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RESEARCH ARTICLE

Epistemic tensions in R&D alliances and the role of inter-organizational management controls

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Abstract
Access to heterogeneous knowledge resources is suggested in the literature as an important explanation of firm innovation and performance. The exchange of knowledge, however, can be a complex managerial challenge, especially between different epistemic communities. Our research focuses on the concept of epistemic communities to illuminate the complexity of tensions that arise in heterogeneous knowledge exchange in alliances, thus filling a gap in the literature. Using the Straussian grounded theory case study approach, our research investigates the emergence of horizontal, vertical, and inter-organizational epistemic tensions and explores management controls as instruments to guide the knowledge exchange in intermediary-driven research and development alliances. We find that the source of multiple epistemic tensions is rooted in the natural social behaviors of epistemic community members and further shows how these behaviors influence the effective use of inter-organizational management controls in facilitating heterogeneous knowledge exchange.

Keywords: epistemic tension; R&D alliance; inter-organizational management controls; epistemic community; grounded theory

Introduction

Access to heterogeneous knowledge is one of the important motivations for engaging in inter-organizational relationships (IORs) in pursuit of research and development (R&D) goals (e.g., Holmqvist, 2003; Jiang, Tao, & Santoro, 2010). In particular, this article focuses on R&D alliances in which agreements among organizations are based on an incomplete contract or other formal, written governance mechanisms aimed at carrying out joint R&D activities (Agostini, Nosella, & Teshome, 2019). These relationships offer the advantage of accessing highly differentiated knowledge (Pina-Stranger & Lazega, 2010) and enhanced efficiencies in uncertain operating conditions (Grant & Baden-Fuller, 2004). Despite these advantages, the rate of failure or early termination of these relationships is high (Kaplan, Norton & Rugelsjoen, 2010). In this article, we explore a potential source of such instability, rooted in epistemic tensions that emerge among partners in R&D alliances (Haw, Cunningham, & O'Doherty, 2018; Sharma, 2003). Epistemic tension refers to the tension that arises when different knowledge systems within an organized entity contradict or make competing demands involving the beliefs, views, and preferred methods of generating knowledge between different units, groups, teams, or communities. In other words, this tension occurs when members of different epistemic communities (ECs) collaborate and dispute over what constitutes credible expertise, fact, proof, or warrants for claims when knowledge systems collide in decisions or actions.

ECs endorse knowledge systems that rely on a shared set of norms, values, beliefs, notions of validity, and a common policy to address a set of problems with their competencies (Christensen, 2006; Haas, 1992; Irvine, Cooper, & Moerman, 2011; Neves & Gómez-Villegas, 2020). Working together with members from another EC can create tensions and a lack of focus (Ocasio, 1997) as they must reconcile or choose between knowledge systems as a precursor to collaboration. In summary, different cognitive and normative frameworks held by ECs may keep them from connecting effectively and focusing as a unified entity.

As a potential solution to the problem of diverging interests, insights from both management control theory and organization theory suggest inter-organizational management controls (IMCs), both formal and informal (Almeida, Song, & Grant, 2002; Dekker, 2004; Pernot & Roodhooft, 2014), can support partners to focus on common purpose and mitigate the risks of conflicts. However, the challenge lies in determining the more suitable combination of management controls (Nosella & Agostini, 2019) when applying them beyond the firm. In an inter-organizational setting, drawing the governance structure, decision-making authority, and responsibility allocation among the alliance partners is challenging. To overcome this, Leven, Holmström, and Mathiassen (2014) suggest introducing an intermediary in the R&D alliance to bring together highly heterogeneous knowledge flows. In this context, bargaining between partners is mediated. According to Crespin-Mazet, Goglio-Primard, and Scheid (2013), the mediating role of a *tertius iugens* may be relevant to create a balance between competition and cooperation among members of an alliance. We propose that the intermediary can also serve as a vehicle to integrate epistemic differences, thereby managing epistemic tensions more effectively. This makes the introduction of the intermediary in a R&D alliance particularly useful for the exploration of the relationship between epistemic tensions and management controls (Suvinen, Konttinen, & Nieminen, 2010).

Our study aims to unveil the various types of epistemic tensions emerging in intermediary-driven R&D alliances. We investigate how in this setting IMCs contribute to managing these tensions over the alliance development process using the Straussian grounded theory (SGT) case study approach. We contribute to the recent literature on IORs that has called for a more in-depth investigation of the issues in R&D alliances, potentially rooted in social behaviors and forces that create the tensions. We explore which combination of IMCs might exercise a positive and synergic effect in the management of these epistemic tensions and attempt to explain why they are effective based on the EC theory.

Theoretical background

ECs in IORs

An EC is conceived as a network of practitioners whose shared set of normative and cognitive beliefs form the basis of knowledge validation and purpose (Haas, 1992). An EC satisfies both the informational requirement of traditions and normative requirements of reciprocity, legitimate authority, and common values and beliefs (Ouchi, 1980). Initially, the theory of ECs was developed by Foucault (1969 [1972]) to explain how an 'episteme' is suitable for giving identity and purpose and enabling cohesion in a group. The theory has been subsequently applied in the field of international relationships, for the establishment of standards and new patterns of governance.

The concept of EC can be useful in the field of scientific production and research to discuss how members of different ECs may have different norms and values regarding the purpose and validity of knowledge production (Miller & Fox, 2001). This has led to employing EC concepts in particularly relevant R&D settings within and across firms. Here, the EC's common epistemic framework facilitates the enhancement of knowledge in terms of objectives and practices set by the EC (Håkanson, 2010). This is an important aspect of the EC because its legitimacy largely depends on the degree of internal cohesion (Davis Cross, 2013), and this is particularly challenging in the IOR context if knowledge originates from different knowledge systems in an R&D alliance. Indeed, the common vision and shared values within an organization make that firm behave like an EC giving

its members a sense of identity and a sense of motivation, as well as a common language or code (Håkanson, 2010). In an inter-organizational context, the interaction of different knowledge systems is more complex because competition among different rules, modes, objectives, and values, runs the risk of inefficiencies in learning and a subsequent lack of coordination (Pina-Stranger & Lazega, 2010). The fundamental mechanism by which an organization as EC effectively works is weakened when multiple organizations have to work together, resulting in a management control issue in R&D alliances.

In interdisciplinary collaborations among researchers and scholars, 'language barriers that create confusion about the meaning of terms and broader issues such as integrating among epistemological and ontological differences' (Turner, Benessaiah, Warren, & Iwaniec, 2015, p. 652) are a focus. Additionally, MacLeod (2018) identify four main problems in interdisciplinary relationships, which are mainly related to the difficulty for outsiders in understanding how the system operates or the rationale behind decisions practitioners make when the interdependencies of methods, epistemic principles, technological practices, and of course tacit knowledge are complex: The four problems can be traced to the conceptual and methodological divide; how different groups attribute legitimacy to results; and, finally, the difficulty in problem-solving and outcome validation when recipes and norms are not established (MacLeod, 2018).

