

# **The impact of relational risks within multilateral R&D alliances**

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## **Abstract**

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This paper addresses the issue of R&D management practices within an interfirm setting. It attempts to fill the gap in management literature by advancing the contingency perspective. Instead of examining *ex-ante* determinant factors, this study investigates the impact, in a downstream level, of *ex-post* moderating factors on alliance performance. In addition, management practices need to be addressed differently when dealing with innovation. Based on a sample of multilateral R&D alliances, we design a R&D management practices model that may be implemented within an inter-organizational configuration. The practices studied have a significant positive impact on alliance performance. We infer based on our results that the relevance of these practices appears to be affected by *ex-post* relational risks. Accordingly, dependence and opportunism risks seem to strengthen or damp the benefits of R&D management practices. The implications of these findings are then discussed.

**Keywords:** Alliance, R&D, Management, Relational risk.

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# **The impact of relational risks within multilateral R&D alliances**

## **INTRODUCTION**

The growth of the knowledge economy have intensified interdependencies between firms. Due to the knowledge division, innovations can no longer be based only on company's internal capabilities. As a result, R&D alliances have become an important tool to stimulate innovation in a continual way. In this regard, management literature has traditionally focused on questions regarding the R&D management within organizations. With the significant growth of alliances, the question of interfirm management has received increasing scientific interest over the recent years. According to Chenhall and Moers (2015), opening the boundaries of R&D has implications for the design of management practices. In addition, Davila (2000) and Haustein and al. (2014) stress that management practices need to be addressed differently when dealing with innovation. In R&D alliances especially, the management faces particular issues and raises organizational tensions due to conflicting pressures between innovation needs and control requirements that need to be dealt with simultaneously.

This highlights the importance of considering management practices and control tools used by partners or stakeholder groups to support alliance goals. Dekker (2004) suggests translating to an interfirm setting the management control (MC) concept and defines it as the aim of the firm to ensure that partners behave and act in a way that achieves the predetermined outcomes. This raises the issue of considering the interfirm setting and examining inter-organizational control practices underpinning interfirm alliances. This seems to be more complex to address than it is in the intrafirm setting since the interfirm MC practices are a 'negotiated compromise' (Dekker, 2004). Furthermore, MC literature has mainly focused on the contingency perspective that examines, in an upstream level, environmental determinants influencing management practices choices (Otley, 1980; Fisher, 1995; Chenhall, 2003). This perspective assumes that effectiveness of management control practices are only affected by *ex-ante* contextual factors.

Instead of prior contingency studies, this paper attempts to address the gap in management literature by investigating the impact, in a downstream level, of *ex-post* moderating factors on alliance performance. Using the contingency reasoning, the effectiveness of management

practices depends on their fit with the alliance context. In this line, many authors have studied the impact of contextual factors such as business strategy, competition, uncertainty on performance (Miles et Snow, 1978; Khandwalla, 1972; Chenhall, 2003; Haustein et al, 2014). To complete this perspective, we consider *ex-post* moderating factors rather than *ex-ante* determinant factors. Thus, we examine the moderating effects of relational risks on alliance performance. According to the transaction cost theory, the partners need to select practices that best mitigate the transaction costs related to relational risks, especially dependence and opportunism (i.e., guileful self-interest seeking).

The aim of this research is to allow a better understanding of R&D management practices and how they can support innovation objectives and drive alliance performance. The empirical side of this paper deals with the case of multilateral alliances, especially R&D consortia. Unlike bilateral alliances, R&D consortia include a large number of partners and a broad variety of organizations which increases concerns about goal congruence, spillovers, ownership issues and exploitation choices. As a result, management within consortia seems to be more complex to address as the alliance is multilateral and the interests may diverge due to the heterogeneity of organizations the consortium involves.

The paper is divided in three parts. We present, first, the theoretical background and hypotheses. Then, the second part presents our research protocol and is followed, in the third part, by the presentation and discussion of our results.

