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Connecting Interfirm and Intrafirm Collaboration in NPD Projects: Does Innovation Context Matter?

Stephanie C. Schleimer and Dries Faems

Interfirm collaboration is an important strategy for firms to generate new products and services. Whereas existing research emphasizes the importance of interfirm collaboration engagement to realize synergistic benefits in interfirm NPD projects, it remains surprisingly silent on the potential impact of intrafirm relational processes and how they can impact the interfirm setting. In this article, we therefore explore the impact of intrafirm collaboration engagement on the relationship between interfirm collaboration engagement and new product development (NPD) performance in interfirm NPD projects. Relying on insights from information processing theory, the authors hypothesize that intrafirm collaboration engagement increases firms' capacity to process complex information flows in the case of extensive interfirm collaboration engagement. Moreover, it is expected that the added value of extensive intrafirm collaboration engagement depends on the innovation objective (i.e., incremental versus radical new product development) of the interfirm NPD project. In particular, we hypothesize that the positive moderating impact of intrafirm collaboration engagement on the relationship between interfirm collaboration engagement and NPD performance is stronger for radical interfirm projects than incremental interfirm projects. Analyzing 195 interfirm NPD projects, a negative interaction effect between interfirm and intrafirm collaboration engagement is observed in radical interfirm NPD projects, whereas significant interactions between them remain absent in incremental interfirm NPD projects. Jointly, these findings provide first evidence that intrafirm relational processes can substantially impact partners' ability to realize relational rents in interfirm settings. Moreover, the negative interaction effect between interfirm and intrafirm collaboration engagement points to potential trade-offs between inward-looking and outward-looking absorptive capacity.

Practitioner Points

- Apart from interfirm collaboration engagement, it is also important to consider intrafirm collaboration engagement when engaging in interfirm NPD projects.
- In radical innovation projects, which are characterized by high interfirm collaboration engagement and high intrafirm collaboration engagement, managers are likely to expect problems and conflicts to emerge.
- Managers should realize that the added value of interfirm and intrafirm collaboration engagement is different for incremental and radical projects.

Introduction

The role of interfirm collaboration (i.e., collaboration between functional units of different firms) is widely recognized as vital for developing new

products and services (Faems, Van Looy, and Debackere, 2005; Gulati and Nickerson, 2008). Despite their widely touted benefits, the failure rates of interfirm new product development (NPD) projects are high, indicating that they entail both relational and performance risks (Gerwin, 2004; Gulati and Nickerson, 2008). Adopting a relational view on interfirm relationship, scholars (e.g., Agarwal, Croson, and Mahoney, 2010; Faems, Janssens, Madhok, and Van Looy, 2008; Hardy, Phillips, and Lawrence, 2003; Lawson, Petersen, Cousins, and Handfield, 2009; Mohr and Spekman, 1994) emphasize the positive impact of interfirm collaboration engagement (i.e., intensity of interaction between functional units of different firms) on partners' ability to come to synergistic combinations of their complementary resources and skills in interfirm NPD projects. However, they remain surprisingly silent on the potential impact of intrafirm collaborative activity on the performance of interfirm NPD projects (Hillebrand and Biemans, 2004; Schleimer and Schulman, 2011a).

Adopting insights from information processing theory (Daft and Lengel, 1986; Egelhoff, 1991; Tushman and Nadler, 1978), the authors expect that intrafirm

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collaboration engagement (i.e., intensity of interaction between functional units within the same firm) moderates the relationship between interfirm collaboration engagement and NPD performance (i.e., ability to meet the initial expectations of the product/process in development). In addition, it is anticipated that this moderating impact might be differential in different innovation settings (i.e., incremental versus radical settings). In particular, the authors posit that the moderating impact is stronger for radical interfirm NPD projects than incremental NPD projects due to differences in task variety and task analyzability across these settings.

To explore the impact of intrafirm collaboration engagement on the relationship between interfirm collaboration engagement and NPD performance in different kinds of interfirm NPD projects, the authors rely on a sample of 194 interfirm NPD projects of Australian firms that are situated in high-technology industries. Our findings show that the added value of interfirm collaboration engagement intensity is contingent on (1) the level of intrafirm collaboration engagement and (2) the setting (i.e., incremental versus radical NPD projects) in which the relationship is embedded. This article contributes to the application of information processing theory in the context of interorganizational collaboration, showing that combinations of extensive interfirm and intrafirm collaboration engagement might actually hamper NPD performance in settings that are characterized by high task variety and low task analyzability.