Management controls for heterogeneous knowledge exchange in IORs

Despite advances in the literature on management controls in IORs, it has traditionally favored issues regarding the use of controls within organizations instead of across organizations (Kherrazi, 2020). Originally defined as a set of procedures and processes that motivate the partners in an IOR to achieve desirable or predetermined outcomes (Dekker, 2004; Otley & Berry, 1994), IMCs are approached from a management accounting perspective mainly consisting of formal measure-based practices of control. Informal controls are needed to address partners' changing requirements and expectations (Fryxell, Dooley, & Vryza, 2002) to overcome the formal control limitations in foreseeing all possible contingencies inherent in IORs. The focus on R&D has gained momentum due to the peculiarities associated with such kinds of collaboration, such as the knowledge-sharing-protection dilemma (Bogers, 2011) and the intrinsic uncertainty and complexity of the innovation process.

With both formal and informal controls, a debate concerning the complementarity or substitutability of these two types of control remains open. Initially, according to transaction cost economics (Williamson, 1979), on the one hand, informal controls are posited as substitutes for formal controls, in particular when the transaction costs associated with instituting formal controls would be excessively high (Grunwald-Delitz, Strauss, & Weber, 2019; Uzzi, 1997). Conversely, when informal controls are well established, formal contracts could be even damaging (Cao & Lumineau, 2015; Grafton & Mundy, 2017). Stouthuysen, Slabbinck, and Roodhooft (2017) focus on how firms may effectively control alliances with different motivations and demonstrate that informal and formal controls partially complement one another in line with some previous research (e.g., Anderson & Dekker, 2014).

In addition, the different efficacy levels of IMCs along the various stages of the relationship indicates another trend – the dynamic approach toward IMCs whose implementation is considered a learning process (Stouthuysen, Van den Abbeele, van der Meer-kooistra, & Roodhooft, 2019). Holtgrave, Nienaber, and Ferreira (2017) posit that, based on the social exchange theory, the value of controls in building trust depends on the temporal stage of the relationship.

Based on the trends presented above, this study aims to contribute to (a) identifying when certain types of epistemic tensions arise over the alliance development process and (b) explaining how IMC combinations contribute to managing different types of epistemic tensions in intermediary-driven R&D alliances. The challenge is to explain why certain IMC combinations are more effective than others and the role they play in why some cases succeed when many alliances fail (Kaplan et al., 2010).

This, combined with the scant attention received so far to the concept of ECs in the inter-organizational management literature, makes the merger between these two streams of research particularly promising.

Methods

To achieve a detailed and in-depth exploratory investigation, the study performs an SGT building approach using multiple case study research. The broad and open-ended research questions are derived from the literature gaps. In this approach, the literature is consulted for several reasons – 'to enhance theoretical sensitivity as a secondary data source, to formulate questions for data collection or stimulate questions during analysis, and to suggest areas for theoretical sampling' (Strauss & Corbin, 1998, p. 49). It allows the new research to move forward from the existing knowledge base, in contrast to the Glaserian grounded theory approach which emphasizes emergence and relies on the researchers' creativity (Glaser & Strauss, 1967; Strauss & Corbin, 1998). The purpose of SGT is to describe the phenomenon of interest and gain insights into the context, people, their actions, and the results of their interactions. The approach is concerned with the specificity of its canons and techniques. The level of analysis is the alliance, where we consolidate the individual perspectives of the different alliance partners, to mitigate bias especially when investigating competing views.

Sample and data collection

In our case selection, we considered the availability and sufficient access to rich sources of information (Yin, 2014) to retrace events and confirm accounts through the triangulation of multiple interviews and project reports. Considering this requirement, correspondence with several potential cases was conducted, and from these, three homogeneous cases were selected following a purposeful sampling strategy using the selection criteria (see further). The variations between the cases were minimized to perform literal replication (Eisenhardt, 1989; Yin, 2014) to control for external validity. The selection criteria considered cases of alliances with (a) joint R&D agreement involving multi-way knowledge flows, (b) interdependent funding which means activities are partly funded by government and the partner organizations, (c) partners located in the same region, (d) intermediary-driven network structure that dictate the alliance governance structure, decision-making authority, and responsibilities among members, (e) technology-based outputs, and with (f) defined contract duration.

Case 1 focuses on tracking systems which advance the technological readiness of autonomous navigation systems. Each technology is developed exclusively for the partners' individual markets. Case 2 is working on developing the knowledge needed to provide proof-of-concept for the integration of additive manufacturing into manufacturing lines for the serial production of customized parts. Unlike Case 1, the various expertise of the industrial partners in Case 2 has been brought together to build a single production line facility. Lastly, Case 3 centers on exploring new technologies in the field of active safety and vehicle dynamics. Overall, all the cases offer interesting illustrations of R&D alliances achieving expected goals. Due to confidentiality, the company names are not revealed, but the details of cases under investigation and the informants are presented in Appendix 1. The semi-structured questionnaire, designed to maximize validity and reliability (Yin, 2014), is in Appendix 2. The data collection involved interviews with the different alliance members from May 2017 to May 2018. The data collection is a retrospective approach in which the investigation looks back at the events in relation to the outcome of interest. Best practices for active listening and qualitative interviewing were applied as these yield more useful insights and are procedural requirements to manage potential retrospective bias.

We have structured our interviews as follows: first, we set the context by explaining the purpose of the retrospective. We provide some background information on the project and told the informant what we already know about the cases under investigation. We explain the particular interest

of the study and identify the time period. The concept of IMCs is explained to informants by providing examples to help with recall. We ask open-ended questions that allow the informant to provide detailed responses about their experiences, perceptions, and insights, while avoiding leading questions. If a response seems vague or incomplete, we ask the informant to clarify or expand on their statements. Occasionally, we paraphrase what we heard and summarized key points to ensure we understood responses accurately. In the end, we allow time for final thoughts and feedback. We clarify the next steps for the data collected and express appreciation for their participation. The interviews last around 75 min on average and are primarily held in the main offices of the partner companies, except for one held in the intermediary's office and another via online conference. The things said in these interactions are encoded into transcripts. Since an audiotape is used, the informant's prior permission is sought explaining that it is important to verify whether their views have been correctly recorded. Beyond interviews, the study collected data from multiple sources, including annual reports, sample contracts, project files, company websites, rule books, and email correspondence. Cross-comparison of information from these sources reduces possible bias and increases internal validity. Finally, preliminary findings are discussed with the informants to ensure information is acquired and elaborated properly (Yin, 2014).

