see. If it's a second warning, then we have to make it more formal.… With the cash, it's quite easy, because we send them an invoice, but in-kind is more difficult. But let's say they don't deliver enough, and their obligation is just shifted to the next years. So, they get more and more and more commitment. And then at some stage, we see, 'this is not realistic, you're just pushing the problem in front of you.' So then, we have to decide if we take them out of the project. Because it's not fair if you get all the results, and then at the end, 2021, you have 1000 h of in-kind not delivered. That should not happen." *Project Manager in Project A*	Performing paradox (managing contribution)	Successful management of inter-organizational tensions caused by the performing paradox
17	"Being in a competitive environment, it's not that easy to talk about your knowledge and problems because you are afraid that it makes you vulnerable." *MLM, company in Project E*	Learning paradox (data sharing versus protection)	Inter-organizational tensions
18	"We are both in the same industry. We are quite advanced companies, so even just a small hint of something could actually trigger thoughts on the other side already." *HLM, company in Project B*	Learning paradox (data sharing versus protection)	Inter-organizational tensions
19	"We don't have formal agreements with all the companies. Some are local. Some are here but have owners in [a foreign country]. So, the procedures are different. We take that data from a Norwegian company. It's more trust-based: we can use zip files and do the manual work ourselves, and the bureaucracy is lessened.… But when we try to take the data from a [foreign]-owned company, then the process is a bit more bureaucratic, and they certainly have to go back to headquarters and ask for approval. And these kinds of processes take a much longer time." *Work package manager in Project A*	Learning paradox (solution for data sharing and protection: different procedures for different companies)	Successful management of inter-organizational tensions caused by the learning paradox
20	"To start with, we didn't really know how this would work out and we were holding back more. Now, we see that it's possible to do both things: to support the projects as they are defined but also keep what we want to keep for ourselves." *MLM, company in Project A*	Learning paradox (solution at the firm level)	Successful management of inter-organizational tensions caused by the learning paradox
21	"The idea in the beginning was to have one research group working with all companies. But, one company said that they cannot collaborate with the other because they are too strong competitors. So they asked us to find a new model where there's no information going between the research group working with each of those two competing companies." *Project manager in Project D*	Organizing paradox (changes in the project organizational structure were required)	Inter-organizational tensions
22	"And now you have two groups of researchers working with those two companies in the same project." *Project manager in Project D*	Organizing paradox (managed through separate meetings)	Successful management of inter-organizational tensions caused by organizing paradox
23	"Separate meetings with them to discuss what they want, what they like, what they have seen from the project, how happy they are, what they need to do, what the interest is for the project.… They are competitors and to talk more freely you need one to one." Project manager in Project A	Organizing paradox (managed through separate meetings)	Successful management of inter-organizational tensions caused by organizing paradox

P1b: In the pre-project phase of coopetitive innovation projects in mature industries, companies with a hierarchical, internally oriented organizational culture experience greater organizing paradoxes and intra-organizational tensions than companies with a rational, externally oriented organizational culture.

The findings about management of intra-organizational tensions rooted in performing paradoxes are to some extent aligned with existing research. Prior research has indicated the relevance of managerial perceptions for holding intra-organizational tensions at a moderate level (Bengtsson, Raza-Ullah, & Vanyushyn, 2016; Raza Ullah, 2017). Similarly, our data suggest that performing paradoxes were managed through managerial assessment of the project relevance and decisions to allocate resources to external coopetitive projects. However, two significant differences between the contexts of emerging and mature industries appeared. First, while resource allocation at the collaborative level was critical in emerging industries (Tidström et al., 2018), we identified its crucial importance at the firm level in the context of mature industries. Second, our data suggest that resource allocation was the responsibility of senior managers, based on top-down processes (Hutchison-Krupat & Kavadias, 2015), which have not been proven to be effective in emerging environments (Schlapp, Oraiopoulos, & Mak, 2015). Conversely to Bengtsson, Raza-Ullah, and Vanyushyn (2016) and Lundgren-Henriksson and Kock et al. (2016), who reported middle managers were responsible for sabotaging a coopetition strategy, we identified that in the context of mature industries, top managers defined the strategy and terminated its implementation, even when middle managers valued it.

The findings also revealed that hierarchical, top-down decision-making processes and rigid internal procedures may hinder the management of intra-organizational tensions in mature industries. This confirms the findings of prior research about the issues that are caused by incompatibility of the coopetition strategy with internal companies' routines and practices (Lundgren-Henriksson & Kock, 2016; Vanyushyn et al., 2018). It also confirms the need to adjust internal organizational structures, processes and practices when the companies in mature industries try to switch from more closed to collaborative innovation (e.g., Chiaroni et al., 2010; Ciravegna & Maielli, 2011).

