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The role of interpartner dissimilarities in Industry–University alliances: Insights from a comparative case study

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ABSTRACT

Based on a comparative study of two alliances, this paper provides an in-depth examination of the role of interpartner dissimilarities in Industry–University (IU) alliances. We make a conceptual distinction between routine-based dissimilarities (differences in partners' behavior) and orientation-based dissimilarities (differences in partners' goals and expectations), illuminating their joint implications for collaborative processes and outcomes over time. Our findings reveal that interpartner dissimilarities might not be problematic at the start-up or honeymoon stage in IU alliances. In the post-formation alliance stages, however, they are likely to complicate the collaboration. Orientation-based dissimilarities might frustrate partners' attempts to solve routine-based dissimilarities by impeding successful joint sensemaking. We conclude that different combinations of the two types of dissimilarities are likely to trigger particular coordination and cooperation patterns in IU alliances, eliciting different outcomes on both technological and relational levels.

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1. Introduction

Industry–University (IU) alliances¹ are a crucial element in the innovation strategy of organizations and a top priority for policy makers (Bishop et al., 2011; Martin, 2012). European policy makers, for instance, increasingly advocate an 'Open Innovation 2.0' approach, emphasizing the need for multidisciplinary collaboration, where firms and research organizations (ROs) work together to develop an innovation ecosystem.² Firms and ROs possess highly complementary resources – e.g. industrial vs. scientific knowledge (Du et al., 2014) –, triggering substantial potential for synergistic value creation (Santoro, 2000; George et al., 2002). At the same time, fundamental organizational dissimilarities exist

between firms and ROs, which might complicate the management of IU alliances (Bruneel et al., 2010; Tartari et al., 2012). When firms and ROs engage in an alliance, both routine-based dissimilarities (i.e. firms and ROs behave differently in IU alliances) and orientation-based dissimilarities (i.e. firms and ROs have divergent goals and expectations in IU alliances) are likely to be present. These different types of interpartner dissimilarities might disrupt firms and ROs' ability to collaborate effectively and thus to realize the intended synergies (Parkhe, 1991; Bruneel et al., 2010).

Although the existence of interpartner dissimilarities between firms and ROs and their disruptive effects are widely acknowledged (e.g. Cyert and Goodman, 1997; Carayol, 2003; De Fuentes and Dutrénit, 2012), a systematic analysis of how these dissimilarities play out and evolve over time remains absent. Reviewing extant research, we argue that prior studies tend to underemphasize the interactions between different types of interpartner dissimilarities (e.g. Sarkar et al., 2001; Bjerregaard, 2010). In addition, adopting cross-sectional designs, they tend to offer a snapshot perspective on dissimilarities, largely ignoring how they evolve over time (e.g. Lavie et al., 2012). Jointly, these limitations restrict our understanding of the nature, impact, and dynamics of interpartner dissimilarities in IU alliances. Overcoming these limitations is key to explaining why some IU alliances succeed while others fail.

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¹ We use 'IU alliances' as an umbrella term for collaborative agreements between firms and a variety of research organizations (ROs), including universities and other ROs such as public research institutes and private technology centers.

² For more information, see <https://ec.europa.eu/digital-single-market/news/open-innovation-20-yearbook-2013>

The overall aim of this study is therefore to provide a more systematic examination of the role of interpartner dissimilarities in IU alliances. In particular, we examine how different types of interpartner dissimilarities jointly shape collaborative processes over time and eventually impact outcomes in IU alliances. To do so, we conducted an in-depth longitudinal study of two IU alliances – one successful and one failed – that were initiated by the same firm (i.e. an established animal nutrition company) and were embedded in the same institutional setting (i.e. a publicly-funded consortium).

Based on our comparative analysis, we show how, at different stages of the alliance lifecycle, the interaction between routine-based and orientation-based dissimilarities have important implications for collaborative processes and outcomes. Our findings reveal that, in case of high resource complementarities between the partners, IU alliances are likely to experience an initial honeymoon period, during which routine-based and orientation-based dissimilarities remain latent. As collaboration moves to more mature stages, however, the role of interpartner dissimilarities is likely to become more salient. At that point, the presence of orientation-based dissimilarities is likely to function as a hampering factor, complicating the reduction of routine-based dissimilarities, which in turn leads to ineffective coordination and cooperation. In contrast, in the absence of orientation-based dissimilarities, firms and ROs are more likely to mitigate their routine-based dissimilarities, resulting in favorable outcomes on both relational and technological levels. Jointly, these findings enrich our theoretical understanding of the role of interpartner dissimilarities in IU alliances. Moreover, our insights provide managers and policy makers with relevant guidelines on how to improve the likelihood of success in IU alliances.

2. Conceptual background

In this section, we first explain why high resource complementarities and salient interpartner dissimilarities are both likely to be present in IU alliances. Subsequently, we review extant theorizing on the impact of interpartner dissimilarities on collaborative processes and outcomes. Finally, we discuss the research gaps that we aim to address in this study.

2.1. Complementarities and dissimilarities in IU alliances

Firms are for-profit institutions aimed to develop successful products in competitive markets; ROs are non-profit institutions focused on generating and disseminating scientific knowledge (Cyert and Goodman, 1997; Martin, 2012). Given these different institutional missions and foci, firms and ROs develop different resources (e.g. market vs. scientific knowledge), which can result in complementarities –i.e. resources are “different, yet interdependent and mutually supportive” (Wang and Zajac, 2007; p. 1293). For instance, IU alliances allow firms to get fine-grained and privileged access to ROs’ scientific knowledge, enhancing their innovation capabilities (e.g. Bishop et al., 2011). In turn, ROs can get a better understanding of how their scientific knowledge can be applied in commercial innovation activities, generating input for new scientific discoveries (e.g. George et al., 2002). These resource complementarities between firms and ROs create high potential for synergistic value creation in IU alliances (Santoro, 2000; George et al., 2002).

At the same time, as firms and ROs are embedded in different institutional settings, substantial interpartner dissimilarities are likely to exist between them (Bruneel et al., 2010; De Fuentes and Dutrenit, 2012; Tartari et al., 2012). Interpartner dissimilarities refer to differences in the partners’ organizational attributes

(Parkhe, 1991).³ For instance, ROs tend to emphasize the logic of science, long-term horizons, and the scientific diffusion of knowledge, whereas firms follow the market logic, short-term business deadlines, and knowledge protection criteria (e.g. Carayol, 2003; Lhuillery and Pfister, 2009).

Alliance scholars emphasize that the concept of interpartner dissimilarities is multifaceted (Parkhe, 1991), suggesting the existence of different types of dissimilarities (Sarkar et al., 2001; Bruneel et al., 2010; De Fuentes and Dutrenit, 2012; Lavie et al., 2012). Studying interfirm alliances, for instance, Sarkar et al. (2001) refer to operational dissimilarities (i.e. organizational procedures) and cultural dissimilarities (i.e. goals and objectives). In the setting of IU alliances, De Fuentes and Dutrenit (2012, p. 1666) note that firms and ROs “differ in terms of the *incentives* they have to collaborate and the *behaviors* they adopt during the collaboration process” (emphasis added). Similarly, Bruneel et al. (2010) distinguish between transaction-related and orientation-related barriers in IU collaboration. Building on these insights, we make a conceptual distinction between two main types of interpartner dissimilarities in IU alliances. First, partners can exhibit what we label ‘routine-based dissimilarities’ or differences in their collaborative routines (e.g. Lavie et al., 2012). These routines are patterns of behavior that describe how an organization operates and interacts with its alliance partners (Zollo et al., 2002). Second, partners can also be confronted with ‘orientation-based dissimilarities’ or differences in their collaborative orientation, which imply that partners have different alliance goals and expectations (e.g. Bruneel et al., 2010). Overall, the existing literature suggests that both types of dissimilarities are likely to challenge the management of IU alliances (Cyert and Goodman, 1997; Bruneel et al., 2010).

In sum, whereas IU alliances allow partners to pool complementary resources, providing substantial potential for synergistic value creation, routine-based and orientation-based dissimilarities between firms and ROs can hamper the actual realization of such potential (Tartari et al., 2012; Kale et al., 2000; Bruneel et al., 2010). Below, we discuss in more detail the implications of interpartner dissimilarities.

