


# Explicit and tacit synergies between alliance firms and radical innovation: the moderating roles of interfirm technological diversity and environmental technological dynamism

Bin Hao<sup>1</sup>, Jiangfeng Ye<sup>2</sup>, Yanan Feng<sup>3</sup>  and Ziming Cai<sup>3</sup>

<sup>1</sup>School of Business, East China University of Science and Technology, 130 Meilong Road, Shanghai, 200237, China. [binhao@ecust.edu.cn](mailto:binhao@ecust.edu.cn)

<sup>2</sup>School of Business, Anhui University, 3 Feixi Road, Hefei, Anhui 230039, China. [yjf-ll2001@163.com](mailto:yjf-ll2001@163.com)

<sup>3</sup>Nottingham University Business School, Jubilee Campus, Wollaton Road, Nottingham, NG8 1BB, UK, [yanan.feng@nottingham.ac.uk](mailto:yanan.feng@nottingham.ac.uk); [Ziming.Cai@nottingham.ac.uk](mailto:Ziming.Cai@nottingham.ac.uk)

**This study draws on theories of organizational inertia and relational view to examine how the pursuit of partnership synergy influences radical innovation in different technological contexts. We differentiate between two types of synergy: explicit synergy, defined as the potential to exchange interfirm operational elements to renew processes or capabilities, and tacit synergy, conceptualized as the potential to synthesize cross-boundary resources to develop new perspectives or thinking modes. We find that both explicit and tacit synergies have positive impacts on radical innovation, and such impacts are contingent on interfirm technological diversity and environmental technological dynamism in opposing ways. Specifically, environmental technological dynamism positively moderates the relationship between explicit synergy and radical innovation but not the relationship between tacit synergy and radical innovation. In contrast, interfirm technological diversity positively moderates the relationship between tacit synergy and radical innovation but not the relationship between explicit synergy and radical innovation. Our study sheds new light on the generation of radical innovation in alliances. It also provides practitioners with useful guidelines for crafting synergy strategies that will facilitate the pursuit of radical innovation.**

## 1. Introduction

Alliance innovation literature has indicated a synergistic approach for explaining collaborative

innovation: a firm can share, exchange, and combine cross-boundary knowledge and capabilities with its partners to develop and implement innovative ideas, which it would not be able to achieve on

its own (Cui and O'Connor, 2012). Along this line of inquiry, some scholars posit that partnership synergy underpins continuous renewal of technologies, leading to increased innovation outcomes that entail radical changes to existing products or processes (McDermott, 1999; Rothaermel and Deeds, 2004). The rationale is that alliance collaboration acts as a means of overcoming organizational inertia and building new capabilities for radical innovation (cf. Benner and Tushman, 2003; Birkinshaw et al., 2007). According to the alliance literature, partnership relates to different forms of synergistic effects, such as information sharing, the complementarity of assets, and the integration of capabilities (Lorenzoni and Lipparini, 1999; Zhou, 2011; Dwertmann et al., 2016; Korde and Paulus, 2017), which may predict different mechanisms for changing organizational capabilities or routines. Notably, prior literature on partnership and radical innovation has referred to these forms of synergistic effects separately (e.g., Birkinshaw et al., 2007; Karamanos, 2011; Dwertmann et al., 2016), without investigating whether they may function differently or similarly in linking contextual factors to radical innovation. We thus ask: how do different forms of synergy influence radical innovation in different contexts?

This study combines the relational view (Dyer and Singh, 1998) with theories of organizational inertia to investigate whether, and under what circumstances, different forms of synergy in alliance relationships predict a focal firm's radical innovation. We define radical innovation as the development of completely new products that depart from the evolutionary path of existing ones (O'Connor, 1998). Taking dyadic alliance as the unit of analysis, we argue that partnership synergy entails relational rents of both resource complementarity and the potential to leverage existing and newly acquired resources, thereby prescribing a path for overcoming organizational inertia and for spurring the focal firm's radical innovation. Drawing on existing studies that indicate two dominant forms of value, a firm could pursue through alliances with other firms – 'value-in-exchange', such as the exchange of operational elements (referred to herein as *explicit synergy*) (e.g., Vargo and Lusch, 2008; Zhou, 2011), and 'value-in-development', such as the rearrangement of ideas and perspectives (referred to herein as *tacit synergy*) (e.g., Lasker et al., 2001) – we shed new light on the examination of synergy by exploring how explicit and tacit synergies function in linking contextual factors to radical innovation. We conceptualize explicit synergy here as the potential to exchange interfirm operational elements, such as tangible assets or

market information, to renew processes or capabilities so that partner firms create value greater than the sum of their individual efforts. Tacit synergy is conceptualized as the potential to synthesize cross-boundary resources to develop new perspectives or thinking modes that an individual firm would otherwise not be able to achieve. Prior studies have demonstrated that radical innovation is affected by the technological context in which the firms are situated (e.g., Cui and O'Connor, 2012). We thus introduce two types of technological context a firm may find itself in when allying with other firms – interfirm technological diversity and environmental technological dynamism (cf. Wang and Chen, 2009) – that allow us to discover whether different contexts exert different influences on the relationship between synergy and radical innovation.

## 2. Theory and hypotheses

### 2.1. Synergy in interfirm contexts

The concept 'synergy' refers to the co-existence and mutual promotion of two or more subsystems on the basis of resource sharing (Ansoff, 1965). Synergy provides entities with the power to combine strengths, resources, and perspectives (Goold and Campbell, 1998), that is, the combined effect of multiple activities exceeds the sum of their individual effects. According to Dyer and Singh's (1998) relational view, synergistic action in the context of dyadic alliance could be one source that leads to relational rents. Synergy may relate to value-in-exchange (Vargo and Lusch, 2008), suggesting that the interfirm rent-seeking process refers to the exchange of assets and resources to arrive at synergistic outcomes (Lorenzoni and Lipparini, 1999). Value-in-exchange emerges when partner firms each hold assets or technologies that can be shared by others or that complement others' assets or technologies (Goold and Campbell, 1998; Rothaermel and Deeds, 2004; Zhou, 2011; Zaheer et al., 2013). We call this form of synergy *explicit synergy*. Specifically, explicit synergy relates to the exchange of assets, tools, and skills to obtain relational rents of renewed processes or capabilities. It entails added value that can be created by acquiring partners' assets or resources at the expense of a focal firm's own assets or resources (e.g., Cui and O'Connor, 2012). Explicit synergy can be pursued by leveraging transmittable organizational elements that are in visible or codified forms (Zaheer et al., 2013). For example, the alliance between carmakers Daimler AG and Renault-Nissan facilitated the

use of each other’s technologies and product modules in their respective advantageous areas.