Following the paradox perspective, we propose that intra-organizational tensions may be handled at the company-level using a so-called "working through" strategy (Smith & Lewis, 2011). This strategy suggests the acceptance of inevitable tensions rather than defensiveness and requires managers to engage in paradoxical thinking and sensemaking. It also resonates with the cognitive integration of the paradox discussed in the coopetition literature (e.g., Raza-Ullah et al., 2014; Bez, Fernandez, Le Roy & Dameron, 2015). However, to apply a working-through strategy, managers need certain cognitive, behavioural and emotional characteristics, while companies need dynamic capabilities (Smith & Lewis, 2011). Accordingly, we offer a second proposition:

P2: Intra-organizational tensions in the pre-project phase of coopetitive innovation projects in mature industries can be handled by using a working-through strategy at the company level.

Our findings about learning paradoxes as sources of inter-organizational tensions in the pre-project phase are similar to those from emerging contexts (Fredrich et al., 2019; Gast, Gundolf, Harms, & Matos Collado, 2019; Tidström et al., 2018). As demonstrated in other studies, the companies were deeply concerned about sharing "project-specific versus company-specific" data, competitors' learning and absorptive capacities, risks of knowledge leaks and intellectual property rights over the project results (Fernandez & Chiambaretto, 2016; Fredrich et al., 2019; Ritala & Tidström, 2014). As Klimas (2016) indicated, companies preferred independence over collaboration, with a strong focus on value protection and appropriation mechanisms.

Following the paradox perspective, we propose that inter-organizational tensions caused by learning paradoxes in the pre-project phase need to be managed by an iterative combination of the two strategies described by Smith and Lewis (2011) applied at the project level: the working-through strategy and the iterative splitting-and-integration strategy. The working-through strategy is suitable to reach formal solutions to protect intellectual property, while the iterative splitting-and-integration strategy enables the development of specific rules for sharing sensitive information and separation of competing companies, when needed. Both strategies proved necessary for the successful management of inter-organizational tensions caused by learning paradoxes in the pre-project phase, since a failure to employ the second approach resulted in one company's withdrawal from a project. While Rouyre and Fernandez (2019) claimed the crucial importance of formal knowledge protection mechanisms in coupled coopetitive projects, our findings align more closely with Tidström et al. (2018) suggestion for the mutual use of interactional and procedural practices. Our findings also accord with the importance of proactive efforts in the early project phases (Jalali Sohi et al., 2019; Nguyen et al., 2018; Nobelius & Trygg, 2002) based on both flexibility and control (Kock et al., 2016; Koppenjan et al., 2011) that are reported in the project management literature. The data further confirmed that unresolved tensions in the pre-project phase led to failures, as highlighted in previous studies (e.g., Floricel et al., 2016). Thus, we offer the following propositions:

P3a: Learning paradoxes are the dominant sources of inter-organizational tensions that companies in mature industries experience in the pre-project phase of coopetitive innovation projects.

P3b: In the pre-project phase of coopetitive innovation projects in mature industries, the successful reduction of inter-organizational tensions caused by learning paradoxes requires an iterative combination of the splitting-and-integration and working-through strategies at the project level.

6.2. Types of tensions and their management in the project implementation phase

Our findings revealed that inter-organizational tensions are the dominant type of tension in the project implementation phase. While performing and organizing paradoxes appeared at the company level and caused strong intra-organizational tensions in the pre-project phase, we found that the same paradoxes – together with the learning paradox – raised inter-organizational tensions in the project implementation phase. Therefore, coopetitive innovation projects can be understood as dynamic environments with "persistent opposing forces that require constant adaptation and purposeful solutions" (Smith & Lewis, 2011, p. 387) in each of the project phases. Extending the insights about coopetitive dynamics proposed by Dahl (2014), we reveal that performing, organizing and learning paradoxes in the project implementation phase were influenced by the development of cooperative and competitive interactions between the two project phases and the shift between cooperative and competitive attitudes among the partners (Ritala & Tidström, 2014). Thus, we propose the following:

P4: Inter-organizational tensions rooted in performing, organizing and learning paradoxes are the dominant types of tensions that companies in mature industries experience in the project implementation

Table 5
Summary of Propositions.

Organizational paradox	Pre-project phase		Project implementation phase	
	Type of tension	Management	Type of tension	Management
Performing	Intra-organizational (P1a)	Working-through at the company level (P2)	Inter-organizational (P4)	Working-through at the project level (P5a)
Organizing	Intra-organizational (P1a, P1b)	Working-through at the company level (P2)	Inter-organizational (P4)	Splitting-and-integration at the project level (P5b)
Learning	Inter-organizational (P3a)	Splitting-and-integration combined with working-through at the project level (P3b)	Inter-organizational (P4)	Splitting-and-integration at the project level Working-through at the company level (P5c)

phase of coopetitive innovation projects.