Coding and data analysis

Taken from the interview transcripts and the archival documents, data is organized following the SGT approach (Bohm, 2004; Strauss & Corbin, 1998), employing open coding, axial coding, and selective coding. The first step is open coding that allows meaning to emerge from the raw data. Quotes from the transcripts and archival documents are assigned simple codes that signify common themes or concepts. The codes are further aggregated into sub-categories and categories to simplify the search for patterns. The second step is axial coding using a theoretical framing concept or coding paradigm where the categories are placed under four dimensions: causes, actions, conditions, and consequences (Bohm, 2004). This step aims to explain a phenomenon developed from a network of relationships of concepts that surround it. Using a coding paradigm gives definition and specificity to the categories, and only 'through such specification, categories are defined and given explanatory power' (Corbin & Strauss, 1990, p. 8). Figure 1 exhibits the structure of the codes (*c*), their corresponding categories (*C*) and sub-categories (*sC*), and the dimensions (*D*) to show how the abundant data have been organized to derive meaningful information. Most of these codes have been revisited and revised to reflect consistency in their meanings, thus applying the general principle of constant comparative method in SGT.

The last step of the coding process is selective coding which is 'the process by which all categories are unified around a *core* category and categories that need further explication are filled-in with descriptive detail' (Corbin & Strauss, 1990, p. 14). This step is an iterative thinking process that requires sense-making out of the collection of codes and their categories. Figure 2 illustrates how the different categories are linked to the core category or the main phenomenon of interest. The coding process is performed by one researcher and then revised and examined by another researcher. Finally, the authors discuss any inconsistencies until an agreement is reached.

According to Corbin and Strauss (1990, p. 5) 'grounded theory seeks not only to uncover relevant conditions, but also to determine how the actors respond to changing conditions and to the consequences of their actions'. Performing within- and cross-case analyses allow the comparison of key dimensions surrounding the phenomena, highlighting (a) the epistemic tensions as the cause; (b) the IMCs as the action; (c) the alliance development stage as a condition at which the IMCs have been applied; and finally leading to (d) control effectiveness as the consequence. It is through this coding paradigm that we investigate this interplay. Control effectiveness is assessed based on the IMCs ability to influence the escalation or reduction of the degree of tensions and prevent the emergence of new problematic tensions. Tensions that do not necessarily lead to problems are defined *low-degree tensions*, which, however, foreshadow potential conflict because of observed differences among

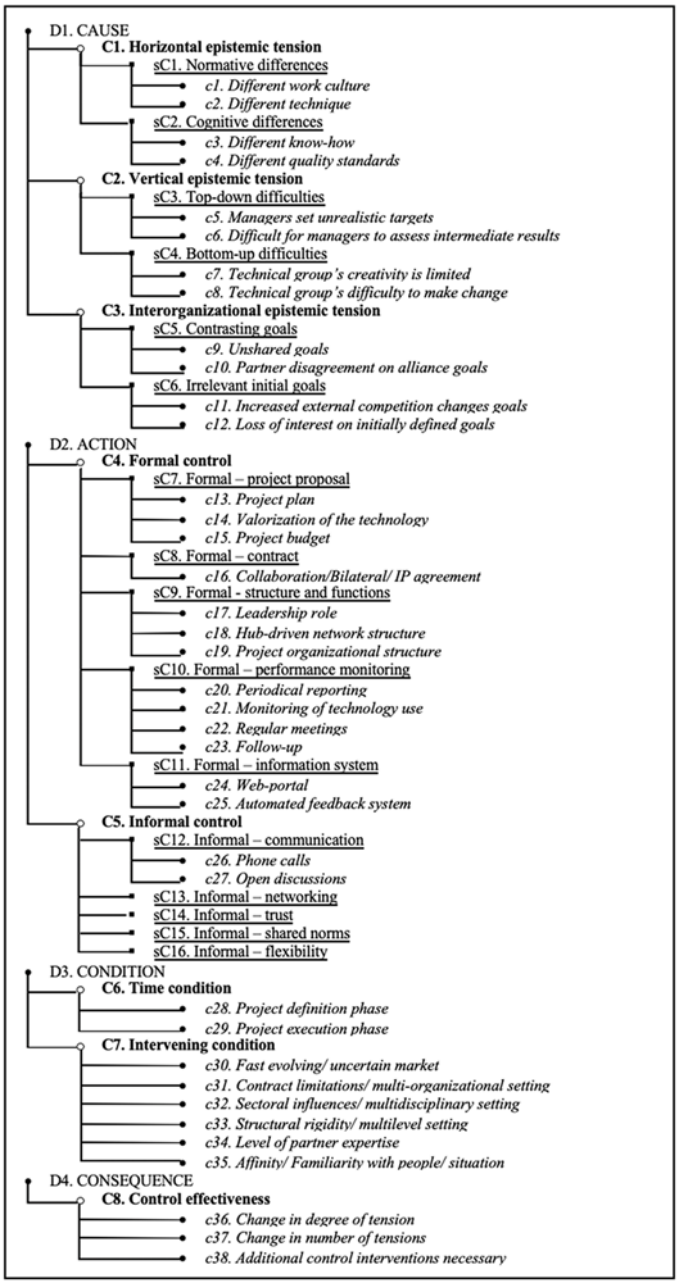

Figure 1. Code structure for organizing concepts derived from the data collection.

alliance members. When tensions lead to problematic conditions, they are identified as *medium-degree tensions*, and they become *high-degree tensions* once they threaten the continuity of the alliance. Two major phases are also identified: the former is the definition phase (Phase 1), a period prior to the defined agreement duration, which takes about 6–8 months before the activities are set up. This time is dedicated to the preparation and approval of the design and content of the agreement, specifying the rights and obligations of the parties. The latter is the execution phase (Phase 2), going from

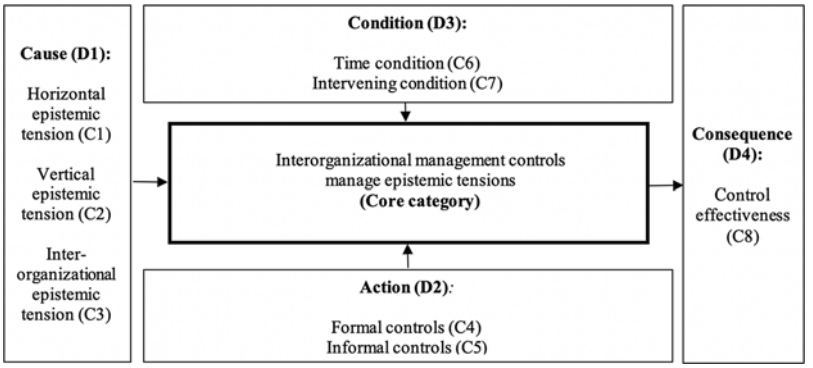

Figure 2. The coding paradigm showing the core category, categories, and dimensions.