The article is structured as follows. First, hypotheses are developed on the performance implications of inter-

firm and intrafirm collaboration engagement in different innovation settings. Subsequently, the methodology is discussed. Following are the results of all analyses. Finally, a discussion of the main implications of the findings follows, limitations of this study are outlined, and interesting avenues for future research are identified.

Theoretical Background and Hypotheses

Relational View Perspective on Project Performance in Interfirm NPD

The relational view perspective has emerged as a distinct research stream from the industry structure perspective and resource-based view in explaining how firms can gain a competitive advantage (Dyer and Hatch, 2006; Dyer and Singh, 1998). The core argument of the relational view is that firms, combining complementary resources through relational processes in unique ways, may realize an advantage over competing firms who are unable or unwilling to do so (Agarwal et al., 2010; Dyer, 1997; Zajac and Olsen, 1993). Relational view scholars emphasize the importance of intensive interaction between firms to come to successful project completion. Such interfirm collaboration engagement facilitates the emergence of shared norms and values across members of collaborating partners, which increase the motivation to share information (Das and Teng, 2004). It also facilitates the emergence of interfirm routines or “stable patterns of behavior [...] across organizations” (Zollo, Reuer, and Singh, 2002, p. 709). When such interfirm routines are established, coordinated exchanges between the partners are facilitated, which ultimately increases the ability to exchange not only codified but also tacit information (Faems et al., 2008; Zollo et al., 2002).

In sum, relational view scholars outline that interfirm collaboration engagement represents a critical form of relation-specific investments that contribute to extensive and rich information flows between partners in interfirm projects, which increase the probability of successful product development (Colombo, 2003; Van Wijk, Jansen, and Lyles, 2008). It is therefore hypothesized:

H1: Greater interfirm collaboration engagement increases NPD performance in interfirm projects.

Information Processing Perspective on Interfirm NPD Performance

Whereas relational view scholars emphasize the relevance and importance of intensive interaction between

BIOGRAPHICAL SKETCHES

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different firms, they remain surprisingly silent on the potential role of intrafirm collaboration engagement. Relying on insights from information processing theory, it is proposed that (1) the intensity of interaction between functional units within firms might substantially influence partners' capacity to process information flows that emerge in the case of extensive interfirm collaboration engagement and (2) the added value of intrafirm collaboration engagement depends on the innovation context in which the focal interfirm project is embedded.

Interaction between intrafirm and interfirm collaboration intensity. Relational view studies argue that intensive interfirm interaction triggers extensive and rich information flows between partners, increasing their ability to accomplish project goals. Information processing scholars (Daft and Lengel, 1986; Egelhoff, 1991; Tushman and Nadler, 1978), however, emphasize that, to benefit from such information flows, firms need to possess sufficient information-processing capacity. Moreover, these scholars point to intrafirm interaction as an important mechanism to increase firms' capacity to process information flows that originate from external sources, such as interfirm partners. In particular, extensive intrafirm collaboration engagement across different functional units allows reaching a common frame of reference within the firm, increasing the ability to make sense of and act upon incoming information flows (Daft and Lengel, 1986; Weick, 1979). Additionally, intensive interaction among functional units leads to firm-specific knowledge that increases firms' capacity to not only monitor and screen, but also leverage externally generated information (Helfat, 1997).

Taking these information processing arguments into the context of our study, it is expected that, when intensive interaction is present within firms, their capacity to process extensive and rich interfirm information flows increases, which, in turn, is likely to positively influence the performance of the interfirm NPD project.¹ Conducting a case study of six interfirm product development projects, Hillebrand and Biemans (2004) also provide first empirical support for these information-processing arguments. In particular, they conclude that “a combination of low internal cooperation and high external cooperation may result in major misunderstandings, project delays, higher product development costs, and lower

product quality.” At the same time, they find that in those cases where “high external cooperation is combined with high internal cooperation, no such problems occurred” (Hillebrand and Biemans, 2004, p. 215).

In sum, it is expected that, when extensive intrafirm collaboration engagement is present, the positive performance implications of increased interfirm collaboration engagement are likely to be stronger. Building on these information-processing insights, it is hypothesized that:

H2a: Intrafirm collaboration engagement moderates the relationship between interfirm collaboration engagement and NPD performance in interfirm projects in such a way that the positive effect of interfirm collaboration engagement on NPD performance is stronger when higher levels of intrafirm collaboration engagement are present.