Unlike scholars who have focused on finding one best way to organize entire coopetitive projects, through integration, separation or coworking principles (e.g., Le Roy & Fernandez, 2015), our findings revealed the need to alternate between different management strategies, within and across different project phases, to successfully address the observed paradoxes. For instance, performing and organizing paradoxes in the implementation phase have been successfully managed by the working-through and splitting-and-integration strategies, respectively, applied at the project level. However, the learning paradoxes required a combination of a splitting-and-integration strategy at the project level, operationalized through different mechanisms applied for different companies, and a working-through strategy at the company level, which enabled companies to learn which information can be shared. This reveals the need for interconnected management styles applied simultaneously at the project level (Fernandez & Chiambaretto, 2016; Tidström et al., 2018) and at the company level (Dahl, 2014; Gast, Gundolf, Harms, & Matos Collado, 2019).

Furthermore, while the previous research attention has mainly been directed to coopetitive managerial capabilities within companies (Bengtsson, Raza-Ullah, & Vanyushyn, 2016; Raza-Ullah, 2020; Raza-Ullah et al., 2014), our findings show the importance of project managers' abilities to observe, understand, communicate and react to observed paradoxes in a timely fashion to successfully solve inter-organizational tensions in the implementation phase. Lastly, the absence of the belonging paradoxes that we expected to find in the implementation phase may be explained by the specific organization of all sampled projects. Company employees were members of integrated project teams, but they remained stationed at their own firms and only participated in common project meetings. This organization did not lead to internally conflicting tasks or tensions. Based on the findings discussed above, we offer our final propositions:

P5a: A working-through strategy, applied at the project level, reduces the inter-organizational tensions rooted in performing paradoxes in the implementation phase of coopetitive innovation projects in mature industries.

P5b: A splitting-and-integration strategy, applied at the project level, reduces inter-organizational tensions rooted in organizing paradoxes in the implementation phase of coopetitive innovation projects in mature industries.

P5c: A combination of the splitting-and-integration strategy at the project level and the working-through strategy at the company level reduces tensions rooted in learning paradoxes in the implementation phase of coopetitive innovation projects in mature industries.

The discussion and propositions are summarized in Table 5.

6.3. Implications for research and practice

This study makes several contributions to the coopetition literature. First, it enriches the understanding of the coopetition paradox by revealing how organizational paradoxes (Smith & Lewis, 2011) influence coopetitive tensions and which strategies can be used to successfully address them. The mainstream coopetition literature (e.g., Fernandez et al., 2018) regards the appropriate management of tensions as the key to success of coopetitive innovation projects. Thus, improving our understanding of the management of tensions is of critical importance for the development of both coopetition theory and practice. Second, we improve the understanding of intra-organizational and inter-organizational tensions (e.g., Bengtsson, Raza-Ullah, & Vanyushyn, 2016). We distinguish between project phases in which one or the other type is prevalent and reveal that these tensions at the project and company level overlap. Third, our focus on different project phases provides novel insights into the effects of actions that participants undertake during collaboration and thus contributes to knowledge about coopetitive dynamics (Dahl, 2014; Pattinson et al., 2018). Fourth, our findings indicate that some peculiarities, such as strong organizational paradoxes, which caused significant intra-organizational tensions in the pre-project phase, may be attributed to mature industries and represent context-specific insights (Czakon & Rogalski, 2014; Jakobsen, 2020). Furthermore, this study answers scholarly calls for more understanding from the project perspective (Bengtsson, Raza-Ullah, & Vanyushyn, 2016) while also pointing out that interrelations between the project and company levels cannot be ignored. In addition, we contribute to the project management literature by offering new insights into the pre-project phase. Lastly, we developed a set of propositions that can guide future empirical studies.

The findings of this study may be useful for project managers, competing companies and other relevant parties that may participate in coopetitive innovation projects in mature industries. The propositions may serve as recommendations (Table 5) on how to manage tensions during different project phases and to prevent the withdrawal of companies from collaborations. Our findings suggest that the pre-project phase is critical for the continuity of projects in mature industries. To avoid escalation of intra-organizational tensions in this phase, companies need to direct the efforts into the alignment of goals of various internal stakeholders and different managerial levels. Companies also need to assess whether their internal organizational cultures support the required levels of openness and management of the risks of coopetitive collaborations. If needed, they should adjust their internal procedures and practices. To illustrate, the incentive systems within companies may prevent managers from taking the risks that collaborative, and especially coopetitive, innovation entails. These bonus systems may need to

be changed. These findings suggest that the working-through strategy should be employed at the company level to manage intra-organizational tensions in the pre-project phase. Therefore, it is important to develop the managerial capabilities of companies so that they can cope with the coopetition paradox and solve the intra-organizational tensions in this phase.