2.2. Impact of interpartner dissimilarities on collaborative processes and outcomes

Whereas numerous studies on the particular phenomenon of IU alliances conceptually stress interpartner dissimilarities to explain the challenging nature of such alliances (e.g. Cyert and Goodman, 1997; Carayol, 2003; De Fuentes and Dutrenit, 2012), they rarely conduct a direct empirical examination of dissimilarities (e.g. Lhuillery and Pfister, 2009; Du et al., 2014). In the broader literature on interorganizational collaboration, however, studies do provide a more in-depth examination of interpartner dissimilarities and their implications. In this latter literature, a core premise is that interpartner dissimilarities can be detrimental to collaboration because they are likely to disrupt coordination and cooperation processes⁴ (Gulati et al., 2012).

³ We build on Parkhe’s (1991) seminal conceptualization of interfirm diversity. Our concept of ‘resource complementarities’ mirrors Parkhe’s (1991) notion of ‘Type I diversity’ or “reciprocal strengths and complementary resources furnished by the alliance partners” (Parkhe, 1991). ‘Interpartner dissimilarities’ reflects what Parkhe (1991) labels ‘Type II diversity’ or “differences in partner characteristics that often negatively affect the longevity and effective functioning (of alliances)” (Parkhe, 1991). In this way, we account for both constructive and disruptive differences between firms and ROs.

⁴ Coordination is the “adjustment of partners’ actions to achieve jointly determined goals”, whereas cooperation refers to “joint pursuit of agreed-on goal(s) in a manner corresponding to a shared understanding about contributions and payoffs” (Gulati et al., 2012).

Looking from a learning perspective, some scholars emphasize that routine-based and orientation-based dissimilarities disrupt coordination and cooperation by impeding interpartner learning (Parkhe, 1991). As partners interact, they have the opportunity to learn about each other and become familiar with their particular routines, procedures, goals, and expectations (Doz, 1996; Inkpen and Currall, 2004). Developing such an understanding is essential to the partners' ability to design an alliance strategy that synchronizes their actions toward mutual benefit (Lioukas and Reuer, 2015). Interpartner learning is therefore the foundation for effective coordination and cooperation (Inkpen and Currall, 2004; Gulati et al., 2012). Routine-based and orientation-based dissimilarities, however, can hamper interpartner learning (Parkhe, 1991). Organizations show limited ability in actually understanding procedures and goals that are different from their own (Doz, 1996; Lane and Lubatkin, 1998). Dissimilar partners might thus struggle to anticipate each other's expectations as well as behaviors that are crucial for alliance development (Lavie et al., 2012; Lioukas and Reuer, 2015). In this way, routine-based and orientation-based dissimilarities might prevent partners from learning to work together and coordinate and cooperate effectively. For instance, routine-based dissimilarities usually imply different views on how to conduct alliance operations (e.g. partners disagree on which tasks should be accomplished), which can trigger coordination problems such as suboptimal sequencing of joint work (Wilkofer et al., 1995; Gulati et al., 2012). In this way, routine-based dissimilarities can challenge the development of joint collaborative routines, a key interorganizational learning process for effective coordination in alliances (Zollo et al., 2002).

Looking from a more cognitive perspective, other scholars suggest that routine-based and orientation-based dissimilarities disrupt coordination and cooperation by triggering interpretative conflicts between the partners (Kumar and Nti, 2004; Weber and Mayer, 2014). Since coordination and cooperation require a shared vision (Gulati et al., 2012), these interpretative conflicts can make effective coordination and cooperation problematic. Attribution theory suggests that partners frame particular behaviors and outcomes as desired, depending on their own interpretative schemas (Ross et al., 1977; Kumar and Nti, 2004). Subsequently, partners use these assumptions to attach meaning to alliance events (Smith and Barclay, 1997). Dissimilar partners are likely to rely on different schemas, holding different assumptions about behavior and performance in the alliance (Weber and Mayer, 2014). Therefore, they might interpret alliance events in very different ways (Fey and Beamish, 2001; Kumar and Nti, 2004). Similarly, attention-based theory suggests that attributes of organizations (e.g. routines, goals) act as 'attention structures', channeling their attention to particular aspects of reality (Ocasio, 1997; Barnett, 2008). Therefore, partners that exhibit routine-based and orientation-based dissimilarities are likely to focus their attention on different aspects of the collaboration. What decision-makers' think and do "depends on what issues...they focus their attention on" (Ocasio, 1997, p. 1990). By triggering divergent attention foci, routine-based and orientation-based dissimilarities can thus create interpretative conflicts between the partners (Weber and Mayer, 2014). For instance, orientation-based dissimilarities often imply different reciprocity norms (Lui and Ngo, 2005), which can lead to cooperation problems such as misunderstandings where partners misattribute each other's behavior –e.g. erroneously accusing each other of opportunism (Fey and Beamish, 2001). Hence, orientation-based dissimilarities can trigger interpretative conflicts that hinder the establishment of relational quality (Sarkar et al., 2001; Lavie et al., 2012), disrupting effective cooperation in the alliance.

Applying these insights provided by existing alliance research to the particular setting of our study, we can expect that interpartner dissimilarities might hamper coordination and cooperation in IU

alliances, by (i) impeding firms and ROs to learn about each other, and (ii) causing interpretative conflicts between them. In this way, interpartner dissimilarities might complicate value creation in IU alliances.

2.3. Research gaps

Although the extant literature provides relevant insights into how interpartner dissimilarities affect collaborative processes and outcomes, we point to two important issues that limit our understanding of the role and implications of dissimilarities in IU alliances. First, whereas existing studies acknowledge the multidimensional nature of interpartner dissimilarities (e.g. Sarkar et al., 2001; Lavie et al., 2012), they tend to focus on the independent implications of different types of dissimilarities, underemphasizing their potential interactions. For instance, Lavie et al. (2012) conclude that dissimilarities in (i) the partners' task routines and (ii) environmental responsiveness *separately* hinder relational mechanisms in alliances (e.g. trust, commitment). However, they do not examine how these different types of dissimilarities *jointly* affect relational mechanisms. We argue that it is theoretically important to look at the connections between different types of dissimilarities. In his conceptual paper, Parkhe (1991) already emphasized that the different dimensions of interpartner dissimilarities are interrelated, in such a way that they can impact the collaboration collectively. He further stressed that the particular configuration of dissimilarities (i.e. degree and type) determines what kind of management efforts are needed to enable alliance learning (Parkhe, 1991). These insights suggest that routine-based and orientation-based dissimilarities are interconnected and jointly shape interpartner adjustment and learning. Therefore, disentangling such connections is crucial to better understand how dissimilarities affect alliance processes and eventually determine outcomes such as realization of complementarities. The first objective of this paper is therefore to examine how different types of dissimilarities jointly impact collaborative processes and outcomes in IU alliances.

Second, it needs to be stressed that the majority of existing studies on interpartner dissimilarities adopt cross-sectional designs (e.g. Fey and Beamish, 1991; Lavie et al., 2012), which are not particularly well suited to examine evolving phenomena (Salk, 2005). Parkhe (1991), however, already stressed the dynamic nature of interpartner dissimilarities, arguing that their magnitude and effects are likely to evolve as partners transition across different phases of the alliance lifecycle. In a similar vein, Doz (1996) argues that dissimilarities are particularly problematic at the initial stages of collaborative relationships, when partners lack mutual working experiences. These latter studies suggest that, to increase our understanding of how interpartner dissimilarities impact alliance success, we need to study their evolution over time. Therefore, the second objective of this study is to examine the role and implications of dissimilarities throughout the lifecycle of IU alliances.

3. Methodology

3.1. Research design and cases

We conducted a comparative study of two IU alliances (see Table 1), which allows answering 'how' questions about complex contemporary events (Eisenhardt, 1989; Yin, 2003). These two alliances, labelled under the pseudonyms of 'Plant Proteins' and 'Organic Pigments', were formed in 2008 in the setting of a Spanish publicly-funded consortium, which we refer to as 'Aqua&Sust' Consortium, aimed to develop innovations in aquaculture. In each alliance, the consortium's lead firm (LeadFirm, an animal nutrition

Table 1
The ‘Plant Proteins’ and ‘Organic Pigments’ alliances.