Moderating impact of innovation settings. Information-processing scholars do not only consider information-processing capacity but also highlight that information-processing requirements play a key role in determining the extent to which firms benefit from information flows. In particular, they emphasize that projects, having different task characteristics (i.e., task variety and task analyzability), are likely to have different information-processing requirements. While task variety refers to the frequency of unexpected and novel events, task analyzability refers to the extent to which employees can follow an objective procedure to resolve problems (Daft and Lengel, 1986, pp. 563–64). With higher levels of task variety and lower levels of task analyzability, the information-processing requirements of the task at hand increase (Lengel and Daft, 1984; Tushman, 1978).

Relying on these information-processing insights, intrafirm NPD studies (e.g., De Visser et al., 2010; Song and Xie, 2000) have examined how the innovativeness of intrafirm NPD projects influences the relationship between intrafirm collaboration and NPD performance. In order to do so, an explicit distinction between radical and incremental NPD projects is made (De Visser et al., 2010). In incremental NPD projects, the core aim is to improve existing products, conducting exploitative activities such as optimization, standardization, and refinement (March, 1991). In radical NPD projects, however, the core aim is to come up with new products, conducting explorative activities such as fundamental research, experimenting, and prototyping (Tushman and Smith, 2002). These intrafirm studies provide empirical evidence that in radical innovation projects, where task variety is high and task analyzability is low, the added value of cross-functional collaboration (i.e., face-to-face interaction between members of different functional units) is

¹ The authors acknowledge that firms' increased capacity to process interfirm knowledge flows might not only trigger joint benefits (i.e., increased interfirm project performance), but also brings along higher private benefits (i.e., increased ability to absorb knowledge from the other partner). The authors explicitly discuss this issue in the Limitations section.

higher than in incremental innovation projects, where task variety is relatively low and task analyzability is relatively high.

Based on these prior theoretical and empirical insights, it is therefore expected that, for incremental interfirm projects, information-processing requirements are relatively low, hence reducing the need to complement intensive interfirm interaction with intensive intrafirm interaction. In radical interfirm projects, however, complementing extensive interfirm collaboration engagement with extensive intrafirm collaboration engagement is likely to be more relevant, because of the high information-processing needs determined by the requirements prevalent in such projects. It is therefore hypothesized:

H2b: The positive moderating impact of intrafirm collaboration engagement on the relationship between interfirm collaboration engagement and NPD performance is stronger for radical interfirm projects than incremental interfirm projects.

Method

Sampling and Data Collection

To test our hypotheses, fine-grained project-level data are needed on the intensity of interfirm and intrafirm collaboration and their performance implications. In order to obtain that data, a questionnaire was developed, comprising survey scales on interfirm collaboration engagement, intrafirm collaboration engagement, and NPD performance in the setting of interfirm NPD projects (i.e., projects between different firms that involve the development of new products/services or the adjustment of existing products/services). To ensure the reliability and validity of the survey, an extensive literature review on these issues was conducted. The survey was pilot tested by 30 NPD managers in high-technology industry sectors on the comprehensiveness of the survey questions and the readability of all items. In addition, the final version of the survey was pretested by 30 product managers of the Australian Electrical and Electronics Industry Association during an innovation conference prior to the main data collection. In the actual data set, none of these pretest responses were included.

For the final survey, 20 industry bodies were identified representing high-technology industries from the Australian Industry Group (AIG). AIG is Australia's largest association, representing all key industry sectors within the nation. The authors chose to focus on high-technology industries because collaboration for NPD pur-

poses is very common and important in these industries (Colombo, 2003). Subsequently, these industry bodies were contacted via phone and asked to participate. Eleven bodies agreed to distribute the survey among their member firms.²

Participation of a senior product development manager was requested for this survey. These managers were asked to consider the most recent service or product innovation that they had developed together with an external firm, regardless of whether the endeavor was successful or not. Surveys were e-mailed initially by the industry bodies to a total of 3000 member firms. Two reminders were also distributed. Of these, 1962 had multiple memberships across the industry bodies and associations, which resulted in 1038 firms receiving the survey. One hundred ninety-four fully completed surveys were received, representing an effective response rate of 19%, which is comparable to prior studies on interfirm NPD projects (Sanders and Premus, 2005). As most of the industry associations did not want to provide specific information on their member firms, the authors were not able to perform nonresponse bias tests on the full sample. However, for two industry associations (Australian Electrical and Electronics Industry Association and the Telematics Industry Association), general information of member firms was provided such as the firm's primary type of business, firm age, and firm size. For these two associations, respondents and nonrespondents were compared. No significant differences emerged between them in terms of these three variables ($P > .10$; NS).