## **1. THEORETICAL BACKGROUND AND HYPOTHESES**

R&D alliances appear as hybrid organizational forms situated in the middle of the market-hierarchy continuum. Given the autonomy of their members (Jones et al, 1997) and the lack of shareholders and conventional authority (Provan and Kenis, 2007), R&D management is needed to achieve the benefits of such collaborations. This allows firm to ensure that partners behave and act in a way that achieves the predetermined outcomes. To study how R&D is managed within multilateral alliances, we built a framework relying on alliance governance and management.

In R&D alliances, the management practices include two kinds of management practices: formal and informal (Smith et al., 1995). Formal practices are related to the transaction costs and organizational theories and refer to the economic and organizational controls that define the intentions and expectations of stakeholders groups, clarify responsibilities, distribute roles, coordinate tasks and provide guidelines for conflict resolution. For Ouchi (1979) and

Dekker (2004), they can be subdivided into two practices: outcome control and behavior control.

According to organizational theory, the outcome control allows partners to set goals, specify mutual expectations and assess the consortium's performance (Dekker, 2004; Das & Teng, 1998). The existence of a collaborative structure helps to formulate and align the partners' intentions and to coordinate their interdependent tasks and, thus, promotes joint actions and interest convergence between partners. A (collaborative) structure exists (between) within an organization(s) when there is a set of activities, tasks and roles that require a constant allocation of resources (Desreumaux, 1992; Donada and Nogatchewsky, 2008). Using the transaction costs reasoning, the behavior control ensures that partners' behaviors comply with the expected behavior to achieve the predetermined outcomes (Ouchi, 1980, Dekker, 2004). This leads partners to set up a common and formal arrangement, which delineates the rights and obligations of each member, specifies the rules, and defines procedures for dispute resolution and IP ownership.

Thus, formal management practices such as collaborative structures to control outcomes (Barratt, 2004, Dekker, 2004) and complex contracts to control behaviors (Poppo and Zenger, 2002, Wothus et al, 2005, Lee and Cavusgil, 2006, Simon, 2009) are an effective means to manage alliances. This formalization secures the relationship, protects the interests of stakeholder groups and, thus, acts as an incentive for collaboration which increase the commitment and investment of partners. Following Poppo and Zenger (2002), Dekker (2004), Brulhart and Favoreu (2006), Simon (2009) and Van der Meer-Kooistra and Scapens (2015), we posit a positive impact of outcome and behaviour controls on alliance performance.

- *H1a: Outcome control has a positive effect on alliance performance*
- *H1b: Behaviour control has a positive effect on alliance performance*

In addition to these requirements, R&D alliances need also informal devices to cope with environmental and technological uncertainty and allow adjustment and adaptation to changes. According to the relational theory, informal control includes mechanisms such as self-regulation (Ouchi, 1979), norms, values and institutions (MacNeil, 1980), social and cultural context. In line with Ouchi (op.cit) and Dekker (2004), we call this control a social control. Moreover, social based control allows the transfer of tacit outputs which are difficult to codify or transfer via the market (Maskell et al., 1999). Following MacNeil (1980), Ferguson et al., (2005), Brulhart and Favoreu, (2006) and Van der Meer-Kooistra and Scapens (2015), we posit that social control is likely to have a positive impact on alliance performance.

- *H1c: Social control has a positive effect on alliance performance*

Our design of management practices within R&D alliances relies on these three control practices. They are supposed to drive alliance performance by managing appropriation hazards, coordinating interdependent tasks and meeting adaptation and adjustment requirements. However, previous research consider differently their effectiveness and, thus, their impact on performance.

To study management practices effectiveness, the contingency perspective has mainly focused upon *ex-ante* determinants (Otley, 1980; Fisher, 1995; Chenhall, 2003). Studies using the contingency reasoning examine the performance effects of a combination of management practice and context such as business strategy (Miles et Snow, 1978; Khandwalla, 1972), environment uncertainty (Chenhall, 2003), external funds (Haustein et al, 2014), etc. The effectiveness of management practices depends on their “fit” with context. In this sense, managers need to select control devices that match the set of contingencies facing the alliance to maximize performance.

To complete this perspective, we consider *ex-post* moderating factors rather than *ex-ante* determinant factors. Especially, we examine the moderating effects of relational risks. According to the transaction cost theory, the partners select controls that best mitigate the transaction costs related to relational risks, especially dependence and opportunism (i.e., guileful self-interest seeking). Relying on the transaction economic theory, these risks are seen as a result of “lock-in” due to specificity of transactions or investments.