Alliance description	‘Plant Proteins’ Alliance		‘Organic Pigments’ Alliance
Objective	Exploring plant proteins for aquaculture nutrition		Exploring organic pigments for aquaculture nutrition
Horizon	3 years (Jan. 2008–Dec. 2010)		3 years (Jan. 2008–Dec. 2010)
Budget	432.000€		590.000€
Consortium subproject	Nutrition		Nutrition
Partners’ joint experience	No		No
Collaborative outcomes	Success (good technological and relational outcomes)		Failure (poor technological and relational outcomes)
Partners description	Proteins Institute	LeadFirm	PigmentsCenter
Type of organization	Public research institute (non-profit)	Multinational firm (for profit)	Private technology center (non-profit)
Mission	“To contribute to addressing oil-related industrial needs through scientific and technology production”	“To contribute to the progress of animal nutrition. . . through market leadership and innovation”	“To add value to agri-food businesses through innovation and technology development”
Size	Employees ₂₀₀₇ : 176 Income ₂₀₀₇ : 4.3mill. €	Employees ₂₀₀₇ : 1100 Sales ₂₀₀₇ : 100mill. €	Employees ₂₀₀₇ : 190 Income ₂₀₀₇ : 13 mill. €
Research capabilities	Strong (e.g. leading research center in olive oil industry)	Moderate (e.g. R&D expenses ₂₀₀₈ : 4mill. €)	Strong (e.g. leading research center in agri-food industry)
Technology expertise (contributions to alliance)	Plant proteins (human nutrition)	Animal proteins/artificial pigments (fish nutrition)	Organic pigments (human nutrition)
Experience in IU alliances	Moderate-high (e.g. projects with firms = 60% income ₂₀₀₇)	Moderate (e.g. long-term alliances with two centers)	High (e.g. 350 projects with firms = 80% income ₂₀₀₇)
Internal alliance execution (department and research team) ^a	Plant Proteins Group: 12 employees Manager: PhD. Chemical Sc. Head Engineer: PhD. Chemical Engineering	Nutrition Area: 40 employees Manager: PhD. Veterinary Head Engineer: Chemical Engineer	Organic Pigments Group: 17 employees Manager: PhD. Chemical Engineering Head Engineer: Chemical Engineer (started with PhD)

^a In each organization, the specific department responsible for the alliance designated a head engineer who internally reported to her/his manager. Lead Firm designated one head engineer and one manager for both alliances.

company) teamed up with a different RO (ProteinsInstitute and PigmentsCenter) to explore new product development opportunities in aquaculture nutrition.

The studied alliances provide an appropriate research setting because they represent ‘polar cases’ (Yin, 2003) in terms of collaborative outcomes (success vs. failure), while sharing the same institutional background (i.e. ‘Aqua&Sust’ Consortium) and similar structural conditions (e.g. contract, technological objectives, absence of partners’ joint experiences). In this way, we were able to conduct a systematic comparison and minimize extraneous variation (Eisenhardt, 1989).⁵

3.2. Data collection and analysis

In total, we conducted 34 interviews, which lasted on average 1.5 h. They were conducted face-to-face in the native language of the interviewees. To mitigate retrospective data collection biases, we interviewed multiple informants and triangulated interview data with information from documents (e.g. contracts, corporate and technical reports), and direct observation at several consortium meetings (Eisenhardt, 1989; Yin, 2003). The Appendix A provides more details about our data collection efforts. We structured our research in three sequential phases of data collection and analysis (Langley, 1999; Faems et al., 2008).

3.2.1. Phase 1 (April 2008–October 2010)

This study emerged from a larger research project, which focused on the collaborative dynamics in R&D consortia. This larger project was started in April 2008. In the first phase, we conducted 24 interviews with 19 informants, which provided overall informa-

tion on the focal alliances as being part of the broader ‘Aqua&Sust’ Consortium. We also reviewed public and private documents (e.g. press releases, contracts), and conducted direct observation in consortium meetings. In this way, we gained a rich understanding of the two focal alliances (e.g. partners’ characteristics, ongoing evolution) and the setting in which they were embedded. In addition, this prolonged engagement in the field helped us familiarizing with key informants, increasing the quality of subsequent data collection (Miles and Huberman, 1994).

3.2.2. Phase 2 (October 2010–September 2011)

This phase started with exploratory interviews with the Lead-Firm’s R&D Manager to get additional information on the two focal alliances. We also reexamined our data records and compiled all the relevant information for each alliance (Miles and Huberman, 1994). Subsequently, we conducted four semi-structured interviews (May–July 2011): two interviews with the R&D Manager of LeadFirm (one per case) and one interview with each head engineer in ProteinsInstitute and PigmentsCenter. We asked them to describe the alliances in great detail (e.g. anecdotes, examples, milestones). In this way, we developed a deep understanding of critical alliance events (Faems et al., 2008). We then reconstructed the history of the two alliances in detailed case study reports, which contained many empirical quotes to enhance accuracy (Langley, 1999). Applying a temporal bracketing strategy (Langley, 1999), we identified three alliance lifecycle stages in our cases: start-up (January–December 2008), execution (December 2008–December 2009), and termination (December 2009–December 2010). This strategy provided a temporal structure for the in-depth analysis of interpartner dissimilarities within and between cases across the different stages.

3.2.3. Phase 3 (July 2011–May 2012)

In this phase, we coded and analyzed the data, systematically linking empirical observations to relevant concepts (Miles and Huberman, 1994; Gioia et al., 2013). Building on existing research, we started from the conceptual distinction between routine-based

⁵ Minimizing extraneous variation, we could eliminate alternative explanations suggested by prior studies. For instance, since the partners in both cases lacked a history of prior collaboration, the success of the ‘Plant Proteins’ alliance cannot be attributed to the fact that the partners had addressed their dissimilarities and built trust in the past (e.g. Bruneel et al., 2010).

Table 2
Overview of coded concepts.^a

<i>Collaborative routines</i>	
Communication	<ul style="list-style-type: none"> • Communication quality (communication frequency and transparency): Degree of frequency and transparency to which relevant information is shared with partners (Mohr and Spekman, 1994) [High vs. low] • Communication formalization: Degree to which communication with partners is standardized through rules and procedures (Vlaar et al., 2006) [High vs. low]
Joint work and decision-making	<ul style="list-style-type: none"> • Allocation of responsibilities (decision making and technical execution): Partners' participation in technical execution and decision making (Mohr and Spekman, 1994) [Joint vs. centralized] • Organization of joint work: Degree of integration of partners' alliance tasks (Reuer et al., 2002) [Integrative vs. sequential]
Task execution and flexibility	<ul style="list-style-type: none"> • Task execution: Criteria used to perform and evaluate progress of alliance tasks (Lavie et al., 2012) [Industrial vs. scientific] • Task flexibility: Degree of flexibility in implementing task-related changes (Das and Teng, 2000) [High vs. low]
<i>Collaborative orientation</i>	
Alliance rationale	<ul style="list-style-type: none"> • Purpose of the collaboration: Goals the partners strive to attain with the alliance (Parkhe, 1991) [Exploration of technological opportunities with vs. with(out) commercial value] • Desired outcomes: Outputs the alliance is expected to bring (Kumar and Nti, 2004) [Feasible vs. un (feasible) technological solutions]
Reciprocal obligations	<ul style="list-style-type: none"> • Partners' inputs: Partners' specific contributions of resources (Doz, 1996) [Industrial vs. scientific knowledge] • Importance of formal contract: Extent to which partners' obligations are stipulated in the formal alliance agreement (Ring and Van de Ven, 1994) [High vs. low]
Alliance scope and horizon	<ul style="list-style-type: none"> • Scope: Range of R&D activities covered by the alliance (Oxley and Sampson, 2004) [Broad vs. narrow] • Horizon: Position of the alliance in the time-to-market continuum (Das and Teng, 2000) [Long-term vs. medium/short-term]
<i>Initial conditions</i>	
<i>Collaborative processes</i>	
	<ul style="list-style-type: none"> • Resource complementarities: Extent to which the partners' resources are mutually reinforcing (Wang and Zajac, 2007) • Honeymoon: Initial period in a relationship, during which favorable prior beliefs of the parties prevail, such that the relationship is shielded from the risk of dissolution when initial outcomes are unfavorable (Fichman and Levinthal 1991: 446) • Coordination efforts: Explicit actions to adjust the partners' activities to achieve jointly determined goals (Gulati et al., 2012) • Coordination problems: Extent to which the partners face difficulties in adjusting their actions to achieve jointly determined goals (Gulati et al., 2012) • Cooperation problems: Extent to which the partners face difficulties in building mutual understanding on goals, contributions, and reciprocal obligations (Gulati et al., 2012)
<i>Collaborative outcomes</i>	
	<ul style="list-style-type: none"> • Technological outcomes: Degree to which alliance goals are fulfilled and technological complementarities are realized (Parkhe, 1991; Kale et al., 2000) • Relational outcomes: Degree of relational quality or partners' satisfaction with their interaction pattern (Ariño and Doz, 2000)

^a Between brackets, the scale (e.g. high vs. low) we used to characterize each dimension of the partners' routines and orientation (see also Table 3).

and orientation-based dissimilarities (see Table 2). To code these two core concepts, we followed a four-step process. First, we categorized empirical statements (mainly from interviews) as related to either collaborative routines or orientation⁶ (Rerup and Feldman, 2011). Second, we grouped them into different dimensions and sub-dimensions of routines (e.g. communication: quality and formalization) and orientation (e.g. alliance rationale: purpose and desired outcomes), which we identified by iteratively juxtaposing our data with existing alliance literature (Gioia et al., 2013). Third, we characterized the different (sub-)dimensions for each partner (e.g. high vs. low communication formalization). Finally, we compared the routines and orientation of the two partners in each alliance, identifying detailed interpartner (dis)similarities (Tables 3–5 in the next section provide more details).