An alternative view ties synergy to value-in-development, indicating that the relational rent-seeking process entails the development of new perspectives and modes of thinking (e.g., Korde and Paulus, 2017). Value-in-development emerges when the combination of partners’ resources and perspectives facilitates the development of new thinking or ideas about how value can be created (Lasker et al., 2001). Such a synergistic process is fueled by perceptions about the extent to which relational rents can be created via synthesizing and developing perspectives and modes of thinking (Dwertmann et al., 2016). We call this form of synergy *tacit synergy*. Tacit synergy mainly centers on the transformation of attitudes, perspectives, and thinking modes derived from the synthesis of resources and knowledge (Lasker et al., 2001). For instance, the alliance between luxury brand Gianni Versace and property developer Tomson Group adds greater perceived value for prospective homebuyers by integrating luxury elements into the interior design of homes. Tacit synergy can be pursued when partner firms hold knowledge bases that mesh for joint learning and innovation, and that entail the potential to inspire each other (Baum et al., 2010). In this regard, partner firms’ organizational elements can be absorbed and integrated into new product development so that additional value (in excess of exchange value) can be created (e.g., Hernandez and Shaver, 2019). Due to the need to conduct a development process before tacit synergy can be realized, the relational rents from a given partnership cannot easily be predicted (cf. Gassmann et al., 2010). A comparison between explicit and tacit synergies is shown in Table 1.

## 2.2. Synergy and radical innovation

### 2.2.1. Explicit synergy and radical innovation

As indicated by Levinthal and March (1993), firms benefiting from cost reductions or product improvements in serving existing customers are inclined

to persist with great zeal in extending activities alongside their original routine – a repeated pattern of response for problem-solving or other computational activities (Nelson and Winter, 1982). This is because a lack of new knowledge, tangible resources, or capabilities that significantly differ from their own hampers divergence from the existing routine (Benner and Tushman, 2003). In this regard, firms can easily encounter the inertia of process, i.e., ‘failure to change organizational processes that use firm resources’ (Gilbert, 2005, p. 741). While such inertia in process management tends to be an obstacle to radical innovation (Benner and Tushman, 2003), we argue that explicit synergy plays a crucial role in overcoming the inertia of process and thus has an impact on radical innovation. According to Dyer and Singh (1998), relational advantage stems from the establishment of interfirm routines that facilitate the transfer, recombination, and creation of specialized knowledge. By embracing explicit synergy, a focal firm can well leverage combined resources by developing relation-specific capabilities and routines (Dyer and Hatch, 2006), which indicates the potential to escape from the inertia of intra-firm process and to develop radical projects (McDermott, 1999). Also, explicit synergy entails the exchange of knowledge that a focal firm can draw on to pursue relational rents (Dyer and Singh, 1998). While the firm’s original knowledge-learning routine may not ensure the acquisition of such relational rents, the focal firm will have to renew its own process routine and rebuild its capabilities (Davies et al., 2018), thereby shifting the well-structured response paradigm and overcoming the inertia of process. The focal firm can then obtain greater flexibility in searching for novel solutions and opportunities in the frame of the relationship (Dyer and Singh, 1998). In other words, explicit synergy entails opportunities for escaping from the competence trap and a confined technological trajectory, tipping R&D activities toward those with the potential for discontinuity and disruption (Birkinshaw et al., 2007).

Table 1. A comparison between explicit and tacit synergies

	Explicit synergy	Tacit synergy
Description	Exchange elements between firms for renewing processes or capabilities	Synthesize elements for developing new perspectives or thinking modes
Condition	Relationship firms both hold assets or resources that can be shared with each other	Relationship firms come from related industry or market areas that entail the potential to inspire each other
Predictability of benefits	Benefits can be easily seen in advance	Benefits cannot be predicted until collaboration has been proceeded
Value created	Value-in-exchange	Value-in-development
Example	Automobile manufacturers collaborate to adopt each other’s core parts	The synthesis of technologies of automobile and rechargeable battery helps reframe our thinking of how an automobile can be powered

H1: *Other things being equal, there is a positive relationship between explicit synergy and radical innovation.*

### 2.2.2. Tacit synergy and radical innovation

Firms' resistance to changing habits and mental models often translates into the inertia of cognition (Garud and Rappa, 1994), which rejects breakthrough ideas and the motivation for developing radical innovation. Cognitive representations are normally based on prior experiences rather than current or newly acquired knowledge, and thus account for major sources of inertia (Tripsas and Gavetti, 2000). Because tacit synergy entails value-in-development that helps generate divergent, comprehensive, and transformative thinking to facilitate the acquisition of relational rents, we propose that it decreases the inertia of cognition (Mayo, 1997; Sheth et al., 2008) and thus has a positive effect on radical innovation.

According to Dyer and Singh (1998), relational advantages relate to a rent-seeking process in a particular relationship. Divergent and comprehensive thinking (as indicated by tacit synergy) fuels such a process by generating extensive alterations of knowledge development, thus leading to novel insights and unusual ideas being generated. Divergent thinking, which entails the ability to go beyond the boundaries of an established way of looking at things and see them in many different ways (Lasker et al., 2001), promotes the rent-seeking process in alliances through which a focal firm expands the boundaries of a mental model and breaks existing frames of reference (i.e., inertia of cognition) (Reid et al., 2014). The prevalence of divergent thinking early in a technology's lifecycle means that the pursuit of relational rents may lead to the development of ideas and potential opportunities that will be 'unusual' and 'radical' (O'Connor, 1998). A focal firm developing such a thinking mode can see things from many, often paradoxical, perspectives (Reid et al., 2014), thus leading to the generation of novel products or services perceived as new and desirable by the market (Sampson, 2007). Moreover, relation-specific capabilities enable the focal firm to leverage divergent and comprehensive thinking by integrating and exploring knowledge from both sides of the relationship, which plays a crucial role in overcoming the inertia of cognition (Reid et al., 2014).

Another aspect of tacit synergy that may overcome the inertia of cognition is transformative thinking (Lasker et al., 2001). According to Sheth et al. (2008), transformative thinking is crucial for new insight emergence, especially when two or

more conceptually disparate knowledge domains are linked. During a rent-seeking process of seeing things from different perspectives, the focal firm may change its assumptions and methods of working (Mayo, 1997), thus decreasing cognitive inertia and facilitating the generation of novel insights. In addition, when being exposed to diverse ideas and experiences that allow for thinking 'outside of the box', a firm with transformative thinking can construct a more holistic view, identifying where multiple issues intersect and promoting broader analyses of problems and opportunities (Lasker et al., 2001), thereby helping to navigate a radical project to a successful outcome.