The dependence describes a situation when one or more partners are not easy or very costly replaceable. When this dependence is asymmetrical or non-mutual, it makes the alliance vulnerable to the “Exist option” risk, i.e., the less dependent partner leaves the co-operation (Hirshman, 1970). It may also destabilize the relationship and lead to alliance failure (Doz and Hamel, 1998; Soudi, 2012). The hazards associated with dependence need to be safeguarded by detailed formal contracts (Lush and Brown, 1996) to ensure that other non or less dependent parties will not defect during the co-operation (Williams, 1988). To ensure that partners execute their engagement as well as securing the relationship, the control needs to rely more on formal practices when dependence risk is present. According to Yan and Gray (1994) and Soudi (2012), the dependence may also destroyer the common social capital, making social control unnecessary or meaningless.

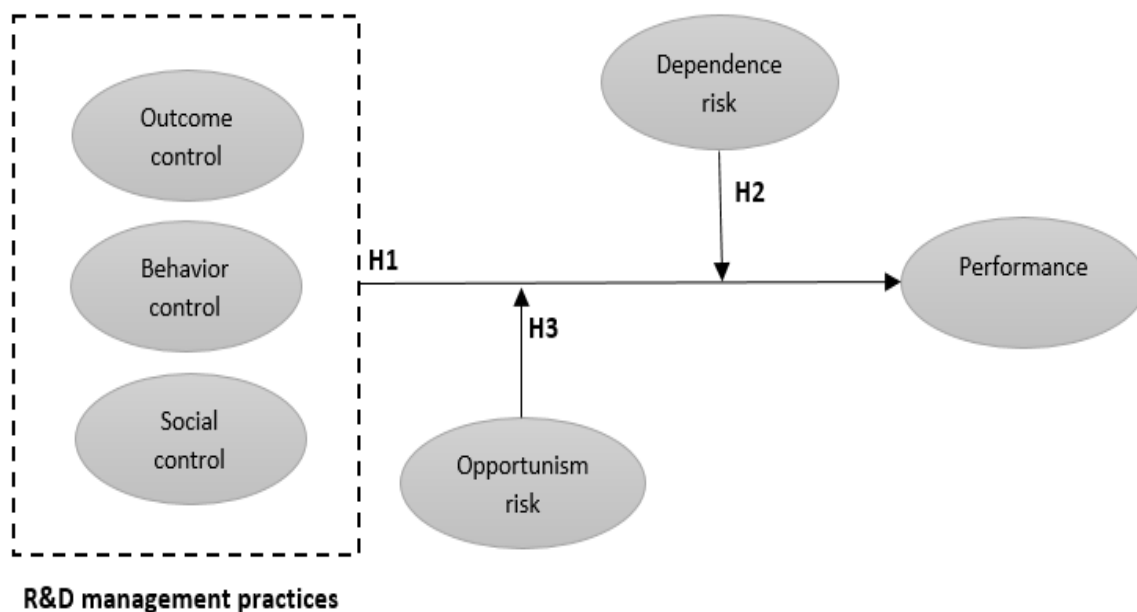
Based on this, the hypothesis 2 posits:

- *H2a: Dependence risk moderates positively the relationship between outcome control and alliance performance*
- *H2b: Dependence risk moderates positively the relationship between behavior control and alliance performance*
- *H2c: Dependence risk moderates negatively the relationship between social control and alliance performance*

Regarding the opportunistic behavior, it refers to the proclivity of exchange partners to engage in deceptive and self-serving behavior (John 1984; Hill 1990; Williamson 1985). The presence of opportunism risks leads partners to manage this risk by relying more on formal controls (Williamson, 1985; Poppo and Zenger 2002; Ding and al., 2013), i.e., setting up formal mechanisms like contracts and collaborative structures (Dekker, 2004). Fear of opportunism implies to put emphasis on formal and enforceable controls. However, this may damp the trust between the parties (Brousseau, 1989). Based on this, the hypothesis 3 posits:

- *H3a: Opportunism risk moderates positively the relationship between outcome control and alliance performance*
- *H3b: Opportunism risk moderates positively the relationship between behavior control and alliance performance*
- *H3c: Opportunism risk moderates negatively the relationship between social control and alliance performance*

Accordingly, the conceptual model of our study can be presented as in Figure 1.