As Table 2 shows, we also coded other concepts relevant to explain the role of dissimilarities in the cases: (i) initial conditions of *resource complementarities* (e.g. proteins strength LeadFirm's products; aquaculture strengths ProteinsInstitute's research); (ii) collaborative processes: *honeymoon* (e.g. "the exciting phase", LeadFirm Manager), *coordination* (e.g. red phone between engineers in 'Plant Proteins' alliance), and *cooperation* (e.g. "(PigmentsCenter) does not put enough effort", LeadFirm Manager); and (iii) collaborative outcomes: *technological* (e.g. a co-patent in 'Plant Proteins' alliance), and *relational outcomes* (e.g. "A big disappointment" in Organic Pigments alliance, LeadFirm Manager).

⁶ For instance, interviewees described routines by explaining how they normally operated in IU alliances (e.g. "we take off the lab coat to put on the firm's uniform", PigmentsCenter) and how their behavior evolved in the studied period (e.g. ProteinsInstitute's task routines changed as the alliance unfolded). Interviewees described collaborative orientation by explaining how they construed IU alliances (e.g. "ROs provide technological solutions", LeadFirm) and answering questions about the focal alliance (e.g. "What did you expect when the agreement was formalized?").

Once the main concepts were coded, we engaged in a more in-depth analysis of the relationships between dissimilarities, collaborative processes and outcomes in the cases. We applied two validity-enhancing strategies (Eisenhardt, 1989): (i) we combined within-case and cross-case analyses, and (ii) we applied the principle of researcher triangulation in analyzing data.⁷ Overall, this approach allowed us to identify explanatory patterns, rule out alternative explanations, and formulate propositions on how dissimilarities impact processes and outcomes in IU alliances.

As we were engaged in this latter phase, we also conducted some additional data collection efforts. We attended the consortium's closing meeting (October 2011) and conducted four additional interviews (March–April 2012) with key informants who had not yet been interviewed in prior stages (i.e. the head engineer in LeadFirm and the managers in ProteinsInstitute and PigmentsCenter). We followed a revised version of the initial protocol and discussed emergent findings with the new informants (Miles and Huberman, 1994). These additional data collection efforts allowed us to fine-tune our explanatory framework, further enhancing internal validity (Eisenhardt, 1989).

4. Findings

4.1. Initial complementarities and dissimilarities

Both the 'Plant Proteins' and 'Organic Pigments' alliances aimed to explore the use of new ingredients (respectively, plant proteins and organic pigments) in aquaculture nutrition. In both cases,

⁷ For instance, the second author (i.e. the 'outsider' researcher) acted as "a devil's advocate" (Rerup and Feldman, 2011: 584), challenging the causal relations identified by the first author and pointing to alternative ones (Gioia et al., 2013), which were in turn confirmed or rebutted by the first author, relying on her deep understanding of the cases.

Table 3
Initial dis (similarities) in the ‘Plant Proteins’ and ‘Organic Pigments’ alliances.

			Characteristics of the routines/orientation of each partner			Identified dis(similarities) ^a	
			LeadFirm	ProteinsInstitute	PigmentsCenter	‘Plant Proteins’ Alliance	‘Organic Pigments’ Alliance
Collaborative routines	Communication	Communication quality (transparency)	High	High	High	Similarity	Similarity
		Communication quality (frequency)	High	Low	High	Dissimilarity	Similarity
		Communication formalization	Low	Low	High	Similarity	Dissimilarity
	Joint work and Decision making	Allocation responsibilities (decision making)	Joint	Joint	Centralized	Similarity	Dissimilarity
		Allocation responsibilities (technical execution)	Joint	Centralized	Joint	Dissimilarity	Similarity
		Organization of joint work	Integrative	Sequential	Integrative/sequential	Dissimilarity	Similarity
	Task execution and flexibility	Task execution	Industrial	Scientific	Scientific	Dissimilarity	Dissimilarity
Collaborative orientation	Alliance rationale	Task flexibility	High	High	Low	Similarity	Dissimilarity
		Purpose of the collaboration	Exploration of technological opportunities with commercial value	Exploration of technological opportunities with commercial value	Exploration of technological opportunities with(out) commercial value	Similarity	Dissimilarity
	Reciprocal obligations	Desired outcomes	Feasible technological solutions	Feasible technological solutions	(Un)feasible technological solutions	Similarity	Dissimilarity
		Partners’ inputs	Industrial vs. scientific knowledge	Industrial vs. scientific knowledge	Industrial vs. scientific knowledge	Similarity	Similarity
		Importance of the formal contract	Low	Low	High	Similarity	Dissimilarity
	Alliance scope and horizon	Alliance scope	Broad	Broad	Narrow	Similarity	Dissimilarity
		Alliance horizon	Medium-term	Medium-term	Long-term	Similarity	Dissimilarity

^a Resulting from the comparison of the partners’ routines/orientation (respectively, LeadFirm vs. ProteinsInstitute; LeadFirm vs. PigmentsCenter).

Table 4
Initial (Dis) similarities in the 'Plant Proteins' Alliance: Illustrative evidence.^a

		Similarities	Dissimilarities
Collaborative routines	Communication	LF and PI: High communication quality (transparency) If you want a made-to-measure suit you have to let the (research) center get into your processes (LFE) We give it all we got, all our expertise and technology (PIM)	LF: High communication quality (frequency) We prefer an ongoing follow-up of the project (LFM) PI: Relatively low communication frequency Periodical meetings are crucial... firms give us feedback on the results we have obtained (PIE)
	Joint work and decision making	LF and PI: Joint allocation of responsibilities (decision-making) ROs have to propose technological solutions and alternatives (LFM) Firms have to rely on us because we have the technical expertise they lack (PIE)	LF: Joint allocation of responsibilities (technical execution) We actively contribute with our technology and people (LFM) PI: Technical execution centralized at the RO Companies play a relatively passive role of in the technical phase of research projects (PIM)
	Task execution and flexibility	LF and PI: High task flexibility. Ad hoc changes. We do not let an opportunity go just because it is not in the project's description (LFM) Adjusting technical aspects of a project is not big deal...it does not make sense to keep something that does not work (PIE)	LF: Task execution based on industrial parameters We keep a close eye on production costs (LFE) PI: Task execution based on scientific parameters ...we usually work to get at least 90% of protein richness, the accepted standard for lab tests (PIE)
Collaborative orientation	Alliance rationale	LF and PI's purpose: Exploring technological opportunities with commercial value. ...plant proteins have enormous potential ... to deal with increasing production costs (LFM) ...reinforce the LF's competitive position (PIE) LF and PI's desired outcomes: Feasible technological solutions. Plant proteins for aquaculture nutrition products. ...technological solutions for industrial problems (LFE) ...tangible results, not only a report (PIM)	
	Reciprocal obligations	LF and PI: Low importance of the formal contract. It sets the general bases of the relationship. Our bonds (with external partners) always go beyond the contract (LFM) (a change in the project) was out of contract, but part of the project... we felt it was our obligation (PIE)	
	Alliance scope and horizon	LF and PI: Medium-term horizon. New products in the medium term. Inputs of subsequent exploitation projects. ...in a few years the market will be dominated by sustainable solutions...plant proteins could help to recover the overexploited fish stocks... LF wants to lead such a revolution (LFM, consortium meeting) ...next steps would be testing how the products behave in pilot plant and larger-scale levels (OIE)	

^a For the sake of brevity, we only provide examples of empirical evidence for some (dis)similarities. LF: LeadFirm; PI: ProteinsInstitute; LFE: LeadFirm Engineer; PIE: ProteinsInstitute Engineer; LFM: LeadFirm Manager; PIM: ProteinsInstitute Manager.

resource complementarities between the partners were extensive. By replacing animal proteins by plant proteins and artificial pigments by organic pigments, LeadFirm could improve the efficiency and ecological quality of its aquaculture nutrition products. At the same time, aquaculture nutrition was a new research field for both ProteinsInstitute and PigmentsCenter, whose activities had been confined so far to human nutrition. Therefore, in each alliance,

bringing together the expertise of both partners could significantly advance the firm's products and the ROs' research portfolios.