H2: *Other things being equal, there is a positive relationship between tacit synergy and radical innovation.*

### 2.3. The moderating roles of technological dynamism and interfirm technological diversity

We then introduce two technological contextual factors identified in prior studies (e.g., Wang and Chen, 2009): environmental technological dynamism (external context) and interfirm technological diversity (intra-alliance context). Environmental technological dynamism describes the rate and the unpredictability of change in a firm's external technological environment (Jaworski and Kohli, 1993). In the context of high technological dynamism, the frequent changes in product technologies pose challenges to a focal firm (Schubert et al., 2016). This will enhance the firm's willingness to revise its process routine so as to adapt to the changing environment (Davies et al., 2018). In case that explicit synergy allows for such a revision, the focal firm will have an enhanced motivation to leverage complementary assets and to make significant changes to its original process routines, which subsequently promote radical innovation. Also, a dynamic technological environment allows for extensive opportunity searching (Schubert et al., 2018). While different technological opportunities may relate to different process routines (Dahlin et al., 2018), the likelihood that the change of original process routines is helpful in grasping an opportunity increase in such an environment. In the process in which the firm pursues opportunities by repeatedly leveraging complementary assets and revising process routines, radical innovation performance can be promoted. Hence, the greater the technological dynamism, the stronger the relationship between explicit synergy and radical innovation.

However, environmental technological dynamism may not have a significant impact on the relationship between tacit synergy and radical innovation. When two firms collaborate with each other, their knowledge structure, technological trajectories, and inner-working procedures can be predictors of the shift of cognitive schemata (Greve and Taylor, 2000). Partner firms that strategically fit in with each other in terms of knowledge base and inner-workings, as a result, are able to realize tacit synergy and consequently promote radical innovation (Burdy et al., 2018). Since the realization of tacit synergy and the associated cognition shift are largely dependent on the strategic fit of partner firms' characteristics, rather than exogenous factors such as technological dynamism which may not affect the extent of fit, we could expect that environmental technological dynamism has no significant impacts on the relationship between tacit synergy and radical innovation.

*H3a: Other things being equal, environmental technological dynamism will strengthen the relationship between explicit synergy and radical innovation.*

*H3b: Other things being equal, environmental technological dynamism will not strengthen the relationship between tacit synergy and radical innovation.*

Technological diversity is an idea that resembles functional diversity based on the technological backgrounds of firms (Sampson, 2007). It is suggested that technological diversity relates to the breadth of the knowledge base that can be leveraged toward radical innovation (Kobarg et al., 2019). While tacit synergy can be helpful in overcoming the inertia of cognition, firms in an environment with great interfirm technological diversity are able to fuel such a process. Specifically, great interfirm technological diversity enables a firm to recombine internal and external knowledge and develop inner-working procedures novel to it (Makri et al., 2010). When the firm has developed divergent and transformative thinking as entailed by tacit synergy, it will be able to combine such thinking modes with the novel inner-workings in R&D activities (Liedtka, 2015), which facilitates the overcoming of cognitive inertia. Meanwhile, the renewed cognition will be highly effective in spurring radical innovation in the context of great interfirm technological diversity as it provides a basis for the creation of new linkages between different knowledge bases (Troilo et al., 2014). Hence, the greater the interfirm technological diversity, the more likely a firm will draw on its divergent or transformative thinking to explore an extended knowledge base and to create ground-breaking ideas (Kobarg et al., 2019).

However, interfirm technological diversity may not moderate the relationship between explicit

synergy and radical innovation. Our discussion above suggests that the impact of explicit synergy on radical innovation lies in the overcoming of the inertia of process. Such an impact involves partner firms' joint activities at the operational level, which will be fueled when facing external pressures or when there is an opportunity to increase their relational rents (e.g., Zhelyazkov, 2018). From the perspective of external pressures, interfirm technological diversity may not account for such pressures since it may fail to pose challenges to partnership operations as did by environmental technological dynamism. From the perspective of opportunity searching, technological diversity entails potential to extend partner firms' knowledge base (Lin and Chen, 2005) but will also cause difficulty in knowledge absorption (Tanriverdi and Venkatraman, 2005), which may jointly predict an insignificant impact on the relationship between explicit synergy and radical innovation.

*H4a: Other things being equal, interfirm technological diversity will strengthen the relationship between tacit synergy and radical innovation.*

*H4b: Other things being equal, interfirm technological diversity will not strengthen the relationship between explicit synergy and radical innovation.*

### **3. Methodology**

#### *3.1. Data collection*

Our empirical setting is China's high-tech industries. We obtained a sampling frame of 500 high-tech firms located in China. The questionnaire was originally designed in English and then translated into Chinese by two independent translators, followed by a back-translation process (see online supporting document). After interviewing 15 senior managers and 6 scholars and conducting a pilot study, we refined the measure items to ensure face and content validity and then finalized the questionnaire.

We conducted the survey through a computer-based approach between May and October 2014. We selected one top manager or senior manager in each firm as the key informant. Senior managers were from marketing or R&D departments because they are familiar with interfirm collaboration issues and innovation-related knowledge. Given that a marketing department is research-oriented and provides the necessary research about customer needs, and connects information about markets with new product development and design, senior managers from marketing departments were suitable informants for our study. Since all the informants were either top or senior managers and had been in their

position for an average of 4.7 years, they were highly qualified to complete the questionnaire. Hence single informant bias may not be a major concern in our sample.

We sent each informant the questionnaire by email, enclosing instructions and contact information. After completion, the informants returned the questionnaire by email. We received 205 valid questionnaires (a response rate of 41%) from firms in electronics and information technology, new energy and new material, mechanical and electronic equipment, new pharmaceuticals and bioengineering, and aerospace and semiconductor industries. Chi-squared tests were used to compare earlier respondents with later respondents. The results suggest no significant differences in firm age (CMIN/DF = 0.53,  $p = 0.72$ ), firm size (CMIN/DF = 1.11,  $p = 0.19$ ), industry (CMIN/DF = 1.10,  $p = 0.29$ ), and duration (CMIN/DF = 1.81,  $p = 0.12$ ) across two groups, showing no concern of non-response bias.

### 3.2. Measurements

#### 3.2.1. Dependent variable

*Radical innovation* was measured using three items adapted from Zhou and Li (2012). The respondents were asked to rate the extent to which they introduced innovation that, (1) involved a fundamentally major improvement over the previous technology; (2) led to products that were difficult to replace with substitutes using older technology; (3) brought substantial transformation in consumption patterns in the market.

#### 3.2.2. Predictors

To measure *explicit synergy*, we asked the informants to rate the extent to which partnership promoted: (1) inputs sharing, (2) complementarity of resources, and (3) facilitated operations on inter-related markets and processes. These three items capture the key aspects of explicit synergy associated with interfirm relationships (Jap, 1999; Zhou, 2011). We first listed potential synergistic effects of interfirm collaboration that could be identified explicitly through literature review, and selected the five most frequently mentioned, including inputs sharing, complementarity, facilitated operation, synchronization, and cost reduction. We then asked the managers and academics in strategy and innovation fields to comment on these aspects and supplement any other aspects that might have been missed. We finalized the scale with the three aspects after conducting a pilot study to test the adequacy of the measure.