**Fig1. Conceptual model**

## **2. RESEARCH METHOD**

The target sample for this study is R&D consortia as a form of multilateral alliances. The consortia studied here are sponsored by European framework programme for research and innovation. A consortium is an agreement between a minimum of three partners from three EU Member States to develop a R&D project funded by the European Commission or their respective governments. The study's sample comprises 232 firms involved in R&D consortia. Given that a consortium may include different categories of partners (institutions, universities, public bodies, research organizations, firms, etc.), we surveyed only private for-profit entities category.

To avoid the Common Method Biases (CMB), we followed some of Podsakoff et al's recommendations (2003, pp. 887–888). In order to obtain responses from different sources (Podsakoff et al, 2003), we surveyed multiple independent consortia and multiple participants within each consortium (consortium coordinators and partners).

To ensure ease of administration of the survey and for validation purposes, the questionnaire of the study was designed in two stages. In the first stage, the initial drafts of the questionnaire were based on the knowledge and measures gained from previous literature on the subject (Mothe, 1997, Dekker, 2004; Poppo and Zenger, 2002, Klein Woolthuis et al, 2005, Simon, 2009). In the second stage, a preliminary version of the questionnaire was submitted to experts to evaluate all questionnaire aspects: items, syntax, accuracy, clarity, etc. Then, adjustments were made drawing on their feedback and a new version was designed to be addressed to participants. The table below (1) presents all variables and measures adopted in this study.

Before studying the relations between constructs and to test for CMBs, it was necessary to conduct confirmatory factor analyses (CFA) to assess the overall reliability and validity of variables and measures. We then used the structural equation modeling for hypothesis testing.



**Table 1: Variables and measures**

Variable	Construct	Items	Measure
<b>Independent variables</b>	Outcome control (Desreumaux, 1992 ; Dekker, 2004 ; Donada and Nogatchewsky (2008))	-Existence of a dedicated collaborative structure within the firm partner (i.e., a function/department that manages all alliance-related activities)	Binary
	Behavior control (Poppo and Zenger, 2002 ; Dekker, 2004; Klein Woolthuis et al, 2005 ; Simon, 2009. Brulhart and Favoreu, 2006 ; Souidi, 2012)	-Degree of completeness of the alliance agreement -Degree of legal complexity of the alliance agreement (highly customized and required considerable legal work) -Degree of formalizing exchanges within the alliance -Degree of defining conflict resolution procedures	5 Points Likert scale
	Social control (Macneil, 1978 ; Poppo and Zenger, 2002 ; Dekker, 2004 ; Klein Woolthuis et al, 2005 ; Brulhart and Favoreu, 2006),	-Level of mutual trust between partners -Frequency of informal exchanges within the alliance	5 Points Likert scale
<b>Dependent variables</b>	Alliance performance (Poppo et al, 2002; Blanchot, 2006; Pekkola and Ukko, 2016; Paswan et al, 2017).	-Level of technological success -Level of alliance impact on firm business -Level of relationship quality within the alliance -Level of global partners' satisfaction	5 Points Likert scale
<b>Moderating variables</b>	Dependence risk (adapted from Mothe, 1997 ; Souidi, 2012)	-Level of partner's perception regarding the overall level of its investment in the alliance -Level of partner's perception regarding the importance of the R&D alliance to its innovation or technological strategy	5 Points Likert scale
	Opportunism risk (Chen and Chen, 2002; Poppo and Zenger 2002; Souidi, 2012)	-Level of partner's perception about the difficulty of anticipating the actions of other partners -Level of partner's perception about the risk of opportunistic behavior of other partners	5 Points Likert scale
<b>Control variables</b>	Size	The number of partners using five groups in the survey: very small (2–4 members), small (5–9), medium (10–19), large (20–29) and very large (+30) alliances	5 Points Likert scale
	Scope (adapted from Nooteboom et al., 2005)	Level of heterogeneity of the alliance. The alliance is heterogeneous when it includes a broad variety of members; industrials, institutional members, universities, start-ups, research firms, associations, etc.	5 Points Likert scale



### 3. RESULTS

#### 3.1 CONFIRMATORY TESTS

Before testing our hypotheses, we conducted the CFA (confirmatory factor analyses) to test the measurement model. For internal consistency, we measured the composite reliability (CR) and rho coefficient. The results in table 2 indicate that all the constructs show a good reliability as: rho and CR are all higher than 0.7 (Fornell and Larcker 1981).