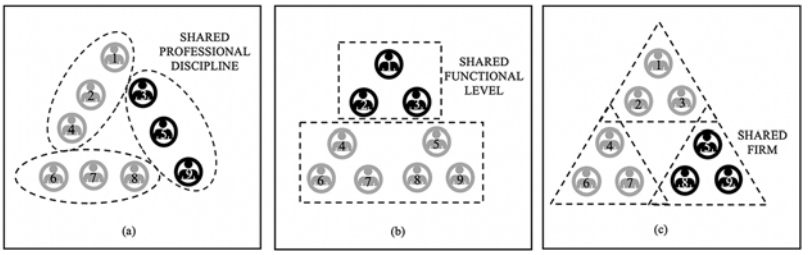

Figure 3. Epistemic tensions across multiple boundaries in an R&D alliance – (a) horizontal, (b) vertical, and (c) inter-organizational epistemic tensions.

the time of the launch of the alliance activities up to their completion. This period begins with Phase 2a, which is at the onset of the agreement and is observed to progress to Phase 2b as it nears the conclusion of the alliance.

Results

The emergence of epistemic tensions and the associated IMC

The investigation is particularly keen on the first dimension that views epistemic tensions as causal conditions that lead to the phenomenon of interest. Figure 3 illustrates the three facets at which members of various ECs predominantly interact in an R&D alliance. Epistemic tensions are observed between the boundaries that separate them in which (a) horizontal epistemic tensions involve tensions among different professional disciplines, (b) vertical epistemic tensions involve tensions among different functional levels, and (c) inter-organizational epistemic tensions.

We provide this illustration to extend the traditional views, which are limited to intra- and inter-organizational perspectives. The shared set of epistemological frameworks are shown by grouping the same set of alliance members into various competing ECs. Defining the boundaries that separate the various epistemic groups allows us to present the complexity associated with multiple epistemic tensions in an R&D alliance and at the same time reveal their connections.

Horizontal epistemic tensions

The R&D alliance is composed of subgroups whose members share a common episteme in their scientific knowledge domains. Because of differences in normative and cognitive standards, members of these different subgroups may be severely limited in reconciling their differences (Mom, van Neerijnen, Reinmoeller, & Verwaal, 2015) when members of these subgroups interact.

The category 'normative differences' pertains to different practices or way-of-doing of the members rooted in the norms, rules, and evaluative standards of the scientific or professional community they belong to. 'Cognitive differences', on the other hand, are associated with different belief systems, opinions, or way-of-thinking linked to their respective knowledge domains (Verwaal, 2017). We identify them as horizontal epistemic tensions associated with the limitation of alliance partners to assimilate knowledge from other scientific or professional disciplines.

In Case 1, we find engineers working on the hardware aspect face different challenges than the software engineers, and within the projects, they are expected to solve their own problems. Without a clear understanding of one another's expertise and know-how, alliance partners do not know the level of output to expect from the other members. In Case 2, cognitive differences emerge from differences in expertise and knowledge, and normative differences come with claims that certain means of accomplishing a task are superior to the approaches of others. In contrast, the partners in Case 3 claim no similar threats as the informants agree describing having a strong supply chain relationship and a common familiarity of the car industry. Only later do tensions emerge due to differences in opinion between the more scientifically inclined and those in charge of industrializing the products.

We then observe that for *horizontal epistemic tensions*, formal IMCs such as the Intellectual Property (IP) agreement, define the minimum requirements and the limitations of the engagement, and thereafter create the environment in which partners can freely exchange information. In the cases, alliance members describe having a secure information system in which key information is shared allowing members to communicate and develop the required understanding of how technology works. According to Partner A in Case 1 – 'It is important that the intermediary has its web portal … partners could read the reports in that. So, in that respect, you have a basic insurance of knowledge-sharing.' Partner E is positioned in the center as the intermediary, which allows it to balance knowledge inputs and take-away conflicts in terms of the access and use of knowledge resources. The same is observed in Case 2 where the information system includes a feedback mechanism for communicating the quality of output. Partner L describes:

> Well when you receive complaints, then there you know that there is a certain level of mistrust. And then I try to distinguish between – is this mistrust to the person or the organization, or is it mistrust on the skill of the person or the organization, because that to me makes a big difference. You can trust somebody as a person, without trusting his or her skills. And I had a feeling that there was really no mistrust at the personal level, but there was sometimes mistrust on the skill level.

But by openly communicating errors through the feedback mechanism, partners are able to manage any cognitive differences. The same is true in Case 3. Partner Z recalls: 'During the project that runs specifically two years (…) after the first year we do a kind of health check of the project, like a customer satisfaction survey.' Partner W particularly appreciates this mechanism explaining: 'When they [our engineers] have picked up that knowledge, then we will give that feedback to the intermediary. And if it is really happening, then it is not only us who is giving that feedback.' The project follows the management framework orchestrated by the intermediary and this framework according to Partner W is basically the same when it comes to most of his research projects. 'After so many years, you got a standard that works (…) Project development processes, innovation processes are pretty well standardized between companies, especially in the same industry. All in the automotive industry are more or less the same.' – Partner W explains.

Vertical epistemic tensions

In the cases, tensions emerge from differences in top-down and bottom-up approaches, as well as perspectives and working norms of members holding managerial and technical roles. From one end, Partner A describes: 'Like recently we had an idea (…) but it didn't work because it didn't

fit the procedure.' The procedure described in this scenario is governed by the administrative process determining the R&D activities' eligibility for funding in Case 1. Contrary to this view, the project leader explains: 'Many researchers complain about administration. [But] I think they are a bit narrow-sighted on what needs to be accomplished in a project.' These conflicting accounts are evidence of epistemic tensions between these levels. In this setting, employees abiding by different procedural norms develop certain skillsets that are not easy to unlearn when challenged by a new framework and new authority. In Case 2, tensions originating from the management level are more apparent. Managers realize in the course of the project that targets initially set are too strict or sometimes impossible to achieve. Reporting the work in progress becomes challenging because assessing when the technology works well enough is difficult. Case 3 involves larger partner organizations, which makes it more limiting, especially when changes in the planned activities need to be approved by the managers of the other partners. In Case 3, one of the partners mention – 'People often must go to their own company's legal department to ask for approval before anything is disclosed in the alliance.' Managers lead the efforts in formalizing alliance activities primarily because of fund management. However, alliance partners at the technical level complain how taxing procedures take away time from doing real innovation work. The categories 'top-down difficulties' and 'bottom-up difficulties' are the codes that identify these epistemic tensions depending on the source.

We then observe IMCs for *vertical epistemic tensions*. At this level, informal controls such as social processes of negotiation and conflict resolution and a communication channel are more effective in resolving tensions following the establishment of the alliance governance structure and guided by the role of the project leader. In other words, open communication benefits from previously established formal structures and functions. Alliance members recognize the project leader's mediating role, allowing them to interfere when problems arise at different levels in the organization. Partner G in Case 2 explains: 'If at first you don't or are not able to come to an agreement, you say let's get a third party. In that kind of times there must be formal rules.' Partner X in Case 3 also describes something similar – 'And say OK we can only take one route, not two routes so if things turn out to be more complex on multiple routes … it is the budget that will force us to decide which way to go.'