Common method bias was accounted for using several procedures prescribed in the literature. First, the authors clearly separated the measurement of the predictor and criterion variables into different sections in order to create a psychological separation between these constructs (Parkhe, 1993). Second, the performance variables were placed after the predictor variables in order to diminish the possibility of consistency artifacts (Salancik and Pfeffer, 1977). In addition, the authors methodologically separated the criterion and predictor variables by letting the respondents complete them under different

² The 11 industry bodies agreeing to distribute the survey via electronic mail to product managers from their database were: Australian Electrical and Electronics Industry Association, Australian Manufacturing Technology Institute Limited, Telematics Australia, Commonwealth Scientific and Industrial Research Organization, AUSInnovation, Australian Information Industries Association, Australian Laboratory Managers Association, Science Industry Australia, Australian Manufacturing Technology Institute Limited, Medical Industry Association Australia, and Materials Australia. Three of these (Commonwealth Scientific and Industrial Research Organization, AUSInnovation, and the Australian Information Industries Association) also published an electronic link of the survey on their websites.

response formats (i.e., different Likert scales). Third, by protecting the respondents' anonymity, biases concerned with evaluation apprehension as well as social desirability were reduced (Podsakoff, Mackenzie, Lee, and Podsakoff, 2003). Fourth, a Harman one-factor test was performed, loading all measurement items into a principal component factor analysis. As no single factor emerged and factor 1 only explained 34.83% of the variance, common method bias was not likely to be a concern in the data.

Variables

Dependent variable. According to existing NPD literature, measures of NPD performance should encompass multiple aspects including the characteristics of the developed product/service itself (Blindenbach-Driessen, Van Dalen, and Van Den Ende, 2010; Narasimhan and Das, 2001; Scannell, Vickery, and Droege, 2000) and the success of the developed product/service in the market (Homburg and Pflesser, 2000; Spekman, Kamauff, and Myhr, 1998). Accordingly, the authors included items in the measure of NPD performance that represent performance in relation to the quality and cost-efficiency of the developed product/service as well as performance in terms of achieving customer satisfaction, providing value for customers, and keeping current customers (Schleimer and Shulman, 2011b).

The study relies on expectation fulfillment measures to operationalize these different aspects of NPD performance, analyzing the extent to which partners were able to meet the initial expectations in relation to the multiple aspects of NPD performance. In particular, the survey of this study asked respondents to indicate the extent to which the initial expectations on the five dimensions of NPD performance were met, using a 5-point Likert scale (i.e., 1 = initial expectations were not met; 2 = initial expectations were met to some extent; 3 = initial expectations were met to a large extent; 4 = initial expectations were fully met; 5 = the results of the project exceeded the initial expectations).

Independent variables. In line with prior research (Schleimer and Shulman, 2011b), the authors relied on five items to measure interfirm collaboration engagement. Using a 5-point Likert scale, respondents were asked the extent (i.e., never, rarely, sometimes, routinely, always) to which they (1) sought advice and counsel with each other, (2) helped each other in planning activities, (3) provided suggestions to each other, (4) shared proprietary information with each other, and (5) provided infor-

mation that could help the other partner. The average score on these five items represents the construct interfirm collaboration engagement.

In the survey, the authors asked respondents whether more than one unit of their firm was involved in the focal interfirm NPD project. Sixty respondents (31%) reported that only one unit of their firm was involved in the focal innovation project, whereas more than one unit was involved in 134 observations (69%). If the respondents indicated that multiple units were involved, they had to answer additional questions on the intensity of interaction between these intrafirm units. The five questions respondents answered in relation to intrafirm collaboration engagement were adjusted slightly from those posed for interfirm collaboration engagement. When only one unit was involved, the authors attributed a score of 0 to the different intrafirm collaboration intensity items. The average on these five items was used to calculate the intensity of intrafirm collaboration engagement.³

Respondents were also asked to indicate whether the project aimed for (1) the development of a new product/service or (2) the significant adjustment of an existing product/service. In line with previous research (Duysters and Lokshin, 2011; Faems et al., 2005), the authors labeled the former type of project as radical, whereas the latter type of project was labeled as incremental. In the sample, 66 projects (34%) were of incremental nature, whereas 128 projects (66%) were of radical nature.

Control variables. Several variables have been introduced in order to control for possible confounding effects. Distinguishing between eight different categories (1–20, 21–50, 51–100, 101–150, 151–250, 251–500, 501–1000, more than 1001 employees), respondents were asked to indicate focal firm size and partner firm size. Based on this information, the authors incorporated the ordinal variable “focal firm size” and “partner firm size” in this article's analyses.