We then conducted a test of construct validity, especially convergent and discriminant validity. Validity tests were assessed for each construct by computing the Average Variance Extracted (AVE). The results in Table 3 show that the AVE is higher than 0.5 and greater than the corresponding inter construct correlation, thus establishing respectively convergent and discriminant validity (Fornell and Larcker, 1981).

**Table 2: Construct Reliability**

	<b>rho_A</b>	<b>CR</b>
Behavior Ctrl	0.780	0.844
Dependence risk	0.835	0.894
Opportunism risk	0.893	0.870
Performance	0.861	0.872
Social Ctrl	0.857	0.880

**Table 3: Convergent and discriminant Validity**

	<b>AVE</b>	<b>Behavior Ctrl</b>	<b>Dependence risk</b>	<b>Opportunism risk</b>	<b>Performance</b>	<b>Social Ctrl</b>
Behavior Ctrl	0.578	<b>0.760</b>				
Dependence risk	0.808	0.183	<b>0.899</b>			
Opportunism risk	0.771	-0.009	0.096	<b>0.878</b>		
Performance	0.633	0.371	0.308	-0.220	<b>0.796</b>	
Social Ctrl	0.787	0.302	0.161	-0.298	0.438	<b>0.887</b>

*Note: Factor correlation matrix with the square root of AVE on the diagonal*

We tested also for possible multicollinearity by estimating the variance inflation factor (VIF) in line with Kock (2015). For this author, *"the occurrence of a VIF greater than 3.3 is proposed as an indication of pathological collinearity, and also as an indication that a model may be contaminated by common method bias. Therefore, if all VIFs resulting from a full collinearity test are equal to or lower than 3.3, the model can be considered free of common method bias."* (2015, p.7). We find a VIF of 1.38 indicating low correlation among independent variables.

### 3.2 HYPOTHESIS TESTING

With regard to the management practices, our findings seem to support the assumption that the three control practices enhance the alliance performance. As shown in the table 4, the path-coefficients ( $>0.1$ ) and the explained variance  $R^2$  ( $> 0.2$ ) are all statistically significant (Chin, 1998). The outcome control through the implementation of a collaborative structure seems to improve the performance of the alliance as predicted in the sub-hypothesis H1a. Similarly, behavior control has a positive effect on performance which is highly significant and, thus, confirms the sub-hypothesis H1b. As supposed in the sub-hypothesis H1c, the social control has also a positive impact on alliance performance which is statistically very significant.

**Table 4: Regression Estimates<sup>1</sup>**

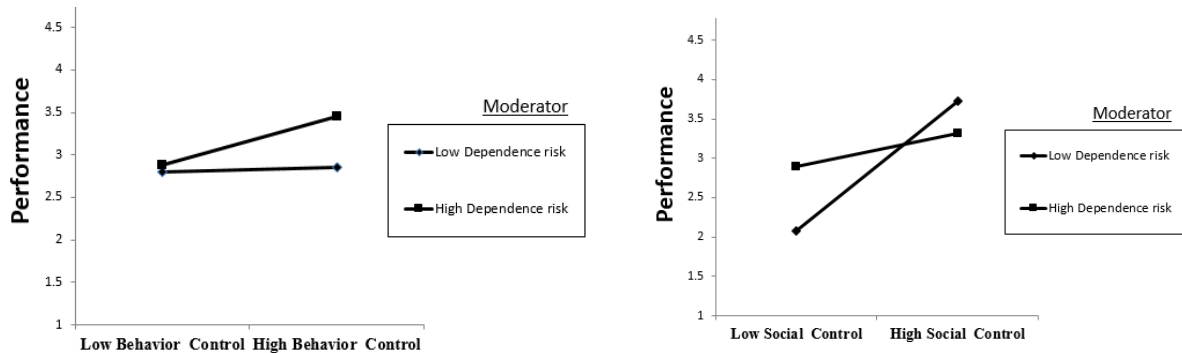
Variables	SEM	
	B	P
Outcome Ctrl -> Perf	0.139	**
Behavior Ctrl -> Perf	0.185	***
Social Ctrl -> Perf	0.581	***
Size -> Perf	0.002	n.s
Scope -> Perf	-0.091	n.s
<b>R<sup>2</sup></b>	<b>0.469</b>	