Using a similar procedure, we developed the measure of *tacit synergy*. Given our conceptualization of tacit synergy reflecting the unforeseen benefits, we paid special attention to new thinking and perspectives derived through collaboration (Gray, 1989). We started from Korde and Paulus (2017) and Lasker et al.'s (2001) theorizing of synergy, summarizing three aspects, namely divergent thinking, transformative thinking, and comprehensive thinking. After consulting with 6 academics and 15 managers, and conducting a pilot analysis of the adequacy of the measure based on a sample of 32 firms, we included the three effects in our scale. Specifically, we asked the respondents to rate the extent to which partnership adds value in terms of (1) incorporating divergent thinking, (2) fostering comprehensive thinking, and (3) facilitating transformative thinking.

*Environmental technological dynamism* was measured by two items adapted from Jaworski and Kohli (1993), including that (1) the technology in our market is changing rapidly, and (2) technological changes provide big opportunities in our industry. *Interfirm technological diversity* was measured based on Sampson (2007) and Makri et al. (2010), with three items reflecting the extent to which a firm's technology portfolio, technological expertise, and core technologies differ from its partner.

*Control variables*. At the firm level, we controlled for *firm age* (years since founding), *firm size* (i.e., the natural log of the number of employees), and *industry*. Since our sample included sample firms from five different industries, we created four industry dummy variables with the aerospace and semiconductor industries as the comparison group. We also controlled for *R&D competence* using three items that reflect the quality, speed, and effectiveness of transferring and applying knowledge among manufacturing, design, and development (Yam et al., 2011). At the interfirm level, we controlled for *equity* (1 = yes, 0 = no), *duration* (the number of years of collaboration), and *relationship substitutability* (the possibility of finding a new relationship to replace the original one). In addition, we controlled for *competition intensity* as an environmental variable. The measure of competition intensity was adapted from Jaworski and Kohli (1993), with three items reflecting the situations of promotion wars, competitive responses, and the extent of intensity.

### 3.3. Construct validity

We first conducted an exploratory factor analysis to reduce all items into five variables (Table 2). A scree plot is shown in Figure 1. We then included

Table 2. Results of exploratory factor analysis

Question items	Loading					
	Tacit synergy	Radical innovation	Explicit synergy	Interfirm technological diversity	Environmental technological dynamism	
Inputs sharing	<b>0.872</b>	0.036	0.066	0.066	0.101	
Complementarity of resources	<b>0.859</b>	0.219	0.015	-0.023	-0.069	
Facilitated operations on interrelated markets and processes	<b>0.822</b>	0.281	0.010	-0.024	0.146	
Incorporating divergent thinking	0.267	<b>0.794</b>	0.117	-0.169	0.079	
Fostering comprehensive thinking	0.177	<b>0.838</b>	0.134	-0.084	0.132	
Facilitating transformative thinking	0.091	<b>0.815</b>	0.038	0.051	0.112	
Innovation involves a fundamentally major improvement	0.068	0.280	<b>0.812</b>	-0.035	0.056	
Innovation leads to products that are difficult to replace	-0.034	0.044	<b>0.825</b>	0.119	0.127	
Innovation brings in substantial transformation in consumption patterns	0.060	-0.014	<b>0.770</b>	0.075	0.099	
Differences in terms of areas of the technology portfolio	0.062	-0.072	0.020	<b>0.805</b>	0.086	
Differences in terms of technological expertise	0.031	-0.073	-0.025	<b>0.837</b>	0.013	
Differences in terms of core technologies	-0.084	0.002	0.194	<b>0.787</b>	-0.134	
The technology in our market is changing rapidly	-0.061	0.204	0.128	-0.005	<b>0.878</b>	
Technological changes provide big opportunities in our industry	0.225	0.089	0.155	-0.014	<b>0.862</b>	
Explained variance (%)	16.854	16.194	14.645	14.523	11.714	
Accumulated variance (%)	16.854	33.049	47.693	62.216	73.931	

Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser Normalization. Contents of each item can be seen in online supporting document. Bold values in each column are loadings for corresponding variables.

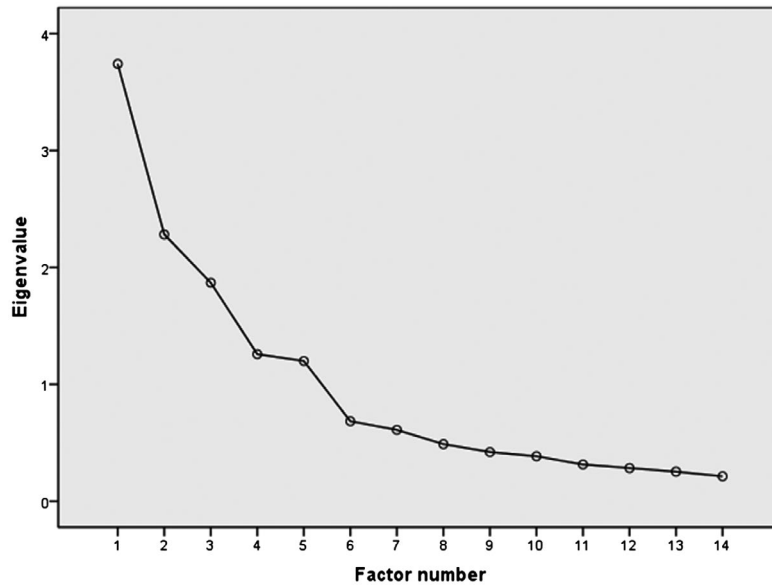


Figure 1. Scree plot.

all the multi-item variables into the same model and conducted a confirmatory factor analysis to test the construct validity. The fit indexes of the model indicated that the overall model fits the data well (CMIN/DF = 2.268,  $p = 0.000$ , GFI = 0.910, CFI = 0.919, IFI = 0.921, RMSEA = 0.079), with all items loaded significantly on the corresponding latent constructs, and squared multiple correlations (SMC) all above 0.3 (see online supporting document). The composite reliability (CR) and Cronbach's  $\alpha$  of all constructs exceeded the threshold of 0.70. The average variance extracted (AVE) ranged from 0.5 to 0.66. All these results indicate convergent validity and reliability. We ran a series of chi-square difference test in pairs to compare the unconstrained model with the constrained model, and checked the Heterotrait–Monotrait ratio of correlations (HTMT); both suggested discriminant validity. We also used the Fornell–Larcker criterion and checked the AVE by each construct relative to its shared variance with other constructs. In all cases, the AVE of each construct was higher than its shared variance with other constructs, again showing discriminant validity.