As Table 3 shows, our data also indicate that interpartner dissimilarities were initially present in both alliances. However, we identified differences in the nature of dissimilarities across the two cases, which turned out to be key in explaining their different evolution and success. Connecting our observations in the two

Table 5
Initial (Dis) similarities in the 'Organic Pigments' Alliance: Illustrative evidence.^a

		Similarities	Dissimilarities
Collaborative routines	Communication	LF and PC: High communication quality (transparency, frequency) We are very open with our research partners...Close contact with the RO is vital (LFM) Fluid communication and transparency are in the PC's DNA... We maintain weekly email or phone contact (PCE)	LF: Low communication formalization We prefer meetings without ceremonies... I just take some notes for my records (LFM) PC: High communication formalization ... quality certifications standards to provide objective proof that we strive for excellence (PC Website)
	Joint work and decision making	LF : Integrative organization of joint work: While you optimize that, we start testing this, and keep me updated so we can adjust the formulae program (LFE) PC: Integrative/sequential organization of joint work Some projects require more coordination (integration) ... If needed, we take off the lab coat to put the firm's uniform on (PCE)	LF: Joint allocation responsibilities (decision-making) If we could make all the decisions, we would not pay the services of the research center (LFM) PC: Decision-making centralized at the firm The firm decides (PCM)
	Task execution and flexibility		LF: High task flexibility. Ad hoc changes. A lot of things might lead to changes (like) a drastic increase in the raw material's price... or simply incompatibilities between ingredients (LFE) PC: Relatively low task flexibility Minor changes are automatically implemented... major changes might require renegotiation (PCM)
Collaborative orientation	Alliance rationale		LF's desired outcomes: Coming up with feasible technological solutions ...something tangible that we can actually use (LFE) PC's desired outcomes. Mapping out alternate (un)feasible technological solutions We did not expect any result in particular (PCM)
	Reciprocal obligations	LF and PC: Partners' inputs LF contributes industrial knowledge (aquaculture nutrition); PC contributes scientific knowledge (organic pigments)	LF: Low importance of the formal contract. It sets the general bases of the relationship. ...a contract is not a straitjacket (LFM) PC: High importance of the formal contract. It sets obligations /commitmentsthe volition of the parties...what we undertake to carry out (PCM)
	Alliance scope and horizon		LF: Broad alliance scope. Explorative phase (pigments' identification- analysis) followed by a transition-to-exploitation phase (pigments' selection-optimization). (To) confirm what works best and how to make it as efficient as possible(LFE) PC: Narrow alliance scope. Explorative activities (identification- analysis of natural pigments) ... exploring a disruptive technology [in aquaculture nutrition]... a new territory (PCM)

^a For the sake of brevity, we provide examples of empirical evidence only for some (dis)similarities. LF: LeadFirm; PC: PigmentsCenter; LFE: LeadFirm Engineer; PCE: PigmentsCenter Engineer; LFM: LeadFirm Manager; PCM: PigmentsCenter Manager.

IU alliances to extant research, we arrived at a fine-grained conceptualization of routine-based dissimilarities and orientation-based dissimilarities. On the one hand, we argue that routine-based dissimilarities comprise partners' behavioral differences in terms of (i) communication (e.g. [Lane and Lubatkin, 1998](#)), (ii) joint work and decision making (e.g. [Mohr and Spekman, 1994](#)), and (iii) execution and flexibility of alliance tasks (e.g. [Lavie et al., 2012](#)). On the other hand, we argue that orientation-based dissimilarities com-

prise partners' divergent ideas about (i) the alliance rationale (e.g. [Das and Teng, 2000](#)), (ii) their reciprocal obligations (e.g. [Ring and Van de Ven, 1994](#)), and (iii) the horizon and scope of their collaboration (e.g. [Das and Teng, 2000](#); [Oxley and Sampson, 2004](#)). Analyzing the cases, we observed that the 'Plant Proteins' alliance only encompassed routine-based dissimilarities, whereas both routine-based and orientation-based dissimilarities were present in the 'Organic Pigments' alliance. Below, we provide a detailed description of

these dissimilarities and their role in the different stages of each studied alliance.

4.2. The 'Plant Proteins' alliance: when only routine-based dissimilarities are present

Analyzing our data, we observed that only routine-based dissimilarities were initially present in the 'Plant Proteins' alliance (see Table 4). In particular, the partners differed in (i) how they communicated (communication quality: high vs. low frequency), (ii) how they organized the work in the alliance (e.g. allocation of responsibilities: joint vs. centralized technical execution), and (iii) the criteria they relied on to execute and evaluate alliance tasks (e.g. task execution: industrial vs. scientific criteria).

For instance, ProteinsInstitute researchers were used to first conduct lab experiments and subsequently report the results to the partnering firm to get feedback on their validity. In contrast, LeadFirm people were used to being actively involved in all phases of the project and to providing continuous feedback to guarantee that tests meet industrial criteria from the very beginning. At the same time, however, orientation-based dissimilarities were absent. A shared vision on key alliance aspects (i.e. alliance rationale, reciprocal obligations, alliance scope and horizon) existed from the beginning. For example, both LeadFirm and ProteinsInstitute informants stressed that the outcome of their collaboration should be commercially exploitable by LeadFirm.

4.2.1. Start-up stage (January 2008–December 2008)

In January 2008, the 'Plant Proteins' alliance became operational. Immediately, the partners engaged in extensive information sharing. Perceiving substantial opportunities to combine their resources, the partners scheduled visits to their respective facilities (March and June 2008) to mutually learn about their technologies and processes. Interviewees noticed how, during these initial months, the partners' enthusiasm about the project further increased:

"The technological capabilities of ProteinsInstitute were even stronger than expected... we realized that this project could bring important results" (LeadFirm Manager)

In the first technological meeting (March 2008), ProteinsInstitute explained to LeadFirm that initial tests had triggered unexpected problems, illuminating the need to change the initial objectives of the project. Informants indicated that both partners attributed these problems to the risk inherent in R&D projects. At this stage, partners did not explicitly point to their routine-based dissimilarities as a hampering factor. Instead, they remained convinced of the potential of their collaboration. LeadFirm stressed that ProteinsInstitute had achieved "meaningful results in a short period of time" (LeadFirm Manager) and thus agreed to adjust the project.

4.2.2. Execution stage (December 2008–December 2009)

In December 2008, when the firm and the RO met to discuss the achievements of the first year of their collaboration, first coordination problems emerged. ProteinsInstitute researchers were very satisfied with the achievements as they exceeded scientific quality expectations. In contrast, LeadFirm people were seriously concerned about their lack of industrial viability. In addition, LeadFirm informants complained that ProteinsInstitute researchers tended to work autonomously in the lab without providing sufficient feedback. In this way, ProteinsInstitute had overlooked important industrial parameters:

"At the beginning, they worked a lot on their own... they made significant progress but without considering our indus-

trial processes... when they showed us the results we had to tell them 'this is not viable for us' " (LeadFirm Manager)

To address these problems, LeadFirm people explained that the ProteinsInstitute team needed to pay more attention to the cost aspect and to provide continuous feedback. ProteinsInstitute informants emphasized that despite being used to work with firms in a different way, they were strongly motivated to implement these adjustments. ProteinsInstitute informants stressed that, because of these conversations with LeadFirm, they realized that (i) the firm was really committed to bringing the project results to life (which was not always the case with firms), and (ii) LeadFirm's advice would actually improve the product development process:

"A protein level lower than 90% used to mean failure for us but LeadFirm people explained to us that even a 75–80% level exceeds common industrial standards... We started realizing that 90% was ideal for the lab but too costly for business" (ProteinsInstitute Engineer)

Interviewees further indicated that this adjustment process was not dramatic. Partners just "realized together that something was wrong and [we] just proceeded to solve it" (ProteinsInstitute Manager) to fulfill the objectives of the alliance (i.e. develop commercially exploitable results). ProteinsInstitute henceforth started interacting more frequently with LeadFirm and started paying close attention to costs, which was highly appreciated by LeadFirm:

"[ProteinsInstitute] listened to us and quickly reacted... they realized we needed to discuss industrial parameters... it is quite simple: we cannot afford to play with materials that our clients cannot afford... When teamwork intensified, we started achieving interesting results" (LeadFirm Engineer)

Making substantial progress in the project, both partners sensed a reciprocal focus on mutual benefits. In addition, interviewees stressed that "a wide range of unexpected technological opportunities had opened up" (LeadFirm Manager). In March 2009, ProteinsInstitute and LeadFirm agreed to introduce new experiments that transcended the initial scope of the contract. As these new experiments required even closer coordination, new adjustments were made to their collaborative working approach. The firm and the RO complemented their weekly email communication with (i) a 'red phone' between LeadFirm and ProteinsInstitute engineers to swiftly address unanticipated problems, and (ii) more frequent face-to-face meetings. Hence, routine-based dissimilarities were mitigated.