Inter-organizational epistemic tensions

The investment of organizational resources in pursuing an alliance activity, puts partners under pressure to deliver results for their respective firms. Partners enter the R&D alliance initially motivated by organizational goals strongly aligned with the objectives, missions, and visions that inherently belong to the organizations they represent. Our study identifies tensions associated with alliance partners' striving to fulfill differing organizationally required aims in goal alignment and resources allocation as epistemic tensions.

In Case 1, 8 months before the expected completion of R&D activities, the project leader recognizes the need to extend the alliance as achieving the promised outcomes seem to rely on the extension of the engagement, though not all of the partner firms agree on this point, anticipating the extension will cause problems for their organizations. The decision of the partner organizations reflects a bias between the common goal of the alliance and the private goal of the firm the partners represent. The informant has the impression that the partner lost interest in the common goal when it became clear that the alliance outcomes were no longer directly aligned with the private objective of the organization he represents. The same is observed in Case 2, as alliance members have contrasting priorities between optimizing their firm performance and the alliance performance. Partner strategies do not match, and they develop unshared emergent goals later in the development process of the alliance. 'We really didn't share 100% of the private goals. Let's say it's the specific applications that have not been shared,' Partner H claims. Partner G also recalls: 'Even as you try to negotiate, it doesn't become clear what the strategy of the other partners is.' Delays in procuring parts slowed down the activities, while the market has evolved faster than expected. Partner H says: 'In a way, the [technology] development speed is too slow (…) but what the industry around us has done probably is ahead of us.

		DEFINITION PHASE	EXECUTION PHASE	
		TENSIONS EMERGE (Phase 1)	NEW TENSIONS EMERGE (Phase 2a)	TENSIONS ESCALATE (Phase 2b)
HORIZONTAL EPISTEMIC TENSIONS	CASE 1	LOW TENSION - COGNITIVE DIFFERENCE FORMAL - CONTRACT *	LOW TENSION - COGNITIVE DIFFERENCE FORMAL - STRUCTURE AND FUNCTIONS	MEDIUM TENSION - COGNITIVE DIFFERENCE FORMAL - INFORMATION SYSTEMS INFORMAL - COMMUNICATION INFORMAL - TRUST
	CASE 2	LOW TENSION - NORMATIVE DIFFERENCE FORMAL - CONTRACT	LOW TENSION - NORMATIVE DIFFERENCE FORMAL - STRUCTURE AND FUNCTION	MEDIUM TENSION - COGNITIVE DIFFERENCE FORMAL - INFORMATION SYSTEM FORMAL - PERFORMANCE MONITORING INFORMAL - COMMUNICATION INFORMAL - TRUST MEDIUM TENSION - NORMATIVE DFFERENCE INFORMAL - SHARED NORMS
	CASE 3	LOW TENSION - NORMATIVE DIFFERENCE FORMAL - CONTRACT *	LOW TENSION - NORMATIVE DIFFERENCE FORMAL - INFORMATION SYSTEM FORMAL - STRUCTURE AND FUNCTIONS INFORMAL - SHARED NORMS INFORMAL - NETWORKING	
VERTICAL EPISTEMIC TENSIONS	CASE 1		LOW TENSION - BOTTOM-UP DIFFICULTIES FORMAL - STRUCTURE AND FUNCTIONS * INFORMAL - FLEXIBILITY	MEDIUM TENSION - BOTTOM-UP DIFFICULTIES INFORMAL - COMMUNICATION
	CASE 2		LOW TENSION - TOP-DOWN DIFFICULTIES FORMAL - STRUCTURE AND FUNCTIONS *	MEDIUM TENSION - TOP-DOWN DIFFICULTIES FORMAL - PERFORMANCE MONITORING MEDIUM TENSION - BOTTOM-UP DIFFICULTIES INFORMAL - COMMUNICATION
	CASE 3		LOW TENSION - BOTTOM-UP DIFFICULTIES INFORMAL - FLEXIBILITY	MEDIUM TENSION - BOTTOM-UP DIFFICULTIES FORMAL - PROJECT PROPOSAL INFORMAL - COMMUNICATION MEDIUM TENSION - TOP - DOWN DIFFICULTIES FORMAL - PERFORMANCE MONITORING FORMAL - STRUCTURE AND FUNCTIONS
EPISTEMIC TENSIONS AMONG ORGANIZATIONS	CASE 1	LOW TENSION - CONTRASTING GOALS FORMAL - CONTRACT * FORMAL - PROJECT PROPOSAL FORMAL- STRUCTURES AND FUNCTIONS		MEDIUM TENSION - CONTRASTING GOALS FORMAL - CONTRACT (FOR NEW PARTNER) INFORMAL - NETWORKING MEDIUM TENSION - INITIAL GOALS BECOME IRRELEVANT INFORMAL - FLEXIBILITY
	CASE 2	LOW TENSION - CONTRASTING GOAL FORMAL - CONTRACT FORMAL - PROJECT PROPOSAL FORMAL - STRUCTURE AND FUNCTIONS		MEDIUM TENSION - CONTRASTING GOALS INFORMAL - COMMUNICATION MEDIUM TENSION - INITIAL GOALS BECOME IRR FORMAL - INFORMATION SYSTEM INFORMAL - FLEXIBILITY
	CASE 3	NO TENSION FORMAL - CONTRACT FORMAL - PROJECT PROPOSAL FORMAL - STRUCTURE AND FUNCTIONS INFORMAL - COMMUNICATION INFORMAL - TRUST		

* With intervening conditions

Figure 4. The use of IMC for the different types of tensions for Cases 1, 2, and 3.

We actually wanted to be ahead of the market and it turned out that we are behind.' The partners' dissatisfaction with the delivered outcome is the result of developing emergent goals that exceed the original alliance goal. In Cases 1 and 2, divergent and emergent goals set the stage for potential epistemic tensions among partner organizations. The partners in Case 3 claim no similar threats.

We observe that for managing the *inter-organizational epistemic tensions*, the contract and the agreement proposal are common formal IMCs established during the definition phase to recognize with equal importance each of the individual private goals of the partner firms and the common goal(s) of the alliance. The informants described this during the interviews and the written agreements confirm their accounts – 'So the biggest problems we have in these kinds of project are … the companies and the efforts the companies are spending, and the hours they are spending on the projects. And in many occasions, they underspend.' The contract details the amount of resources, time, and effort that alliance partners dedicate to the project. The contract describes the individual partners' interests and strategies regarding the use of the new technology. The informants explain how this allows trust and open communication to develop. These quotes illustrate how the control links to the epistemic tension among organizations it aims to address.

IMC patterns in the development process of R&D alliances

Figure 4 presents an illustration of the cross-case analysis comparing the different IMC mechanisms employed over the alliance development process for the three observed epistemic tensions.

Mapping the different levels of tensions across the horizontal, vertical, and inter-organizational levels shows the multiple observations of tensions to determine when tensions remain low or when they are heightened based on the 'level and number of tensions' identified. Highlighting commonalities and differences among the cases help us draw conclusions to answer the research questions.