We introduced several measures to test common method bias. We included interaction terms (e.g., tacit synergy  $\times$  perceived capability-driven power) in our models, which can help alleviate the concern of common method bias (Siemsen et al., 2010). We used Harman's one-factor test and subjected all of the multi-item variables to a factor analysis (Podsakoff and Organ, 1986). The solution represented 67.9% of the total variance, with the first factor only accounting for 24.4%, indicating that common method bias

is unlikely to be a major concern. We then followed Podsakoff et al. (2003) and added an artificial common method variable into our measurement model, with all items loaded on this artificial variable and on their respective variables simultaneously. The results showed that the fit indexes of the model were quite close to those without the artificial variable (CMIN/DF = 2.240,  $p = 0.000$ , GFI = 0.911, CFI = 0.922, IFI = 0.924, RMSEA = 0.078). While the chi-square slightly decreased ( $\Delta\chi^2 = 4.135$ ,  $\Delta df = 1$ ,  $p = 0.042$ ), the variance extracted by the common method factor was 0.25, well below the 0.5 threshold. This again shows no major concern of common method bias.

## 4. Analysis and results

### 4.1. Hypothesis testing

We applied hierarchical regression with robust standard errors to test the hypotheses. To reduce the concern of multicollinearity, independent variables and moderating variables were mean-centered before creating the interaction terms. We checked the variance inflation factors (VIFs) associated with each of the predictors in our models (the highest value was 2.75). We also used the 'coldiag' procedure in Stata, and the result suggests that the condition number for our complete model was 26.69, below the threshold of 30. Therefore, multicollinearity was not a major issue.

Table 3 presents the means, standard deviations, and correlations among the variables. Table 4 shows the results of the regression models. In Model 1,



Table 3. Descriptive statistics and correlations

	1	2	3	4	5	6	7	8	9	10	11	12
1. Firm age												
2. Firm size	0.528***											
3. Duration	0.440***	0.351***										
4. R&D competence	-0.115	0.161**	-0.018									
5. Relationship substitutability	0.123*	0.016	0.144**	0.000								
6. Equity	0.085	-0.131*	0.049	-0.172**	0.125*							
7. Competition intensity	0.019	0.017	-0.061	-0.078	0.119*	0.006						
8. Environmental technological dynamism	-0.126*	-0.030	-0.018	0.247***	-0.096	0.016	0.196***					
9. Interfirm technological diversity	0.022	-0.015	0.043	0.014	0.218***	0.130*	0.065	-0.021				
10. Explicit synergy	-0.077	-0.055	-0.097	0.173**	0.097	0.093	0.066	0.281***	0.129*			
11. Tacit synergy	-0.067	0.205***	0.096	0.574***	-0.198***	-0.106	-0.173**	0.179**	-0.008	0.107		
12. Radical innovation	-0.057	0.014	0.024	0.469***	-0.150**	-0.034	-0.125*	0.311***	-0.128*	0.257***	0.408***	
Mean	2.863	2.668	2.605	5.098	4.171	.23	4.320	5.154	4.524	5.138	5.431	4.381
S.D.	1.015	.817	1.096	1.077	1.762	.421	1.194	1.277	1.196	1.109	1.053	1.219

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$  (sample size = 205).

Table 4. Hierarchical regression results

Independent variables	Dependent variable: Radical innovation			
	Model 1	Model 2	Model 3	Model 4
Firm age	0.07 (0.09)	0.10 (0.09)	0.11 (0.08)	0.10 (0.08)
Firm size	-0.14 (0.11)	-0.16 (0.11)	-0.16 (0.11)	-0.12 (0.10)
Industry dummies	Included	Included	Included	Included
Duration	0.01 (0.08)	0.01 (0.08)	-0.01 (0.07)	-0.01 (0.07)
Relationship substitutability	-0.11** (0.05)	-0.10 (0.05)	-0.07 (0.05)	-0.05 (0.05)
R&D competence	0.56*** (0.08)	0.42*** (0.10)	0.38*** (0.11)	0.40*** (0.10)
Equity	0.14 (0.17)	0.07 (0.16)	0.09 (0.16)	0.17 (0.16)
Competition intensity	-0.06 (0.07)	-0.06 (0.07)	-0.09 (0.07)	-0.06 (0.07)
Environmental technological dynamism (ETD)			0.16** (0.07)	0.20*** (0.07)
Interfirm technological diversity (ITD)			-0.12* (0.07)	-0.16** (0.07)
Explicit synergy (ES)		0.20*** (0.07)	0.17** (0.07)	0.13* (0.07)
Tacit synergy (TS)		0.19** (0.09)	0.19** (0.09)	0.16** (0.08)
ES × ETD				0.11** (0.05)
TS × ETD				0.05 (0.04)
ES × ITD				-0.05 (0.05)
TS × ITD				0.09** (0.04)
F value	6.41***	7.38***	8.41***	9.08***
Adjusted R <sup>2</sup>	0.23	0.28	0.31	0.33

Robust standard errors in parentheses. VIFs range from 1.06 to 2.75.  
\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$  (sample size = 205).

we regressed radical innovation against the control variables. Then we added independent variables in Model 2, and moderating variables in Model 3. Finally, we included all variables and interaction terms in Model 4.

Hypothesis 1 proposes that explicit synergy is positively related to radical innovation. The result in Model 2 shows that the coefficient for explicit synergy is positive and significant ( $b = 0.20$ ,  $p < 0.01$ ). Hypothesis 1 is thus supported. Hypothesis 2 proposes that tacit synergy is positively related to radical innovation. As shown in Model 2, the coefficient

of tacit synergy is positive and significant ( $b = 0.19$ ,  $p < 0.05$ ), in support of hypothesis 2.

The results in Model 4 suggest that the interaction between environmental technological dynamism and explicit synergy is positively related to radical innovation ( $b = 0.11$ ,  $p < 0.05$ ). In contrast, the interaction between environmental technological dynamism and tacit synergy has no significant impact on radical innovation ( $b = 0.05$ ,  $p > 0.1$ ). These findings lend support to hypotheses 3a and 3b. To illustrate the nature of the interaction, we plot the significant interaction effect in Figure 2. As shown in the figure,

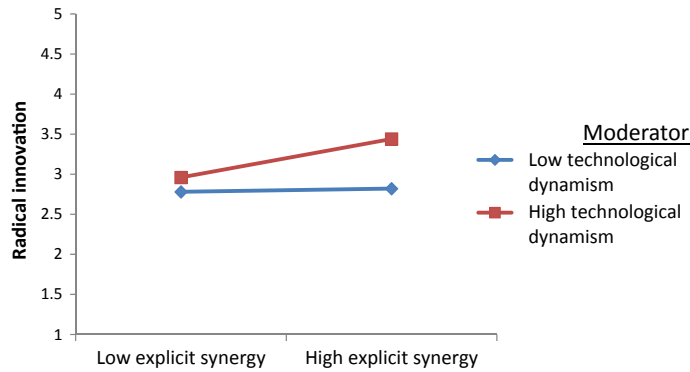


Figure 2. Explicit synergy and radical innovation – the moderating role of environmental technological dynamism.