4.2.3. Termination stage (December 2009–December 2010)

When the project entered its final year, coordination or cooperation problems were absent, which allowed realizing important results. The partners had learnt how to work together effectively. Interviewees also emphasized the emergence of "a nice symbiosis" (ProteinsInstitute Engineer) between the partners:

"We have learnt a lot about proteins... [ProteinsInstitute researchers] have learnt about fish nutrition" (LeadFirm Engineer)

In February 2010, the partners decided to co-patent their accomplishments. In November 2010, one month before the official termination of the alliance, they also agreed on a one-year extension of the contract to jointly move toward commercialization and thus to comply with their "mutual obligations" (ProteinsInstitute Engineer). In June 2011, the partners negotiated new collaborative projects, turning ProteinsInstitute into a strategic partner of LeadFirm. Interviewees therefore consistently labelled this alliance as a big success in technological and relational terms.

4.3. 'Organic Pigments' alliance: when routine-based and orientation-based dissimilarities exist

Our data indicate that both routine-based and orientation-based dissimilarities were initially present in the 'Organic Pigments' alliance (see Table 5). In addition to differences in the partners' collaborative routines – which were similar to those identified in the 'Plant Proteins' case (e.g. task execution: industrial vs. scientific criteria) –, we identified important differences in their collaborative orientation. LeadFirm and PigmentsCenter had inherently different interpretations of (i) the alliance rationale (e.g. desired outcomes: feasible vs. feasible/unfeasible solutions), (ii) their reciprocal obligations (importance of formal contract: low vs. high), and (iii) the scope and horizon of their collaboration (e.g. alliance scope: broad vs. narrow). For instance, LeadFirm framed the 'Organic Pigments' alliance as a vehicle to increase the value of its commercial products. PigmentsCenter, however, framed its alliance with LeadFirm as a collaborative endeavor to explore new technological opportunities, irrespective of their commercial value. PigmentsCenter informants actually described it as a long-term, explorative research project, in which it was not possible to specify intended outcomes *ex ante*.

4.3.1. Start-up stage (January 2008–December 2008)

In January 2008, technical activities started off in the 'Organic Pigments' alliance. As in the 'Plant Proteins' case, technological complementarities stimulated knowledge exchange from the outset. For example, LeadFirm became really interested in an eco-friendly technology available at PigmentsCenter. PigmentsCenter researchers, in turn, were enthusiastic about applying their technology into aquaculture nutrition:

"It was the 'exciting phase'... the project was so promising that we were really motivated to invest in its development" (LeadFirm Manager)

Also in this case, unexpected technical problems arose. In a meeting held in July 2008, PigmentsCenter explained to LeadFirm that first technical attempts had failed. The LeadFirm's R&D Manager proposed to advance in parallel with other tasks, while the emerging problems were being fixed. PigmentsCenter accepted to change the initial sequence of activities. Shortly after, the researchers informed the firm that the new experiments had also failed, arguing "emerging needs of knowledge" (PigmentsCenter Engineer). To provide all relevant information to PigmentsCenter, LeadFirm invited the research team to visit its production facilities. Both LeadFirm and PigmentsCenter informants emphasized that they attributed these problems to the complexity of the research initiation phase, and not to the collaboration itself. As in the previous case, partners did not consider their dissimilarities as a hampering factor at this initial stage. Despite the emergence of technological problems, both partners remained highly enthusiastic:

"We were not worried about first failed experiments; it takes a while to stabilize any research process" (LeadFirm Engineer)

4.3.2. Execution stage (December 2008–December 2009)

As in the 'Plant Proteins' case, the first coordination problems arose after approximately one year in the 'Organic Pigments' alliance. In December 2008, PigmentsCenter codified the experiments and results of the first year in a technical report. Reading this report, LeadFirm people became skeptical regarding PigmentsCenter's accomplishments. Objections to the working and communication style of PigmentsCenter emerged. LeadFirm criticized that PigmentsCenter overemphasized scientific aspects, neglecting key industrial factors:

"They elaborated too much on the scientific issues... we instead sought indications of viability as soon as possible" (LeadFirm Manager)

Partners met in January 2009 to address existing problems. The LeadFirm's R&D Manager emphasized that the project had to be reoriented to fit the firm's industrial problems, suggesting task-related and other operational adjustments. He also proposed to concentrate on one particular research line, which he considered the only way to achieve results with commercial value:

"The report basically contained theoretical knowledge... we realized that we would waste our time and money unless we changed the course of the project" (LeadFirm Manager)

PigmentsCenter accepted to reframe the project. PigmentsCenter informants indicated, however, that the necessity of these changes was far from obvious for them. They believed that experiments had yielded promising indications:

"Some changes in the initial spirit of the project maybe were not essential... [LeadFirm] decided to stop some experiments arguing lack of viability, even before obtaining results" (PigmentsCenter Manager)

Sequential adjustments took place between January and December 2009. Technical efforts, however, remained unsuccessful. Moreover, an in-depth discussion of the partners' different expectations and goals remained absent. Gradually, cooperation problems emerged and escalated. LeadFirm people started complaining about PigmentsCenter's "lack of effort and commitment" (LeadFirm Manager). In contrast, PigmentsCenter informants stressed the huge efforts they had put into the project, the scientific rigor of the experiments, and the relevance of the results:

"In long-term research projects it is not all 'a bed of roses'... failure can be viewed as success: it allows firms to rule out unviable trajectories" (PigmentsCenter Engineer)

Surprisingly, these extreme tensions did not reduce interaction between the partners. LeadFirm informants attributed such intensive interaction to the enormous difficulties during the "the failed re-planning phase", making an analogy with "seeing how a ship is sinking and desperately trying to refloat it" (LeadFirm Manager). In addition, they pointed out that the meetings became tense, which reaffirmed the lack of understanding between the partners. In contrast, PigmentsCenter informants emphasized that intensive interaction with the firm was a sign of mutual understanding, acknowledging normal difficulties in R&D projects. They also described technological meetings with LeadFirm as still being constructive:

"We exchanged some tense emails and interaction became awkward... like if we were speaking Chinese and they Swedish!" (LeadFirm Engineer)

"Working with industrial partners is never easy [but] we did not perceive the presence of a crisis that we needed to resolve" (PigmentsCenter Manager)

4.3.3. Termination stage (December 2009–December 2010)

Strong coordination and cooperation problems remained present when the last year of the alliance started. In the last meeting (January 2010), the researchers stressed the relevance of the results. In contrast, LeadFirm stressed their lack of commercial value. Henceforth, interactions were restricted to "occasional emails and phone calls, just to fulfill administrative obligations" (LeadFirm Manager).

LeadFirm interviewees described the last year of the 'Organic Pigments' alliance as the "disappointment phase" (LeadFirm Man-

ager), where conflicts with PigmentsCenter had destroyed their confidence in the project. LeadFirm did not want to invest additional effort in this alliance. PigmentsCenter informants framed the firm's reaction as a deviation of managerial attention towards other projects that could provide returns in a shorter period:

“... it seemed that the interests of LeadFirm shifted from technical to economic issues. ... they gave priority to other projects that could yield results faster” (PigmentsCenter Manager)

As contractually stipulated, the ‘Organic Pigments’ alliance terminated in December 2010. Comparing the initial contract with information presented in consortium meetings (July 2010 and October 2011), it was clear that the partners had failed to meet the initial alliance objectives. Interviewees, however, offered conflicting assessments. According to PigmentsCenter informants, the realized scientific results could trigger new joint projects. According to LeadFirm interviewees, however, the irrelevance of the outcomes annulled any chance of future collaboration:

“Research institutions must provide technological solutions for firms’ real needs. ... future collaboration [with PigmentsCenter] is not probable” (LeadFirm Manager)

5. Discussion

In this section, we systematically discuss the findings of our comparative case study (see Fig. 1). We present specific propositions on the impact of interpartner dissimilarities on collaborative processes and outcomes at different stages of the alliance lifecycle.