One-tailed test: \*  $p < .10$ ; \*\*  $p < .05$ ; \*\*\*  $p < .01$ . n.s: not significant

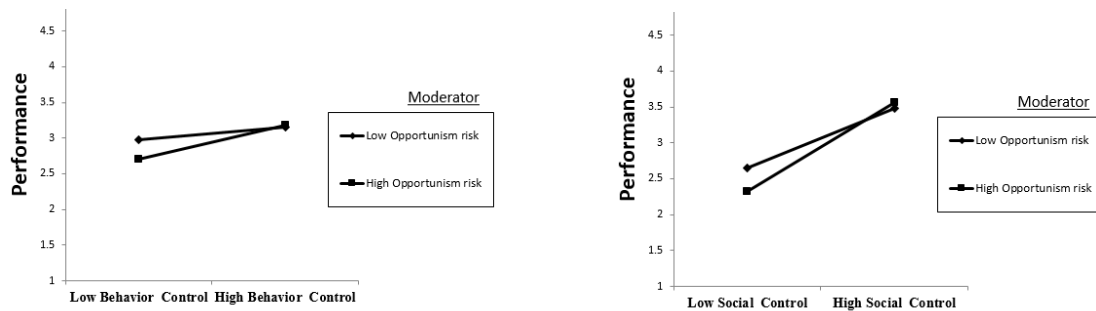
Regarding the hypotheses 2 and 3, we conducted a moderating effect test to examine whether each relational risk moderated the impact of each management practice on alliance performance. Our findings reveal that dependence risk strengthens the relationship only between the behavior control and performance (0.128;  $p < 0.10$ ), while it damps the relationship between social control and performance (-0.105;  $p < 0.10$ ). This seems to confirm the sub-hypotheses H2b and H2c (R-value=.504, cf. Fig. 2).

Regarding the opportunism risk, it seems to moderate positively both behavior (0.103;  $p < 0.10$ ) and social controls (0.100;  $p < 0.10$ ). This confirms only the sub-hypothesis H3b (R-value=.512, cf. table Fig. 3).

<sup>1</sup> We did not report regression estimates relating control and independent variables.



**Fig2. Moderating effect of dependence risk<sup>2</sup>**



**Fig3. Moderating effect of opportunism risk<sup>3</sup>**

#### 4. DISCUSSION

The research results are discussed as follows. First, our results are consistent with previous research findings regarding the purpose of management practice and their impact on performance (Ouchi, 1979; Dekker, 2004; Bedford et al, 2016). As discussed by transaction costs and organizational theories, the choice of formal practices aims to reduce the appropriation concerns and to meet the coordination requirements. The results support also the social theory by emphasizing the role of social and relational norms to meet the adjustment and adaptation requirements. In this context, parties will likely share information in a more timely manner, learn from each other more accurately and jointly solve problems and contingencies in a mutually advantageous way (MacNeil, 1987; Ouchi, 1979). Social considerations like reputation and the will to keep a friendly relationship since the one might need the partner again - the shadow of the future - may make it undesirable to enforce contracts.

<sup>2</sup> We used non-standardized coefficients.

<sup>3</sup> Idem.