Cases 1 and 2 show a similar pattern in which partners decide to set up formal IMCs in Phase 1 in the form of *Contract, Project proposal*, and *Structure and Functions*. These IMCs seem to prevent the escalation of tensions in Phase 2a, but not in Phase 2b, which calls for the addition of several other formal and informal IMCs, such as *Information systems, Networking, Performance monitoring, Flexibility, Communication, and Trust*. Indeed, new tensions emerge in Cases 2 and 3, in which only formal or informal IMCs are used, whereas they do not emerge in Case 1, in which there is an early adoption of a combination of formal and informal controls. In Case 3, which starts with no tensions, the simultaneous employment of both formal and informal IMCs since the beginning of Phase 1 seems to work well to anticipate any kind of tension. The use of *Information systems* and informal IMCs already in Phase 2a prevents the escalation of tensions, thus contributing to managing epistemic tensions effectively.

In our analysis, the controlled and bounded environment established by the formal IMCs is perceived to create ideal conditions that support the knowledge exchange process. Without it, alliance members are likely to hesitate to share proprietary knowledge resources without fully understanding what defines 'too little' and 'too much' information sharing. If they share too much information, there is the risk of opportunism and loss of competitive advantage, but if they share too little information, they risk the lack of knowledge transfer. This situation paralyzes open communication. The IP agreement acts as a formal control and in this case, is effective for managing epistemic tensions not because of the protection it provides, but because it defines clear boundaries and sets the scope of work in terms knowledge exchange.

Some results are particularly relevant when compared with those of Ruangpermpool, Igel, and Siengthai (2020), who focus on trust and formal organization, finding them complementary in the dyadic alliance between a university and a firm, where trust allows formal control to be viewed as a guideline (Ruangpermpool et al., 2020). In their case, the partners did not know one another at all and had never collaborated before, and this may justify the need to establish the relationship by defining the clauses of the agreement. Evidence of such complementarity is particularly strong in our Case 3, where most partners already had some previous collaboration experience. This shows how prior engagements allow partners to develop shared worldviews and from that allow informal IMCs to drive succeeding engagements without the need to install formal IMCs in the beginning of a new engagement. In fact, prior collaboration experience led to the opportunity of starting this R&D alliance in the first place. Case 3 involved partner organizations connected in the same industry supply chain and had previous engagements in their company operations, and this contributes to the complementarity of the private goals of the individual partners, keeping tension low. Three of the partners are also large companies that have a good reputation in research, which establishes initial capability trust. Case 3 proves that the earlier formal and informal controls are established in the development of the alliance development, the more effective they are in preventing the emergence or escalation of tension as the relationship progresses.

The intermediary is highlighted in all three cases because of the structure it brings to the relationship. The intermediary-driven structure is particularly important for partner organizations, small or large, to feel they are on equal footing coming into the relationship. The intermediary in this case creates a governance structure in the alliance and qualifies as a formal IMC. To remain effective, the intermediary does not compromise its position, benevolence, and integrity because perceived biases toward particular groups may increase epistemic tensions. According to Partner X

> I think that there were no real big conflicts but I think one of the big discussion points for us to skip the laboratory-scale implementation and go faster to the industrial case. So, it sacrifices maybe some of the scientific rigor of the research but at least to make sure we go to the industrial scale because it's where you see the real problems. The intermediary at some point might try to do things more on the laboratory-scale but when we see it take too long – Let's go for the car.

The intermediary is a research center and despite sharing the same scientific approach with the other academic partners in the alliance, it effectively facilitated the bargaining and open communication, and with its authority, arrive at a sound and practical decision for the R&D alliance.

Discussion and theoretical propositions

Evidence from the within-case and cross-case analyses generated interesting insights that form the basis for our theoretical propositions contributing to the debate on epistemic tensions and IMCs. Below we discuss the arguments and findings and formally state our theoretical propositions.

Epistemic tensions in R&D alliances

In this study, the prevalent epistemic tensions in R&D alliances are identified as *horizontal* epistemic tensions, occurring at the interdisciplinary boundaries; *vertical* epistemic tensions, occurring between functional levels; and *inter-organizational* epistemic tensions, occurring at the inter-organizational boundaries. More particularly, our cases demonstrate that if we consider different firms as different ECs, partners of R&D alliances are likely to encounter issues in goal alignment during alliance development, and this could make epistemic tensions emerge, as previous research suggests (e.g., Pina-Stranger & Lazega, 2010). However, an alliance member might also experience epistemic tensions when (s)he is called to collaborate with somebody who does not share his dominant epistemic framework, and beyond the inter-organizational dimension, this may occur at the interlevel and interdisciplinary boundaries, potentially exposing alliance members to multiple epistemic tensions simultaneously. Here, we benefit from the extant literature's two traditional intra-organizational and inter-organizational views. But our analysis of the results allowed us to extend the current alliance management discourse to consider more than just these two perspectives.

At the interdisciplinary level, results confirm some previous research (e.g., MacLeod, 2018) stating that alliance partners, due to a lack of knowledge of other members' know-how and experience, come across misalignment of expectations and opinions that become sources of tensions. Notably, from an interlevel perspective, our cases go beyond the clear division of work and formal hierarchy, as this does not seem sufficient to avoid the emergence of epistemic tensions, contrary to what previous literature states (e.g., Pina-Stranger & Lazega, 2010). Instead, alliance members at different levels within the same organization attribute an extra measure of importance to coordination issues and perceive different priorities as far as the alliance is concerned, which seems to cause the emergence of tensions along the alliance development. The complexity of the overlapping ECs may explain the difficulty in predicting the behaviors and biases of individual alliance members. From this, we present our first proposition:

Proposition 1: In an alliance, several types of epistemic tensions emerge at the interdisciplinary, interlevel, and inter-organizational boundaries due to individual partners' association to multiple competing epistemic communities.

The multiplicity of epistemic tensions described in the proposition offer a new possible explanation for the instability of R&D alliances. Epistemic boundaries are more difficult to cross than the organizational ones more commonly studied in the IOR literature. Indeed, previous findings in the alliance literature prove the negative influence of functional diversity both on the short- and long-term performance in the case of international joint ventures (Mohr, 2005) and why only a moderate level of technological diversity (Sampson, 2007) is encouraged to promote innovation in R&D alliances. In this setting, limited absorptive capacity and knowledge assimilation are better explained in terms of the inability of some members to find a common set of standards across multiple competing ECs.

At the same time, we recognize that individual partners may simultaneously adopt several distinct and non-competing knowledge systems, all affecting their conceptions of identity and associated world views. In essence, this equates to an individual's association to several ECs which allows individual partners to make a connection with other alliance members, one way or another. Although a partner might find himself competing with another partner in one knowledge domain, this epistemic tension may be reconciled when partners find common ground in another knowledge system. From this view, we develop our second proposition:

Proposition 2: Bridging an epistemic tension across the interdisciplinary, interlevel, or interorganizational divide is possible when alliance partners find common ground in another dominant epistemic community.