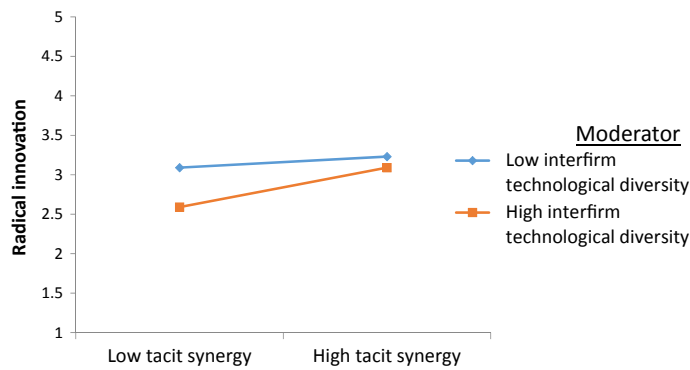


Figure 3. Tacit synergy and radical innovation – the moderating role of interfirm technological diversity.

explicit synergy is positively related to radical innovation when environmental technological dynamism is high; this positive relationship is weakened when environmental technological dynamism is low.

Also in Model 4, the results suggest that the interaction between interfirm technological diversity and tacit synergy is positively related to radical innovation ( $b = 0.09, p < 0.05$ ). In contrast, the interaction between interfirm technological diversity and explicit synergy has a negative but insignificant impact on radical innovation ( $b = -0.05, p > 0.1$ ). Thus, hypotheses 4a and 4b are supported. To facilitate interpretation, we plot the significant moderating effect in Figure 3. As shown in the figure, tacit synergy is positively related to radical innovation when interfirm technological diversity is high; this positive relationship is weakened when interfirm technological diversity is low.

#### 4.2. Robustness check

To correct for potential endogeneity, we employed a two-stage regression model to recheck the results of our analysis. In the first stage, we regressed tacit

synergy and explicit synergy against environmental technological dynamism, interfirm technological diversity, and R&D competence, respectively, to obtain residuals free of these variables. We used the residuals as indicators of explicit synergy and tacit synergy. In the second stage, we regressed radical innovation against the residual of explicit synergy and the residual of tacit synergy, as well as their interactions with environmental technological dynamism and interfirm technological diversity. The results show that explicit synergy and tacit synergy are positively related to radical innovation ( $b = 0.18, p < 0.05$ ;  $b = 0.18, p < 0.05$ , respectively). Environmental technological dynamism positively moderates the relationship between explicit synergy and radical innovation ( $b = 0.15, p < 0.01$ ), but does not moderate the relationship between tacit synergy and radical innovation ( $b = 0.07, p > 0.1$ ). In contrast, interfirm technological diversity positively moderates the relationship between tacit synergy and radical innovation ( $b = 0.18, p < 0.01$ ), but does not moderate the relationship between explicit synergy and radical innovation ( $b = -0.04, p > 0.1$ ). All these results lend support to our hypotheses.

## 5. Discussion and conclusion

The present study extends our understanding of collaborative radical innovation by examining the effects of different forms of partnership synergy on radical innovation when facing different technological contexts. We show that both explicit synergy and tacit synergy are positively related to radical innovation. We further find that interfirm technological diversity will moderate the relationship between tacit synergy (but not explicit synergy) and radical innovation, and environmental technological dynamism will moderate the relationship between explicit synergy (but not tacit synergy) and radical innovation. These findings suggest that within-alliance contexts can bring about substantially different impacts on innovation-driven collaboration from external contexts. This makes sense because any synergy strategy should fit a specific technological context before exerting influences on radical innovation, thereby calling for more attention to be paid to the leverage of different contexts.

Our study contributes to the literature in two ways. First, we contribute to the collaborative innovation literature by introducing explicit and tacit synergies as two factors for predicting radical innovation. Prior studies acknowledged the role of synergy or partnership value in affecting radical innovation while failing to empirically examine the causal relationship between synergy and radical innovation (Karamanos, 2011; Hao et al., 2017). Our study moves one step further, introducing explicit and tacit synergies as two predictors of radical innovation with empirical evidence. In so doing, our work contributes to unravelling the micro-foundation of collaborative radical innovation. Moreover, existing literature focuses predominantly on access to resources or knowledge that can be explicitly identified and utilized (e.g., Birkinshaw et al., 2007). Our findings go beyond the notion of knowledge access, revealing that partnership also benefits radical innovation in an implicit way by shaping a sense of tacit synergy. Also, a differentiation between explicit and tacit synergies allows us to enrich an understanding of the value creation process in radical innovation partnerships. Moreover, the manifestation of tacit synergy represents a means through which alliance firms deepen the understanding of their existing technologies. This is particularly intriguing given the increasing attention being paid to the firm-level effects (e.g., the motivation for internal R&D) of interfirm interactions in recent studies (e.g., Kobarg et al., 2019).

Second, we add to the understanding of partnership synergy by showing how different forms

of synergy perform differently in spurring radical innovation when linking to technological contexts. Whereas existing literature highlights the importance of either explicit or tacit synergy when pursuing radical innovation (e.g., Gassmann et al., 2010; Kobarg et al., 2019), little is known about how these two forms of synergy may function similarly or differently when contextual factors are considered. We add to this line of inquiry, arguing that both explicit and tacit synergies can be effective in spurring radical innovation, subject to different technological contexts. In support of Dyer and Singh's (1998) contingency view of relational advantage, our findings indicate that whether an alliance firm's partnership synergy strategy secures such relational advantage when pursuing radical innovation depends on the specific technological context it roots in. These findings provide insights into the interplay of contextual factors and resources versus thinking modes. They suggest that the value of a specific synergy strategy is anchored on whether the technological context may enable or constrain the firm's initiative to break the original frames of reference. Moreover, the literature on radical innovation does not distinguish contexts (e.g., Zhou and Li, 2012; Hao et al., 2017). Our investigation of the moderating roles of intra-alliance and environmental technological contexts and their distinctive effects on alliance firms' radical innovation can add to our understanding of the boundary of collaborative radical innovation.