5.1. Starting the collaboration: complementarities and the honeymoon period in IU alliances

In the first year of both studied IU alliances, we did not observe strong coordination and cooperation problems. Moreover, in contrast to what previous studies suggest (Parkhe, 1991; Doz, 1996), our interviewees did not refer to interpartner dissimilarities as a hampering factor in starting-up the collaboration. The start-up stage of both alliances can be described as a honeymoon period (Fichman and Levinthal, 1991), characterized by extensive partners’ transparency (Mohr and Spekman, 1994), flexibility (Faems et al., 2008), and attribution of unexpected problems to exogenous factors instead of blaming each other (Ariño and Doz, 2000). However, we need to remark that our data indicate that dissimilarities indeed existed at the start-up stage of both cases (i.e. routine-based dissimilarities in the ‘Plant Proteins’ alliance; routine-based and orientation-based dissimilarities in the ‘Organic Pigments’ alliance). Yet, our analysis suggests that, during the honeymoon period, such dissimilarities remained in a state of latency – i.e. objectively present in the alliance, but unperceived by the partners (Lavie et al., 2012).

Our data suggest that such a honeymoon period can be attributed to the high resource complementarities between the focal firm and the two ROs. We point to two mechanisms that can explain why high complementarities caused dissimilarities to remain latent: attribution bias and attention focus. First, the partners, excited by their strong technological complementarities, underestimated the possibility of having different collaborative routines or orientation. This evidence resembles the notion of ‘false consensus effect’ (Ross et al., 1977), which is an attribution bias by which individuals in a state of excitement overestimate the degree to which others share their behaviors and beliefs. Second, the partners fully focused their attention on starting up those activities required to exploit their complementarities (e.g. intensive knowledge exchange), which constrained the attention they allocated to explore whether their routines and orientation were actually

aligned. In other words, the extensive initial resource complementarities functioned as an ‘attention structure’ (Ocasio, 1997), shifting the partners’ focus of attention away from their dissimilarities. In sum, our findings suggest that high initial resource complementarities between firms and ROs are likely to trigger attribution biases and monopolize partners’ attention, limiting their ability to explicitly recognize their dissimilarities at the beginning of IU alliances:

Proposition 1. *At the start-up stage of IU alliances, high resource complementarities between the partners increase the likelihood of a honeymoon period, during which interpartner dissimilarities are likely to remain latent.*

5.2. Connections between routine-based and orientation-based dissimilarities

Over time, alliance partners gain more information about each other and become more able to critically assess their relationship (Ring and Van de Ven, 1994; Doz, 1996). In line with these insights, the honeymoon period phased out in the observed alliances after the first year. In both cases, the first coordination problems emerged at the initiation of the execution stage. LeadFirm became frustrated by the lack of progress in achieving results that could be viable for industrialization, explicitly pointing to routine-based dissimilarities as the cause of these problems. In particular, the firm complained that the collaborative working styles of the two ROs had resulted in coordination problems (e.g. ineffective communication and sequencing of joint work), explaining the absence of successful intermediate outcomes. In both IU alliances, routine-based dissimilarities thus became manifest – i.e. perceived by the partners (Lavie et al., 2012).

Existing alliance literature suggests that, to deal with routine-based dissimilarities and achieve effective coordination, alliance partners should engage in coordination efforts – i.e. explicit actions to adjust partners’ activities to achieve jointly determined goals (Gulati et al., 2012). In both our cases, the firm and the RO indeed undertook explicit coordination efforts in the form of intensive interaction to address the problems at hand. However, the impact of such coordination efforts turned out to be different across the cases. The nature of interpartner dissimilarities seems to be key in explaining these differences.

In the ‘Plant Proteins’ alliance, intensive interaction between the partners triggered recognition of their conflicting collaborative routines and fostered the necessary adjustments. Based on a shared interpretation of their collaboration, both partners eventually evaluated intermediate outcomes and framed existing problems in a similar way. LeadFirm and ProteinsInstitute both perceived a mismatch between what they interpreted ‘what was their alliance for’ (i.e. results with commercial value) and the actual outcomes of their collaborative efforts, which encouraged them to undertake the necessary adjustments. ProteinsInstitute realized that providing more frequent feedback to the firm and orienting experiments to industrial realities were *sine qua non* conditions to achieve results with commercial value. Once ProteinsInstitute repaired some aspects of its collaborative routines to meet expected outcomes, routine-based dissimilarities gradually reduced. In addition, LeadFirm and ProteinsInstitute smoothly implemented a second wave of adjustments to seize some emerging opportunities.

In contrast, in the ‘Organic Pigments’ alliance, intensive interaction between the partners did not mitigate their routine-based dissimilarities. Each partner evaluated intermediate outcomes and framed existing problems in a different way, according to their divergent orientations with the alliance. LeadFirm and PigmentsCenter, relying on different interpretations of ‘what was their alliance for’, came up with conflicting assessments of the status of

Fig. 1. A comparison of the role of interpartner-dissimilarities in the 'Plant Proteins' and 'Organic Pigments' alliances.

their collaboration. LeadFirm perceived a clear gap between actual and desired outcomes, whereas PigmentsCenter did not. LeadFirm envisaged the urgent necessity of repairing PigmentsCenter's collaborative routines to bridge such a gap and attain results with commercial value, whereas PigmentsCenter did not. For PigmentsCenter, such adjustments were not essential in order to provide the firm with interesting exploratory results. Although PigmentsCenter implemented some changes proposed by LeadFirm, interviewees at PigmentsCenter explained these actions as efforts to please the customer rather than refocusing actions to attain results with commercial value.

In sum, the 'Plant Proteins' alliance illustrates that, in the absence of orientation-based dissimilarities, coordination efforts between firms and ROs are likely to result in joint sensemaking on problems – i.e. joint attribution of problems and definition of solutions (Doz, 1996; Faems et al., 2008). In turn, such joint sensemaking increases the ability of firms and ROs to reconcile differences in their collaborative routines. In contrast, the 'Organic Pigments' case shows that, when the first coordination problems emerge, orientation-based dissimilarities are likely to impede firms and ROs to engage in joint sensemaking, limiting their ability to cope with routine-based dissimilarities:

Proposition 2a. *In the execution stage of IU alliances, coordination efforts between the partners are likely to mitigate their routine-based dissimilarities if orientation-based dissimilarities are absent.*

Proposition 2b. *In the execution stage of IU alliances, coordination efforts between the partners are likely to reaffirm their routine-based dissimilarities if orientation-based dissimilarities are present.*

5.3. Implications for collaborative processes and outcomes

In the 'Plant Proteins' alliance, partners had managed to attenuate their routine-based dissimilarities during the execution stage. As a result, they were able to coordinate effectively and started achieving promising technological results, intensifying the spirit of cooperation in the relationship. Interviewees emphasized strong feelings of reciprocity (Ring and Van de Ven, 1994).

In contrast, the 'Organic Pigments' alliance was still affected by routine-based dissimilarities and coordination issues at the end of the execution stage. Furthermore, LeadFirm and PigmentsCenter had focused on solving those problems, while their orientation-based dissimilarities still remained latent. In this context, the partners ended up immersed in a spiral of coordination and cooperation problems. LeadFirm increasingly questioned the commitment of PigmentsCenter, emphasizing that coordination remained ineffective because PigmentsCenter had not put in enough effort. Our data instead suggest that LeadFirm, by misperceiving differences in their orientations, misinterpreted PigmentsCenter's behavior as non-cooperative, engaging into an 'attribution error' (Ross et al., 1977). Also, time was running out (i.e. after two years, experiments remained unsuccessful). As suggested by Doz (1996), under such pressure, the LeadFirm people did not consider alternative explanations; their negative perceptions escalated, eventually concluding that PigmentsCenter had reneged on its reciprocity obligations.