Existing research on interfirm relationships (Gulati, Lavie, and Singh, 2009) has provided evidence that, as firms repeatedly engage in collaborative efforts, interfirm routines are likely to emerge which increase the likelihood of successful value creation. In this model, the

³ In order to assess the sensitivity of the results to changes in the operationalization of this article's intrafirm collaboration engagement variable, we also constructed an alternative categorical variable, representing three different categories: (1) only one unit of the firm was involved in the focal NPD project; (2) more than one unit of the firm was involved, but the intensity of collaboration engagement was relatively low (i.e., lower than the mean on intrafirm collaboration intensity); (iii) more than one unit of the firm was involved and the intensity of collaboration engagement was relatively high (i.e., higher than the mean on intrafirm collaboration engagement). Using this alternative variable triggered similar results.

authors control for the presence of a history of collaboration between the partners before the initiation of the focal project using the number of prior projects (0 = no prior NPD project was undertaken between the firms prior to this project; 1 = 1 prior NPD project was undertaken; 2 = 2 prior NPD projects were undertaken; 3 = 3–5 prior NPD projects were undertaken; 4 = 6–10 prior NPD projects were undertaken; 5 = 11–15 prior NPD projects were undertaken; 6 = more 15 prior NPD projects were undertaken) the partnering firms have undertaken with one another. The structural form of the interfirm agreement is also known to matter for the collaboration between partnering firms (Reuer and Ariño, 2003). The authors therefore distinguish between contractual (= 1) and noncontractual (= 0) forms of agreements between firms.

As the sample encompassed both new product development as new service development projects, the authors controlled for this difference in their analyses (Schleimer and Shulman, 2011b). Although the focus was on bilateral interfirm projects in which the focal firm collaborated with one external partner, respondents were also asked whether third parties had been involved during the project. Although such third party involvement might lead to a larger pool of resources that can be shared (Lane, Salk, and Lyles, 2001), it might also increase coordination costs and risks of opportunistic behavior (Gong, Shenkar, Luo, and Nyaw, 2007). The authors therefore controlled for the number of third parties (0 = no third parties involved; 1 = 1 other firm involved; 2 = 2–3 other firms involved; 3 = 4–5 other firms involved; 4 = more than 5 other firms involved) that were involved in the NPD project.

Prior studies (Hoegl, Weinkauff, and Gmuenden, 2004; Schleimer and Shulman, 2011b) have provided evidence that not only the intensity of interaction, but also other relational factors such as trust and feelings of joint responsibility might influence partners' ability to come to joint value realization. To minimize the risk of omitted variable bias, the authors therefore control for these additional relational factors. Following Schleimer and Shulman (2011b), four items were used to measure the level of shared responsibilities and four items to measure the level of mutual trust (see Table 1 for all individual items).

Measurement Validity

Table 1 shows that the reliability values (Cronbach's α) of all constructs, which are used in the analyses, are above the cutoff value of .70 suggested by Nunnally

(1978). To examine the convergent validity of all constructs, the factor loadings of each indicator were calculated in the measurement model, using the calis procedure in SAS 9.1 (SAS Institute, Inc., Lane Cove, New South Wales, Australia). As shown in Table 1, the standardized factor loadings of all indicators in the model are greater than the threshold value of .40, indicating sufficient convergent validity (Zhao and Anand, 2009). The measurement model fits with the data, indicating good construct validity of all latent variables.

Results

Table 2 shows the descriptive statistics for each construct and correlations between them. To test the hypotheses, the sample was split, making a distinction between incremental and radical NPD projects. In order to test the moderating effects between intensity of interfirm collaboration and intensity of intrafirm collaboration, several interaction effects had to be introduced. In order to address any potential multicollinearity problems between the main effects and the interaction effects, the authors standardized all noncategorical variables (Aiken and West, 1991). For each ordinary least squares (OLS) regression, the variance inflation factors (VIF) were calculated for each independent variable. All VIF values are below the cutoff value of 5, indicating that the extent of multicollinearity is well within the acceptable range (Hair, Black, Babin, Anderson, and Tatham, 2006).

Table 3 reports the results of the regression analyses on the sample of incremental NPD projects and the sample of radical NPD projects. In H1, the authors expected a significant positive impact of interfirm collaboration engagement on NPD performance. As shown in Model 2 and Model 4 of Table 3, this hypothesis is confirmed for both the incremental and radical sample.