Horizontal epistemic tensions may be resolved when partners share common functional or organizational worldviews. Vertical epistemic tensions may be resolved when partners share common disciplines or organizational worldviews. Epistemic tensions among organizations may be resolved when partners share common disciplines or functional worldviews. Finding common ground in at least one EC enables cohesive response and adaptation that is guided by at least one consistent epistemological framework. The introduction of the concept of ECs extends the traditional view of how knowledge exchange in alliances takes place. With the concept of ECs, we provide new explanations for how diverse knowledge systems both inhibit learning (i.e., when knowledge exchange happens between competing ECs) and facilitate learning (i.e., when knowledge exchange happens within ECs).

Recalling Figure 3, notice how it is also possible for certain alliance members to bridge those who completely have no common membership in an EC (e.g., Partner 1 and 9 do not share a common EC, but may be bridged by Partner 3). Thus, a closer look at alliance formation might reveal ideal patterns of alliance membership. Suppose the combinations of dominant participating ECs can be defined or are known, we can potentially arrive at new strategies for designing diversity in the alliance.

The interplay of formal and informal IMCs

To begin with, we recognize that formal and informal controls are not treated as separate standalone mechanisms, in agreement with the most recent literature on management controls stressing the importance of using both mechanisms (e.g., Kherrazi, 2020). This study shows the dynamic relationship when both types work in combination in the alliance development process. Evidence shows that when both types of controls are present in the same phase of the development process, the level of control effectiveness in managing tensions is higher in terms of preventing the emergence of new epistemic tensions, which further corroborates the importance of observing management controls along the development of the IORs (Grunwald-Delitz et al., 2019). Moreover, this is consistent with literature that supports the complementary view (e.g., Selviaridis & Wynstra, 2015). To drive forward the discussion, we find the interplay of the two control types as not being limited within the phase they have been identified. Their interplay extends along the development process of the R&D alliance. Controls established during the definition phase influence controls in the execution phase. Here, it is important to highlight the implications of establishing the formal controls before starting the alliance activities to allow for more effective use of informal controls in the life of the R&D alliance. In this sense, formal controls seem to create the necessary conditions that promote the effective use of controls to manage tensions in R&D alliances as they develop. This aligns with some previous studies (Van der Meer-kooistra & Scapens, 2015) on the importance of installing 'minimum structures' using formal controls, which in our analysis are perceived as universal rules that can fit the standards of multiple ECs. From this we develop our third proposition:

Proposition 3: Formal IMCs agreed upon the onset of an alliance establish the common basic standards acceptable to multiple ECs and this later facilitates the use of informal IMCs for resolving epistemic tensions.

Epistemic tensions 'across ECs' have previously been dealt with in the context of multinational companies challenged by cross-border units operating within a single organization. Almeida et al. (2002, p. 159) suggest that 'the knowledge managing advantages of the multinational company lie in its ability to standardize procedures and formats, to administer coordination between national units, develop interpersonal relationships between employees, and create a common culture to facilitate communication and cooperation.' An R&D alliance is not accustomed to the same inherent organizational mechanisms for integrating ECs thus formal IMCs need to be installed before agents can rely on more informal IMCs to operate.

Choi, Phan and Choi (2020) identify contract clauses that allow the assessment of contract completeness, which could form the basis for minimum contract detail. An environment in which innovation can flourish needs clearly defined spaces, with clear boundaries where agents can freely exchange new ideas and information. In the same way, creative output also needs limitations in order to remain practical and realistic. The limitations set by the formal IMCs are not intended to restrict, but instead, they are installed to allow free movement and self-organization within them. In our study, we observe that the distinction lies in the limitations defined by the formal IMC. Having defined formal controls in place, alliance members are more aware of the scope of their duties both as a member of the alliance and as a member of different ECs. Without knowledge of their limitations, alliance members are likely to hesitate to actively engage in negotiations, open communication, and knowledge exchange because of the associated risks of partner opportunism.

Conclusion

Our study offers multiple contributions to both theory and practice.

Contribution to theory

This study is one of the first attempts in the inter-organizational management theory to show a new multifaceted viewpoint applying social theory through the lens of ECs. Our results show several perspectives on the nature of epistemic tensions to depart from trends in the alliance literature that only focuses on tensions between partners dealing with the organizational divide. Indeed, by looking at tensions from an EC perspective, this study identifies different epistemic tensions, which brings awareness of the most relevant epistemic boundaries that divide an R&D alliance. With a focus on the problem, the study elevates our understanding of the complexity of exchanging heterogeneous knowledge in IORs. In parallel, we show that different types of controls, both formal and informal, can exist and interact if they are focused on the same coordination problems. They are connected by the type of epistemic tensions the controls they aim to address, whether implemented simultaneously, in parallel, or in succession over the life of the R& D alliance. The combined use of formal and informal IMCs within an R&D alliance creates the conditions that favor the coexistence of 'limitation and freedom', 'creativity and constraints' (Rosso, 2014), or 'firmness and flexibility' (Van der Meer-kooistra & Scapens, 2015).

Contribution to practice

From a practical point of view, the notion that knowledge exchange across organizations is more likely to succeed in open environments has given practitioners a narrow perspective, appreciating only the informal controls that immediately precede the realization of the desired outcome, and forgetting how formal controls established earlier contribute to the embeddedness of informal controls. Formal controls should not only be perceived as mandatory steps to comply with funding

requirements, nor should they be seen as restrictions that limit and slow down creativity. On the contrary, managers should recognize that without having formal controls to establish boundaries in the knowledge-exchange process, developing adequate informal controls such as culture and trust could be problematic in an inter-organizational setting. An alliance member needs to find affinity with other alliance members to establish a shared epistemic framework.

Limitations of the study

The results above should be interpreted considering a number of limitations. In the research design, the case selection criteria limit the context of the validity of the results, which means that the results may not hold true for other types of alliances with different structures or with different funding arrangements. Moreover, the context of an R&D alliance is different from alliances with other purposes and this can involve different sources of tension. This means that this study does not aim to arrive at a statistical generalization but rather arrives at an analytic generalization that allows, in turn, theoretical premises to be built. These can function as tools to make assertions about situations that are similar to the one studied (Rivera, 2008; Yin, 2014), thus laying the basis for future research. Also, due to the limited number of cases observed, there could be potential issues in exhausting all possible epistemic tensions in R&D alliances. The evidence, therefore, is not generalizable, but the insights produced by this study provide the foundation for closer investigation of other sources of epistemic tensions. Another limitation is that no high-tension context is identified from the cases. A theoretical explanation of such absence may be founded on the integrated risk perspective that explains how trust and control act as risk-reducing mechanisms (Das & Teng, 2001). The knowledge of having sufficient trust and control to successfully manage the epistemic tensions during the time of the interview reduces the degree of tensions experienced. Nonetheless, we have shown where our propositions yield predictions that are consistent with the cases, and we recognize the need for further empirical testing to better discriminate among alternative theories of knowledge exchange.

Conflicts of interest. None.