Second, contextual variables may act as moderating factors which affect the MC effectiveness in line with the contingency based perspective. The perception of relational risks appears to impact the benefits of MC practices. Regarding the dependence, our findings indicate that detailed contracts are needed when the dependence risk is high. This supports previous research based on transaction costs theory. In R&D consortia, the dependence seems to be asymmetric since there are many partners and different status of partners (project leader, partner, subcontractor, etc.) within each consortium. Given this one-sided dependence, the dependent party lacks private ordering mechanisms like mutual dependence or hostages that could replace the contractual safeguards. In addition, one could expect that trust is needed to best mitigate such a risk. However, the finding does not support this claim. As concluded by Gray (1994) and Souidi (2012), the dependence may destroy the common social capital, making social control unnecessary or meaningless<sup>4</sup>.

Third, the finding shows that contract may be a suitable ordering mechanism to safeguard against opportunism. This seems to be consistent with transaction costs reasoning. However, the finding contradicts our hypothesis as well as the transaction costs theory as it claims that opportunism moderates positively the effect of social control on performance. This means that social control becomes more effective with opportunism risk presence. To address this question, a sociological explanation would be useful.

According to Nooteboom (1995), combining insights from economics and sociology, there are two dimensions related to the concept of opportunism. The first refers to “opportunities for opportunism” (i.e., opportunities to act against some-one’s interest in a way that he cannot control), while the second refers to “propensity towards opportunism” (i.e., the possibility of opportunistic conduct which is the opposite of trustworthiness). There is a propensity towards opportunism even when there are no opportunities to opportunism. This depends on the social context (trust, values, norms, ethics, etc.). The partner’s opportunities for opportunism can be reduced through contract mechanisms. However, to mitigate the partner’s propensity towards opportunism, there is a need to develop trust, build friendship and further joint ethics, norms or values (Nooteboom, 1995). This might explain why opportunism involves also an increase of social control. In sum, as supported by our findings, we might conclude that opportunism risk strengthens the effectiveness of both the behavior control to close opportunities for

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<sup>4</sup> One might also argue that dependence should be safeguarded by more protective control mechanisms like a joint-venture. This option is not possible in our case as the European consortia do not use the joint research facilities.

opportunism, and the social control to mitigate propensity towards opportunism which remains when all opportunities for opportunistic behavior are closed.

An alternative explanation also consists to take the consortium's life cycle into account. Thus, each stage of life cycle may induce a different opportunistic behavior. Using Usunier and Rudler's (2000) analysis on opportunistic behaviors along a transaction, opportunism can occur in the upstream and downstream phases of a cooperation. In the upstream phases, before the establishment of a consortium agreement, the partners need to negotiate and establish a consensus on the project formulation. This could induce some opportunistic behaviors like transferring risks to the other party or taking inspiration from the project to perform the same project alone or with another partner. After the consortium agreement, opportunism may concern partner's effective contribution to the project, the share of data or exploitation of property. In such contexts, trust makes it possible to act *ex-ante* on opportunistic behaviors during upstream stages of an alliance as it implies reciprocity. Then, the contracts will deal *ex-post* with the opportunism that could occur in the downstream stages. This may also explain why the presence of opportunism can increase both the value of contract and trust and, thus, improve their effects on performance.

## CONCLUSION

Our contribution aimed to address the issue of R&D management practices within multilateral alliances. Based on a sample of European R&D consortia, the findings highlight two main conclusions. First, a R&D management model can be implemented within an inter-firm setting, such a consortium, using three management practices: outcome control, behavior control and social control. These controls have a positive impact on the alliance performance. Second, we infer based on our findings that the relevance of these practices appears to be affected by *ex-post* relational risks in addition to *ex-ante* determinants studied in previous research.

This paper has some research implications. It contributes to management literature by combining two theoretical insights to address interfirm R&D management. It advances the management literature by translating to a multilateral and inter-organizational context R&D management practices mainly studied within intrafirm settings. It advances also the contingency perspective by taking into account *ex-post* moderating factors instead of *ex-ante* determinant factors traditionally used in previous research. Considering all of these factors, this perspective will contribute to provide a better understanding of R&D management practices design and effectiveness.

Despite some notable contributions, this work has some limitations which indicate future research avenues. Our results based on a sample of sponsored consortia we surveyed may not be generalized to other multilateral alliance framework, especially joint-ventures. In addition, future research could investigate on the drivers of trust and social controls.

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