Our study has several managerial implications. First, it has shown that a partnership relates to different types of synergistic effects that could help a partner firm make radical technological changes. Radical innovation partnerships refer not only to the benefits of increased efficiency and reduced costs, but also to appropriate ways to explore partnership value so that disruptive technologies can be developed. For managers, one way to develop radical innovation through partnering is to leverage complementary resources and to renew process routines. Managers should also pay special attention to benefits that are less explicit, but can be instrumental in driving exploration of emerging market domains or technology areas. Such benefits, which we referred to in this study, may be difficult to predict and thus require that managers devote more inputs to realizing them. Managers need to know what types of partnership value they should pursue when spurring radical innovation and take these into consideration in the early stages of partner selection. Second, managers should pay special attention to the intra-alliance and external technological contexts when managing collaborative radical innovation. Managers may pursue either the value of

asset exchange or the value of alternative thinking development to fit in with the specific technological context, or adjust their contexts (e.g., migrating from a location with low technological dynamism to a location with high technological dynamism) to support their collaboration. When the relationship entails great interfirm technological diversity, the focus should be on whether the partner's knowledge and resources complement its own; when the relationship operates in a context of great technological dynamism, the focus should be on whether the partnership leads to a change in thinking modes. Managers should take these into consideration when making alliance management decisions.

Our study has several limitations that also provide directions for future research. First, the effects of explicit and tacit synergies on radical innovation may be different in varying institutional and geographical contexts, as well as across industries. Future studies may test our theoretical framework in different contexts or by conducting comparative studies across industries. Second, while prior studies have suggested that our result of Harman's one-factor test is acceptable (the first factor accounting for 24.4% of total variance) (e.g., Zhou and Li, 2012), an index lower than 20% would be better. Also, we failed to control for the effects of some firm characteristics such as country of origin and incumbency. Third, our theorizing cannot deny the possibility of reverse causality. Theoretically, firms engaging in alliance relationships aim to rely on cross-boundary resources to develop novel, cutting-edge technologies (e.g., Cui and O'Connor, 2012). In this respect, our theorizing, using synergy to predict radical innovation, demonstrates the major direction in such a causal relationship and thus alleviates the concern of causality. Fourth, we only tested how explicit and tacit synergies influence radical innovation separately. Future research can add to our understanding of partnership synergy by exploring if, and how the two types of synergy work in combination to affect radical innovation.

## Acknowledgments

This study was supported by the National Natural Science Foundation of China under Grant No. 71372078, No. 71972002, and No. 71602002. All four authors contributed equally.

## References

Ansoff, I.H. (1965) *Corporate Strategy*. New York: McGraw-Hill.

- Baum, J., Cowan, R., and Jonard, N. (2010) Network-independent partner selection and the evolution of innovation networks. *Management Science*, **56**, 11, 2094–2110.
- Benner, M.J. and Tushman, M.L. (2003) Exploitation, exploration, and process management: the productivity dilemma revisited. *Academy of Management Review*, **28**, 238–256.
- Birkinshaw, J., Bessant, J., and Delbridge, R. (2007) Finding, forming, and performing: creating networks for discontinuous innovation. *California Management Review*, **49**, 3, 67–85.
- Burdy, J., Vogel, R.M., and Zachary, M.A. (2018) Organization–stakeholder fit: a dynamic theory of cooperation, compromise, and conflict between an organization and its stakeholders. *Strategic Management Journal*, **39**, 476–501.
- Cui, A.S. and O'Connor, G. (2012) Alliance portfolio, resource diversity and firm innovation. *Journal of Marketing*, **76**, 24–43.
- Dahlin, K.B., Chuang, Y.-T., and Roulet, T.J. (2018) Opportunity, motivation, and ability to learn from failures and errors: review, synthesis, and ways to move forward. *Academy of Management Annals*, **12**, 252–277.
- Davies, A., Frederiksen, L., Gacciatori, E., and Hartmann, A. (2018) The long and winding road: routine creation and replication in multi-site organizations. *Research Policy*, **47**, 1403–1417.
- Dwertmann, D.J.G., Nishii, L.H., and van Knippenberg, D. (2016) Disentangling the fairness & discrimination and synergy perspectives on diversity climate: moving the field forward. *Journal of Management*, **42**, 5, 1136–1168.
- Dyer, J.H. and Hatch, N.W. (2006) Relation-specific capabilities and barriers to knowledge transfers: creating advantage through network relationships. *Strategic Management Journal*, **27**, 701–719.
- Dyer, J.H. and Singh, H. (1998) The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, **23**, 4, 660–679.
- Garud, R. and Rappa, M.A. (1994) A socio-cognitive model of technology evolution: the case of Cochlear implants. *Organization Science*, **5**, 3, 344–362.
- Gassmann, O., Zeschky, M., Wolff, T., and Stahl, M. (2010) Crossing the industry-line: breakthrough innovation through cross-industry alliances with 'non-suppliers'. *Long Range Planning*, **43**, 639–654.
- Gilbert, C.G. (2005) Unbundling the structure of inertia: resource versus routine rigidity. *Academy of Management Journal*, **48**, 5, 741–763.
- Goold, M. and Campbell, A. (1998) Desperately seeking synergy. *Harvard Business Review*, Issue September–October, 131–143.
- Gray, B. (1989) *Collaborating: Finding Common Ground for Multiparty Problems*, 1st edn. San Francisco: Jossey-Bass.
- Greve, H.R. and Taylor, A. (2000) Innovations as catalysts for organizational change: shifts in organizational