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Appendix 1. Information about (a) the cases and (b) the interviews

	Case 1	Case 2	Case 3
(a) Information about the cases			
Type of agreement	Joint R&D agreement that involve multi-way knowledge flows		
Funding	Interdependent – partly funded by the government and all the industrial partners in the three alliances		
Location	Flemish region (partners are headquartered in the same region)		
Alliance structure	Intermediary-driven network		
Contract duration	2016–2018	2015–2018	2008–2010
Purpose of the alliance	Localization system for tracking and navigation for autonomous operations	Integrated production chain for additive manufacturing of structural applications in polymers	Active suspension of vehicles (computer-controlled suspension)
Number of partners and composition	6 partner organizations (4 industrial partners and 2 research partners)	8 partner organizations (4 industrial partners and 4 research partners)	6 partner organizations (5 industrial partners and 1 research partner)

(*Continued*)

(*Continued.*)

	Case 1	Case 2	Case 3
Industry/core business of partner organization	Partner A: Mechatronic product development and test solutions Partner B: Manufacturing steel wire and coating technologies Partner C: Nautical applications Partner D: Gate and terminal automation solutions Partner E: Strategic research center Partner F: University (core lab)	Partner G: Plantar pressure and analyzing solutions Partner H: Software solutions and engineering with 3D printing Partner I: Digital products and Partner J: Test and quality solutions Partner K: Strategic research center Partner L: Strategic research center Partner M: University (core lab) Partner N: University (core lab)	Partner U: Instrumentation Partner V: Mechatronic simulation Partner W: Suspension technology Partner X: Industrial technology and software applications Partner Y: Car manufacturing Partner Z: Automotive engineering center
*Size and founding year of partner organization	Partner A: Small (2009) Partner B: Large (1880) Partner C: Small (2008) Partner D: Large (1999) Partner E: Medium (2014) Partner F: Large (1939)	Partner G: Small (2014) Partner H: Large (1990) Partner I: Large (1988) Partner J: Large (1999) Partner K: Medium (1949) Partner L: Medium (2014) Partner M: Large (1834) Partner N: Large (1425)	Partner U: Small (2006) Partner V: Large (2012) Partner W: Large (1940) Partner X: Large (1847) Partner Y: Large (1903) Partner Z: Small (2003)
(b) Information about the interviews			
Number and duration (in minutes) of interviews	4 interviews (1–2 hr per interview)	5 interviews (1–2 hr per interview)	4 interviews (1–2 hr per interview)
Type of informants	From 3 of the different partner organizations, CTOs, project leader, technical officers	From 5 of the partner organizations, CEO, CTO, managers, project leader, experts in software development, mechatronics, automation of product testing for precision and mechanics production technologies	From 3 of the different partner organizations, technology director, project leader, research manager, experts in suspension technology, car manufacturing, software applications, and sensor technology
Key informants outside the cases (industry/firm size (founding year)/position of informant/duration of interview)	Interviews with informants from intermediary organizations managing R&D alliances in the Flemish region Interview 1: Plastics and Chemical Industry/Small firm (2017)/Managing director/67 min Interview 2: Semiconductor Industry/Large firm (1998)/Technical advisor/60 min Interview 3: Semiconductor Industry/Large firm (1998)/Project coordinator/60 min (same company as above) Interview 4: Aerostructures/Large (1954)/Section leader on tests and innovation/80 min		

*Firm size measured in terms of the number of employees (according to the European Commission recommendation as of 6 May 2003) where micro-enterprises have less than 10 persons employed; small enterprises have 10–49 persons employed; medium-sized enterprises have 50–249 persons employed; and large enterprises have 250 or more persons employed.

Appendix 2. Interview protocol

(Questionnaire)

Two rounds of interviews are conducted, among which the former is broader, whereas the latter is more specific based on the information collected during the first round. Respondents are asked to refer to one of their experiences in managing IORs (i.e., R&D alliances) to answer the questions.

In the first round of interviews, respondents are asked to describe the R&D alliance in terms of the history, partners' involvement, structure, and organization.

The use of IMCs is codified by identifying well-defined, programmed, or standardized procedures, measures, management practices, and working norms that partners establish to manage the alliance. A list of formal and informal IMCs based in the literature are provided.

The emergence of tensions along the alliance development were categorized to various types based on the source, severity, and timing.

Success is assessed based on the following scale:

☐	Failure	Resulting to losses and/or damages
☐	Unsuccessful	Most of the goals were NOT achieved
☐	Average	Neither a failure nor a big success
☐	Successful	Most of the goals were achieved
☐	Exceeds expectations	Achieved all goals and opened to new opportunities

In the second round of interviews more specific questions are asked.

Differences among goals

1. Which goal(s) is(are) the main basis of your assessment of success?
2. What is your primary interest/goal (as a firm) for engaging in the R&D alliance?
3. What are your expectations from the other partners?
4. Are you open about your interests and expectations to your partners? Do you think your partners are open about their interests and expectations to you? If yes, what are the primary interests of your partners in engaging in the alliance?
5. Kindly assess the degree (low, medium, high) to which the differences among the partners interests and expectations lead to any conflict. Describe these conflicts, particularly if there are difficulties in establishing the common goal of the alliance.
6. Describe how management controls are used to resolve or avoid the conflict.

Differences between levels (e.g., upper project management level vs. lower project execution level)

1. Who are the people involved and what are their roles (considering both managerial and technical roles)?
2. Are managers able to communicate well to the technical people the goals, strategies, requirements, and limitations of the alliance? Describe any difficulties.
3. And vice versa, are technical people level able to communicate well to management feedback from their activities (e.g., research results)? Describe any difficulties.
4. Can you describe any difference between these levels that lead to a conflict? Kindly assess the degree (low, medium, high) to which the differences between the levels lead to any conflict.
5. Describe how management control mechanisms are used to resolve or avoid the conflict.

Differences among technical expertise and backgrounds

Given that partners have different technical expertise and backgrounds …

1. Can you describe situations when people in the project have a different understanding of a concept critical to the project? What views/opinions (way-of-thinking) were not shared?
2. Can you describe situations when people have a different approach/style in executing the project? What practices (way-of-doing things) were not shared?
3. Is there a balance in knowledge contribution from all the partners? Describe the level of knowledge contribution from each partner. When do you think is one knowledge contribution more valuable than another?
4. Kindly assess the degree (low, medium, high) to which the differences among the partners technical expertise and background lead to any conflict.
5. Describe how management control mechanisms are used to resolve or avoid the conflict.

Effectiveness of control mechanisms

1. How do you keep information accurate and up-to-date? Do you assign specific tasks to people to ensure that controls remain in-place?

2. How do you build trust with your partners? How do you know when trust is no longer there?
3. In terms of knowledge-exchange, how do the mechanisms ensure that knowledge is effectively transferred and utilized? Does it ensure that partners provide the same amount of knowledge contribution? How does it work?
4. Have you noticed a change in the use of formal and informal controls over the life of the alliance? What do you think influences these changes?

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