In H2a and H2b, a significant moderation effect of intrafirm collaboration engagement was expected, which would be stronger in radical NPD projects. Model 3 shows that, regarding incremental NPD projects, albeit finding a significant performance effect for interfirm collaboration engagement and intrafirm collaboration engagement, respectively, the interaction between them was not significant. For radical NPD projects, the authors find a significant negative interaction effect (see Model 6 in Table 3). As Figure 1 illustrates, it was observed that, for radical NPD projects, the positive effect of interfirm collaboration engagement on NPD performance becomes weaker as the intensity of intrafirm collaboration engagement increases. Explanations and implications of these results are provided in the discussion section below.

Table 1. Measurement of Latent Constructs

Survey Items	Standardized Estimates	Cronbach α
<i>NPD performance</i>		.88
Success in terms of product/service development costs	.58	
Success in terms of product quality	.66	
Success in terms of achieving customer satisfaction	.80	
Success in terms of providing value for existing customers	.77	
Success in terms of keeping current customers	.69	
<i>Interfirm collaboration engagement</i>		.84
Extent to which partnering firms sought advice and counsel from each other	.79	
Extent to which partnering firms helped each other in planning activities	.70	
Extent to which partnering firms provided suggestions to each other	.75	
Extent to which partnering firms shared proprietary information with each other	.60	
Extent to which partnering firms were expected to provide information that could help the other partner	.76	
<i>Intrafirm collaboration engagement</i>		.99
Extent to which involved units within your firm sought advice and counsel from each other	.96	
Extent to which involved units within your firm helped each other in planning activities	.97	
Extent to which involved units within your firm provided suggestions to each other	.97	
Extent to which involved units within your firm shared proprietary information with each other	.97	
Extent to which involved units within your firm were expected to provide information that could help the other partner	.96	
<i>Sharing responsibilities</i>		.88
Extent to which partnering firms were engaged equally in decision-making processes	.78	
Extent to which partnering firms contributed equally to the development	.84	
Extent to which partnering firms complemented one another as best as they could	.83	
Extent to which partnering firms shared collective responsibility for all results of the development	.79	
<i>Mutual trust</i>		.92
Extent to which partnering firms were perfectly honest and truthful with each other	.90	
Extent to which partnering firms were able to have great confidence in one another	.93	
Extent to which partnering firms could be counted on to do what was right	.84	
Extent to which partnering firms had high integrity	.80	
<i>Chi sq (df)</i>	487.42 (335)	
<i>RMSEA</i>	.0486	
<i>CFI</i>	.97	

Table 2. Descriptive Statistics and Correlations

Variable	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. NPD performance	3.60	.63	1.00										
2. Focal firm size	3.53	2.60	-.06	1.00									
3. Partner firm size	3.65	2.58	.06	.42**	1.00								
4. Prior collaboration	2.57	1.79	.01	.04	-.06	1.00							
5. Third-party engagement	1.66	1.08	-.03	.16*	.06	.25	1.00						
6. Contractual agreement	.76	.43	.14	.04	.04	-.08	.04	1.00					
7. Product innovation	.66	.47	-.03	.07	.09	.16*	-.04	.07	1.00				
8. Radical innovation	.66	.48	-.09	.03	.00	-.11	.18*	.01	.18*	1.00			
9. Sharing responsibilities	3.35	.82	.20**	.05	.01	.06	.10	.05	-.06	-.05	1.00		
10. Mutual trust	3.79	.76	.36**	-.06	-.00	.11	.09	.02	-.04	-.08	.53**	1.00	
11. Interfirm collaboration engagement	3.50	.73	.34**	.06	.02	.14*	.12	-.06	-.14*	-.01	.71**	.56**	1.00
12. Intrafirm collaboration engagement	2.40	1.72	.11	.24**	.06	.06	.08	-.01	.22**	-.04	.05	.00	.04

*Correlation is significant at the .05 level; **correlation is significant at the .01 level.