- cognition and search. *Administrative Science Quarterly*, **45**, 1, 54–80.
- Hao, B., Feng, Y., and Frigant, V. (2017) Rethinking the ‘mirroring’ hypothesis: implications for technological modularity, tacit coordination, and radical innovation. *R&D Management*, **47**, 1, 3–16.
- Hernandez, E. and Shaver, J.M. (2019) Network synergy. *Administrative Science Quarterly*, **64**, 1, 171–202.
- Jap, S.D. (1999) Pie-expansion efforts: collaboration processes in buyer-supplier relationships. *Journal of Marketing Research*, **36**, 461–475.
- Jaworski, B.J. and Kohli, A.K. (1993) Market orientation: antecedents and consequences. *Journal of Marketing*, **57**, 53–70.
- Karamanos, A.G. (2011) Leveraging micro- and macro-structures of embeddedness in alliance networks for exploratory innovation in biotechnology. *R&D Management*, **42**, 1, 71–89.
- Kobarg, S., Stumpf-Wollersheim, J., and Welpe, I.M. (2019) More is not always better: effects of collaboration breadth and depth on radical and incremental innovation performance at the project level. *Research Policy*, **48**, 1–10.
- Korde, R. and Paulu, P.B. (2017) Alternating individual and group idea generation: finding the elusive synergy. *Journal of Experimental Social Psychology*, **70**, 177–190.
- Lasker, R.D., Weiss, E.S., and Miller, R. (2001) Partnership synergy: a practical framework for studying and strengthening the collaborative advantage. *The Milbank Quarterly*, **79**, 2, 179–205.
- Levinthal, D. and March, J.G. (1993) The myopia of learning. *Strategic Management Journal*, **14**, 95–112.
- Liedtka, J. (2015) Perspective: linking design thinking with innovation outcomes through cognitive bias reduction. *Journal of Product Innovation Management*, **32**, 6, 925–938.
- Lin, B. and Chen, J. (2005) Corporate technology portfolios and R&D performance measures: a study of technology intensive firms. *R&D Management*, **35**, 2, 157–170.
- Lorenzoni, G. and Lipparini, A. (1999) The leveraging of interfirm relationships as a distinctive organizational capability: a longitudinal study. *Strategic Management Journal*, **20**, 317–338.
- Makri, M., Hitt, M., and Lane, P. (2010) Complementary technologies, knowledge relatedness and invention outcomes in high technology mergers and acquisitions. *Strategic Management Journal*, **31**, 602–628.
- Mayo, M. (1997) Partnership for regeneration and community development. *Critical Social Policy*, **17**, 3–26.
- McDermott, C.M. (1999) Managing radical product development in large manufacturing firms: a longitudinal study. *Journal of Operations Management*, **17**, 631–644.
- Nelson, R. and Winter, S. (1982) *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.
- O’Connor, G. (1998) Market learning and radical innovation: a cross case comparison of eight radical innovation projects. *Journal of Product Innovation Management*, **15**, 151–166.
- Podsakoff, P.M. and Organ, D.W. (1986) Self reports in organizational research: problems and prospects. *Journal of Management*, **12**, 531–544.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., and Podsakoff, N.P. (2003) Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology*, **88**, 879–903.
- Reid, S.E., de Brentani, U., and Kleinschmidt, E.J. (2014) Divergent thinking and market visioning competence: an early front-end radical innovation success typology. *Industrial Marketing Management*, **43**, 8, 1351–1361.
- Rothaermel, F.T. and Deeds, D.L. (2004) Exploration and exploitation alliances in biotechnology: a system of new product development. *Strategic Management Journal*, **25**, 3, 201–221.
- Sampson, R.C. (2007) R&D alliances and firm performance: the impact of technological diversity and organization on innovation. *Academy of Management Journal*, **50**, 2, 364–386.
- Schubert, T., Baier, E., and Rammer, C. (2016) Technological capabilities, technological dynamism and innovation offshoring. Working paper No.16-044, available at: <http://ftp.zew.de/pub/zew-docs/dp/dp16044.pdf>.
- Schubert, T., Baier, E., and Rammer, C. (2018) Firm capabilities, technological dynamism and the internationalisation of innovation: a behavioural approach. *Journal of International Business Studies*, **49**, 70–95.
- Sheth, B.R., Sandkühler, S., and Bhattacharya, J. (2008) Posterior beta and anterior gamma oscillations predict cognitive insight. *Journal of Cognitive Neuroscience*, **21**, 7, 1269–1279.
- Siemsen, E., Roth, A., and Oliveira, P. (2010) Common method bias in regression models with linear, quadratic, and interaction effects. *Organizational Research Methods*, **13**, 456–476.
- Tanriverdi, H. and Venkatraman, N. (2005) Knowledge relatedness and the performance of multibusiness firms. *Strategic Management Journal*, **26**, 2, 97–119.
- Tripsas, M. and Gavetti, G. (2000) Capabilities, cognition, and inertia: evidence from digital imaging. *Strategic Management Journal*, **21**, 1147–1161.
- Troilo, G., De Luca, L.M., and Atuahene-Gima, K. (2014) More innovation with less? A strategic contingency view of slack resources, information search, and radical innovation. *Journal of Product Innovation Management*, **31**, 259–277.
- Vargo, S.L. and Lusch, R.F. (2008) Service-dominant logic: continuing the evolution. *Journal of the Academy of Marketing Science*, **36**, 1, 1–10.
- Wang, H. and Chen, W.-R. (2009) Is firm-specific innovation associated with greater value appropriation? The roles of environmental dynamism and technological diversity. *Research Policy*, **39**, 141–154.
- Yam, C.M., Lo, W., Tang, P.Y., and Lau, K.W. (2011) Analysis of sources of innovation, technological innovation capabilities, and performance: an empirical study of Hong Kong manufacturing industries. *Research Policy*, **33**, 1123–1250.

- Zaheer, A., Castañer, X., and Souder, D. (2013) Synergy sources, target autonomy, and integration in acquisitions. *Journal of Management*, **39**, 3, 604–632.
- Zhelyazkov, P.I. (2018) Interactions and interests: collaboration outcomes, competitive concerns, and the limits to triadic closure. *Administrative Science Quarterly*, **63**, 210–247.
- Zhou, Y.M. (2011) Synergy, coordination costs, and diversification choices. *Strategic Management Journal*, **32**, 624–639.
- Zhou, K.Z. and Li, C.B. (2012) How knowledge affects radical innovation: knowledge base, market knowledge acquisition, and internal knowledge sharing. *Strategic Management Journal*, **33**, 1090–1102.

**Bin Hao** received his PhD from School of Management and Economics, Tongji University. He is an Associate Professor at the School of Business, East China University of Science and Technology. His research examines how collaboration, in both developing and developed institutional settings, drives incremental and radical innovation. He has published papers in journals such as *R&D Management*, *Technovation*, *International Small Business Journal*, *IEEE Transactions on Engineering Management*, *European Management Journal*, etc.

**Jiangfeng Ye** received his PhD from School of Management and Economics, Tongji University. He is an Associate Professor at the School of Business, Anhui University. He is a member of International Association for Chinese Management Research (IACMR). His main research lines are about

knowledge management and technology management. He has published papers in journals such as *IEEE Transactions on Engineering Management*.

**Yanan Feng** received her PhD from Leeds University Business School. She is an Assistant Professor at Nottingham University Business School. She has won several research awards, such as the Best Full Paper Award at the British Academy of Management (BAM) Annual Conference 2011, and the Best Paper Award at the China Association for Management of Technology (CAMOT) annual conference 2010. Her research interests include knowledge management and decision-making. She has published in journals such as *Technovation*, *R&D Management*, *Journal of Business and Industrial Marketing*, *Leadership and Organization Development Journal*, among others. She is the corresponding author of this paper.

**Ziming Cai** received his PhD from Cardiff Business School. He is an Assistant Professor at Nottingham University Business School. His research interests include HRM and corporate strategy in emerging economies. He has published in journals such as the *International Journal of Human Resource Management* and *Journal of Corporate Finance*.

## Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site.