As suggested by extant alliance research, these inherently different developmental processes led to opposite endings (Ring and Van de Ven, 1994; Doz, 1996; Gulati et al., 2012). In the 'Plant Proteins' alliance, interpartner learning resulted in effective coordination

and cooperation, which contributed to positive alliance outcomes on both technological and relational levels, motivating partners to continue and strengthen their relationship. In contrast, the salient coordination and cooperation problems in the 'Organic Pigments' alliance resulted in poor technological and relational outcomes. LeadFirm decided to stop collaborating with PigmentsCenter when their contract expired. These observations illustrate how different configurations of dissimilarities impact cooperation and coordination in different ways, leading to different outcomes in IU alliances (Parkhe, 1991). In this regard, they also support Gulati et al.'s (2012) arguments that the positive and negative reinforcing links between coordination and cooperation are crucial for alliance performance:

Proposition 3a. *If the partners have managed to mitigate their routine-based dissimilarities (and do not possess orientation-based dissimilarities), coordination and cooperation are likely to be effective, increasing the likelihood of favorable technological and relational outcomes in the termination stage of IU alliances.*

Proposition 3b. *If the partners have not managed to mitigate their routine-based dissimilarities (and their orientation-based dissimilarities remain latent), coordination and cooperation are likely to be ineffective, increasing the likelihood of unfavorable technological and relational outcomes in the termination stage of IU alliances.*

6. Concluding remarks

6.1. Implications for research

Our comparative case study contributes to a richer theoretical understanding of interpartner dissimilarities in IU alliances in two fundamental ways. First, we provide a more integrative view of interpartner dissimilarities in IU alliances. We examine and operationalize different types of interpartner dissimilarities (i.e. routine-based and orientation-based dissimilarities), disentangling their joint implications for collaborative processes and outcomes. Whereas prior research (e.g. Sarkar et al., 2001; Lavie et al., 2012) mainly looked at the independent effects of different types of dissimilarities, our findings strongly suggest that the joint presence of routine-based and orientation-based dissimilarities can lead to detrimental interactions, negatively impacting IU alliances. Orientation-based dissimilarities are likely to frustrate partners' joint sensemaking efforts, hampering their ability to solve routine-based dissimilarities. Firms and ROs' sustained inability to adjust their routine-based differences in turn triggers misattribution of each other's behaviors (Ross et al., 1977). In this way, the joint presence of both types of dissimilarities is likely to disrupt coordination and cooperation in IU alliances, which negatively impacts the relational quality between firms and ROs' and their ability to realize their complementarities. In contrast, in the absence of orientation-based dissimilarities, firms and ROs seem to be more able to attenuate their routine-based dissimilarities through fruitful joint sensemaking, which in turn facilitates coordination and cooperation, increasing the likelihood of successful outcomes in IU alliances.

Second, we contribute to a more dynamic view of interpartner dissimilarities in IU alliances. In contrast to prior research (e.g. Fey and Beamish, 1991; Lavie et al., 2012), we conducted a longitudinal analysis of how dissimilarities evolved across different phases of the alliance lifecycle. Both cases indicate that, in the start-up stage of IU alliances, extensive complementarities between firms and ROs might trigger a honeymoon period (Fichman and Levinthal, 1991), during which coordination and cooperation problems are likely to remain absent. When this honeymoon period phases out, interpartner dissimilarities are likely to play a more prominent role in IU alliances. In the execution stage of both studied alliances, the emergence of coordination problems made routine-based dissimilarities

more salient. Subsequently, the connections between both dissimilarity dimensions triggered specific patterns of coordination and cooperation, which impacted actions and outcomes in the termination stage of both IU alliances (e.g. whether partners' strengthened their collaboration). Overall, these findings show that the role of dissimilarities is likely to change as collaboration between firms and ROs shifts from the initial start-up stage to more mature stages of IU alliances.

6.2. Implications for practice

Our study also yields important recommendations for the management of IU alliances. Although complementarities were initially very high in both cases, the 'Plant Proteins' alliance succeeded, while the 'Organic Pigments' alliance failed. Our data suggest that high initial complementarities are likely to trigger a honeymoon period where managers tend to ignore their dissimilarities. We recommend managers to be aware of the fact that, even when the project seems very promising, firms and ROs might possess orientation-based dissimilarities, implying divergent beliefs on key questions such as 'why we collaborate'. These subtle differences, if neglected, are likely to create substantial problems and frustrations, leading to failure. Therefore, partners in IU alliances should conduct an early diagnosis of their dissimilarities to timely learn *about* each other, determining their ability to learn *from* each other. Our study offers a granular description of both routine-based and orientation-based dissimilarities, identifying specific dimensions for each of them (see Table 2). In this way, we provide managers with a tool to map out specific differences with particular partners (e.g. degree of communication formalization, desired outcomes, etc.). This tool can help firms at the partner selection stage to choose a promising target. When complementarities justify selecting a particular RO, this tool can be useful at the alliance start-up stage to develop actionable measures to cope with the identified dissimilarities.

Our findings also have important implications for policy makers. At regional, national and international policy levels, the crucial role of IU collaboration to stimulate innovation is widely recognized. On a European level, for instance, the Horizon 2020 program stresses the value of intensive collaboration between firms and ROs to address key societal challenges. At the core of these policies lies the assumption that IU collaboration provides great opportunities to bring together complementary resources and thus generate solutions for societal innovation problems. Although IU collaboration definitely entails important opportunities, our study shows that interpartner dissimilarities can hinder such joint efforts. As our findings highlight, it is especially important to consider the presence of orientation-based dissimilarities when public funds are allocated to support collaborative efforts between firms and ROs. We therefore argue that coordinators, evaluators, and program managers of such funded collaborative projects should carefully evaluate the presence of specific orientation-based dissimilarities between partners and monitor their evolution over time. Our detailed description of dissimilarities (Table 2) can also be useful in this regard. In the setting of Horizon 2020 projects, for instance, consensus meetings are organized at the beginning of the project where the funding agency and the involved partners sit together to discuss the project's structure and planning. This type of meetings can be an excellent point in time to identify orientation-based dissimilarities between the partners (e.g. divergent views of alliance rationale) and develop an action plan if substantial differences are present.

6.3. Limitations and future research

Although our research design (i.e. two IU alliances in the same institutional context) enhanced internal validity, it also limits the analytical generalization of our findings. For instance, the partners in our cases had the same national background. Partner nationality, however, is an important additional source of interpartner dissimilarity (e.g. Fey and Beamish, 2001), which might exacerbate differences between firms and ROs. A promising avenue for future research could be studying interpartner dissimilarities in other settings such as cross-border IU alliances. Furthermore, due to the nature of our data, we focused on the absence/presence of dissimilarities, concluding that the joint presence of routine-based and orientation-based dissimilarities hinders processes and outcomes in IU alliances. However, dissimilarities might enable learning up to a certain threshold level (Parkhe, 1991). Future studies could investigate the extent of dissimilarities and its potential non-linear effects on IU alliance outcomes.

To solve orientation-based dissimilarities, partners have to undertake cooperation efforts-i.e. explicit actions to align their expectations and goals (Gulati et al., 2012). In the 'Organic Pigments' alliance, however, the partners did not undertake such efforts. A potential explanation could be that solving routine-based dissimilarities monopolized the partners' attention, limiting their ability to recognize and act upon their orientation-based dissimilarities (Ocasio, 1997). Since orientation-based dissimilarities were present in only one case, we could not explore this issue in depth.

Future studies could explore potential trade-offs in the allocation of partners' attention and their consequences for collaboration.

Finally, whereas we conducted an in-depth analysis of the nature, dynamics, and impact of interpartner dissimilarities in IU alliances, studying their antecedents was beyond the scope of this study. We therefore encourage scholars to explore why interpartner dissimilarities (or certain dissimilarity aspects) are more salient in some IU alliances than in others.

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Appendix A.

See Table A1

Table A1
Main sources of information.

		No. interviews
First phase (April 2008–October 2010)	Lead Firm informants	
	CEO	1
	Aquaculture Division Manager	1
	R&D Manager	5
	Other informants:	
	Project Manager at triggering entity of the consortium	2
	Members of scientific consortium committee	6
	Representatives of consortium firms	4
	Representatives of ROs ^a	5
	Total first phase: 24 general interviews, 19 informants	
Second and third phases (October 2010–May 2012)	Lead Firm Informants	
	R&D Manager ^b	4
	Head engineer Nutrition Area ^c	2
	ProteinsInstitute informants	
	Manager of Plant Proteins Group	1
	Head engineer Plant Proteins Group	1
	PigmentsCenter informants	
	Manager of Organic Pigments Group	1
	Head Engineer Organic Pigments Group	1
	Total second and third phases: 10 specific interviews, 6 informants 'Plant Proteins' alliance: 6 interviews, 4 informants 'Organic Pigments' alliance: 6 interviews, 4 informants	
	Total interviews:	34 interviews, 23 informants
Other sources		
Public documents (e.g. press releases, corporate reports)		
Private documents (consortium): Initial report, consortium agreement, minutes of meetings (4)		
Private documents (both alliances): Contracts, technical reports (5)		
Direct observations: Consortium meetings and committees (June 2009; July and October 2010; October 2011)		

^a Including one interview with the head engineer of Plant Proteins Group in ProteinsInstitute.

^b Including two exploratory interviews (data on both cases) and two semi-structured interviews (one per case).

^c She was responsible for both alliances. Upon her request, we conducted a double interview, structuring it into two separate parts (each devoted to one case and guided by an independent protocol).

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