Table 3. Results of Regression Analysis for Incremental and Radical Sample

Variables	Incremental Sample (<i>n</i> = 66)			Radical Sample (<i>n</i> = 128)		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	−.05	.02	−.00	−.09	−.21	.02
Focal firm size	−.01	−.02	−.03	−.05	−.06†	−.08*
Partner firm size	.04	.03	.03	.04	.05	.05
Prior collaboration	.05	.02	.06	−.03	−.05	−.03
Third-party involvement	−.39*	−.41**	−.46**	.02	.03	.00
Contractual agreement	.64*	.72**	.77**	.18	.24	.16
Product innovation	−.07	.03	−.06	−.04	.10	−.01
Joint responsibility	−.22†	−.48**	−.50**	.13	−.08	−.06
Mutual trust	.41**	.41**	.46***	.28**	.09	.11
Interfirm collaboration engagement		.36*	.39**		.48***	.40**
Intrafirm collaboration engagement			.23*			.18*
Interfirm collaboration engagement*			.12			−.30***
<i>R</i> squared	.29	.35	.43	.16	.24	.33
Change in <i>R</i> squared		.06*	.08*		.08**	.09***
<i>F</i> value	2.87**	3.38**	3.65***	2.83**	4.06***	5.29***

†*p* < .10, **p* < .05, ***p* < .01, ****p* < .001.

Impact of Control Variables

For the incremental sample, the authors find that projects with contractual agreements outperform more informal agreements. At the same time, the presence of contractual agreements did not significantly influence NPD performance in the sample of radical interfirm projects. A potential explanation for this latter result might be that, when task analyzability is low and task variety is high, negotiating contracts might be more difficult and more time consuming (Dyer and Singh, 1998). These transaction costs might offset the potential benefits of contractual agreements in radical interfirm projects. The authors also find a negative relationship between involvement of third parties and NPD performance in incremental inter-

firm projects. This result suggests that, with an increasing number of third parties being involved, it may become increasingly difficult to decide on joint goals and objectives (Reuer, Zollo, and Singh, 2002), reducing the ability to effectively exploit existing products and technologies (Garcia-Canal, Valdes-Illan, and Arino, 2003; Park and Ungson, 2001).

The authors also observe a negative impact of joint responsibility on NPD performance in incremental interfirm projects. This result seems to confirm the argument of collaborative design studies (Faems et al., 2008; Oxley and Sampson, 2004) that, when task analyzability is high and task variety is low, it might be more efficient to implement a modular collaborative structure in which each partner is solely responsible for its own activities. Whereas the authors find a positive relationship between mutual trust and NPD performance in incremental interfirm projects, such significant relationships remain absent in radical interfirm projects. A potential explanation for the absence of a positive relationship in radical interfirm settings might be that, in this particular setting, mutual trust might not only trigger collaborative advantages but also might create rigidity and creative barriers (Nooteboom, 2003).

Discussion

Main Findings and Theoretical Implications

Whereas existing relational view studies (Agarwal et al., 2010; Dyer and Singh, 1998) have emphasized the

Figure 1. Interaction Effect of Interfirm and Intrafirm Collaboration Engagement for the Radical Innovation Sample

importance of interfirm relational processes to generate relational rents in interfirm projects, they have remained relatively silent on the potential impact of intrafirm relational processes on the success of collaborative endeavors. This article, however, provides first evidence that also intrafirm relational processes such as intrafirm collaboration engagement can impact partners' ability to realize value in interfirm settings. Relying on information-processing theory, it was expected that intrafirm collaboration engagement increases firms' capacity to successfully process extensive and rich information flows from intensive interfirm NPD collaboration. Moreover, the authors expected that, because of higher information-processing requirements (i.e., higher task variety and lower task analyzability), this capacity-increasing effect would be most valuable in radical NPD projects. In contrast to these expectations, it was found that intrafirm collaboration engagement negatively moderates the relationship between interfirm collaboration engagement and interfirm NPD project performance in these radical NPD projects.

A plausible explanation for this negative interaction effect can be found in the seminal article of Cohen and Levinthal (1990, p. 128). These scholars define absorptive capacity as "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends." Moreover, they make an explicit distinction between inward-looking absorptive capacity, which refers to the ability to assimilate and exploit knowledge within organizational boundaries, and outward-looking absorptive capacity, which implies the ability to assimilate and exploit knowledge across organizational boundaries. Although Cohen and Levinthal (1990) acknowledge the importance of both inward-looking and outward-looking absorptive capacity, they also point to a potential trade-off between them. They argue that "if all actors in the organization share the same specialized language, they will be effective in communicating with one another, but they may not be able to tap into diverse external knowledge sources" (Cohen and Levinthal, 1990, p. 133). In other words, an extensive focus on processing firm internal knowledge might actually hamper the ability to fully recognize, assimilate, and transform knowledge gained from external sources.