In the project implementation phase, critical attention needs to be paid to inter-organizational tensions at the collaborative, project level that are rooted in performing, organizing and learning paradoxes. Successful management of these tensions is mainly the responsibility of project managers. Thus, the capabilities of project managers to understand and accept the coopetition paradox are critical in the project implementation phase. Project managers need to stay abreast of coopetitive dynamics, craft proactive responses and address specific requirements of the participating companies. An important lesson from our study is that there is no single way to manage an entire project. Different strategies are required in different project phases. In the project implementation phase, project managers need to iterate between the working-through and the splitting-and-integration strategies, sometimes even applying them at both the project and company levels, in order to manage inter-organizational tensions. For example, data sharing and protection tensions need to be managed simultaneously by the working-through strategy at the company level and the splitting-and-integration strategy at the project level. These strategies enable companies to identify information that they can share with other partners and project managers to establish specific procedures for inter-organizational data sharing.

6.4. Limitations, future research directions and conclusions

This research is not without limitations. While we explored only the context of mature industries, we acknowledge that a comparative study of mature and emerging industries might provide more in-depth insights. Most of our sampled projects had not reached the finalization phase, which is another aspect that might be addressed in future studies. We also acknowledge that the presence of universities in the sampled projects might have impacted the relationships between competing companies. Thus, future research could focus on the role of non-competitive partners such as universities and research organizations, which has been explored in only a limited number of papers (e.g., Smiljic, 2020). Most projects in our sample were at least partly funded by the government and had similar degrees of newness. An interesting perspective for future research could be to explore whether and how government funding influences the dynamics of coopetition and relations between competing companies in coopetitive innovation projects. It may also be relevant to explore whether the tensions that arise in radical projects – and their management – differ from those in more incremental projects. Additionally, companies of different sizes were present only in some of the sampled projects. The company size may lead to power differentiation and influence the tensions, and the inability to analyse its influence across the projects is certainly a limitation of this study. Furthermore, while our findings indicate that activities at the company level do affect project-level activities and vice versa, future longitudinal research could examine this relationship in more depth. From a theoretical standpoint, this study used paradox theory as a lens to understand the underlying factors of coopetitive tensions. However, some of our findings could also be interpreted by transaction cost theory, contingency theory or through a combination of the dynamic relational view, knowledge perspective and coopetitive tensions. While our focus was at the project and firm levels, future studies could examine the socio-emotional and cognitive tensions at the individual level. From a methodological standpoint, a flexible pattern-matching approach has just started to be used to explore tensions in coopetition research (e.g., Le Roy et al., 2021). Anchored in the rich previous literature, further theory development may be enhanced by "comparing and contrasting prior knowledge with empirical observations" (Bouncken, Qiu, & García, 2021, p. 7).

Lastly, the originality of this research lies in its revelation of important differences in the types and management of tensions that occur in the pre-project and project implementation phases of coopetitive innovation projects in mature industries. More importantly, we shed light on the influence of tensions in each of the phases on the continued participation of competing companies in these projects. We argue that strong intra-organizational tensions during the pre-project phase may harm companies' participation in coopetitive projects and that they need to be accepted and worked through internally. The strong inter-organizational tensions between competing companies in the project implementation phase need to be addressed at both the project and company levels by iterated working-through and splitting-and-integration strategies. We call for empirical research to further explore and test our propositions.

Declarations of interest

None.

Acknowledgement

"This research has received funding from the Horizon 2020 Programme of the European Union within the OpenInnoTrain project under grant agreement n° 823971. The content of this publication does not reflect the official opinion of the European Union. Responsibility for the information and views expressed in the publication lies entirely with the author(s)."

Appendix A

An example of the coding of sources of tensions in the pre-project phase.

First step in coding: Descriptive codes about the sources of tensions	Second step in coding: Categories according to Smith and Lewis's (2011) classification of organizational paradoxes	Theme that emerged
Risk-averse managers	Performing paradoxes	Intra-organizational tensions
Managers rely on rewards		
The most effective way to use resources		
Resources allocated to internal innovation		
Resources allocated to collaborative innovation		
U.S. ownership and top management	Organizing paradoxes	
Norwegian ownership and top management		
Open Norwegian organizational culture		
Closed U.S. organizational culture		
The idea is a dangerous thing		
Buy research; don't collaborate		
Top-down decision-makingprocess		
The boreoarctic long-lasting decision-making process		
Decisions made by headquarters		
Many hierarchical levels inside the company		
Close to core knowledge	Learning paradoxes	Inter-organizational tensions
Changing competitive edge		
Who has the right to patent?		
When can companies patent?		
How can patents be shared?		
Control over background information		
Which data can be shared?		
Rules for selective data sharing		
Rules for data protection		

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