The findings suggest that such trade-offs between inward-looking and outward-looking absorptive capacity are especially relevant when firms engage in radical interfirm NPD projects. In such settings, the knowledge that enters the focal firm through intensive collaboration engagement with the external partner is more likely to deviate substantially from the knowledge that is normally

exchanged between functional units within the firm. As a result, the internal resistance to absorb such external knowledge might be higher, aggravating the trade-off between inward-looking and outward-looking absorptive capacity. In incremental settings, however, such conflicts between interfirm and intrafirm knowledge flows are less likely to occur, which might explain the absence of interaction effects between interfirm and intrafirm collaboration engagement.

These observations have relevant implications for future research on firms' information processing capacity. Both information-processing scholars and absorptive-capacity scholars tend to emphasize the advantages of intrafirm collaboration engagement to increase firms' capacity to take advantage of external information. In their seminal article, Zahra and George (2002), for instance, emphasize the importance of intrafirm collaboration to bridge the gap between firms' potential and realized absorptive capacity. The findings, however, suggest the need for future research that explicitly considers both the advantages and disadvantages of intensive intrafirm interaction for absorbing external information. Moreover, the findings point to the importance of explicitly considering the broader innovation and/or task context to effectively assess such information-processing advantages and disadvantages.

Limitations and Future Research

The authors acknowledge that the empirical approach faces some important limitations. The first limitation of this study concerns the cross-sectional nature of the data. Although this design allowed testing how intrafirm collaboration engagement moderates the relationship between interfirm collaboration engagement and NPD performance, it does not allow identifying and examining more temporal interactions between them. As case study research (Hillebrand and Biemans, 2004; Holmquist, 2004) indicates that prior interfirm collaboration might influence subsequent the intensity of intrafirm interaction and vice versa, the authors encourage future research to conduct a more longitudinal assessment of the interaction between interfirm and intrafirm collaboration engagement. In addition, different NPD stages might require different levels of collaboration engagement, which suggests that the effectiveness of both intra- and interfirm collaboration engagement also depends on their timing. The causal relationships should also be interpreted with caution. Whereas it was hypothesized that interfirm collaboration engagement affects NPD performance, the authors acknowledge that both aspects might coevolve

over time. Several case studies (Doz, 1996; Faems et al., 2008), for instance, show that first experiences of success within interfirm projects might trigger positive trust dynamics between members of different firms, triggering intensified collaboration, which, in turn facilitates joint development activities.

In this study, the authors relied on data from one single respondent. Although respondents were selected (i.e., project manager of the focal NPD project) that were very informed, this design did not allow controlling for (1) differences in perceptions among different units within the firm and (2) differences in perceptions between the focal firm and the partner firm. Although a full-scale multiple-informant approach is very difficult to implement in this kind of research setting (Zhao and Anand, 2009), it might present a relevant methodological strategy to pursue in future research.

In this article, the innovation context of projects was measured in terms of the distinction between improving existing products (i.e., incremental NPD projects) and developing new products (i.e., radical NPD projects). Obliging respondents to make a choice between these two options, the authors ignore the possibility of NPD projects in which partners both have to exploit existing products and explore new products. They therefore encourage future research to rely on existing ambidexterity research (e.g., He and Wong, 2004; Jansen, Van Den Bosch, and Volberda, 2006) to develop more fine-grained measurements of NPD projects' innovation context.

Several other avenues for future research prevail. Whereas this article focused on the distinction between incremental and radical innovation as an important contextual variable, it might be relevant to study how other contextual aspects (i.e., relative position of both partners in the value chain, environmental uncertainty) influence the interaction between interfirm and intrafirm collaboration engagement. In this article, the focus was on intrafirm collaboration engagement. However, the authors acknowledge the relevance of studying how other intrafirm aspects (e.g., organizational culture, organizational structure, reward and control systems) might also influence firms' ability to succeed in interfirm partnerships. Finally, the authors encourage scholars to also study the long-term firm performance implications of extensive interfirm interactions. Whereas this article's findings suggest that intensive interfirm collaboration engagement enhances the success of both radical and incremental NPD projects in different ways, organization learning scholars (e.g., Alvarez and Barney, 2001; Hamel, 1991) already provided evidence that extensive knowledge transfer might trigger unintended knowledge

spillovers and competitive learning races, which might jeopardize the long-term financial performance of involved firms.

Conclusion

In this article, an in-depth examination of the interaction between interfirm and intrafirm collaboration engagement in interfirm NPD projects was conducted. The findings point to potential trade-offs between interfirm and intrafirm collaboration in the context of radical NPD projects. The authors hope that these findings might stimulate researchers to further explore the interaction between internal and external collaboration in a wide variety of organizational settings and might assist practitioners in optimizing their collaborative innovation strategies.

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